Part X

Clinical Studies and Documentation

"It is always your next move."

- Napoleon Hill

This is a transcript of a 13 Part Television Documentary Series

"MIRACLE WATER"

by NNN/NHK TV Japan.
Shown on Japanese National TV in 1996.

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We do NOT publish them with the intention of trying to prove a curative or therapeutic recommendation

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12. **Sterilization of Dental Equipment to Prevent Infections**

13. **Organic Agricultural Method for Safer & More Delicious Produce.**

[➔ EDITOR'S NOTE: These are full-length transcripts from the original Videos that we have used on our websites. We actually edited those videos and used only the most important parts. These transcripts will all the details for you as many of us use these to weave into our presentations.]

INTRODUCTION:

At the Urging of the Japanese Minister of Health, a Japanese Public TV Station Created an Educational Documentary Series - which, among other things, followed the recovery of a diabetic patient suffering from gangrene of the foot. The film follows the patient, Mr. Abe, from Day One through his complete rehabilitation. The conversation with the doctors went as follows:

"The doctor at the first hospital told me that they had to amputate my foot and the toe on my other foot. If l lost both, I wouldn't be able to work or walk, so I left that hospital':

Mr. Abe was fortunate to know a reporter on the staff at the TV station who took up his cause and helped by directing him to a hospital using the Ionized Water treatment.

Mr. Abe says, "The water makes me feel light and l am in good shape. Now I think I can work after being released from the hospital and am looking forward to that "

Mr. Abe once considered committing suicide thinking there was no chance to save his foot. "My leg would have been cut off, if it would have been two days later. It might have been hell, but now I will be able to work again after I get out of the hospital. I used to fake 16 units of insulin, but now doctors reduced it to IO units. I used to take only 1200 calories, but now I take 1600 and l feel just fine. As they give me more of the water, I feel better and better".

1. Prevent Food Poisoning from Bacteria

Announcer: "Today is the first of a series, and it's about food poisoning."

Reporter: "With the rise in temperatures, the most dangerous time for food poisoning is approaching."

[on screen] Inspectors at the Tsukiji Fish Market, Tokyo

Inspector: "Hello, now that summer is almost here, we'd like to check the safety of your

shellfish and get some samples from you."

Vender: "Sure, go ahead."

Reporter: "Market sanitation inspection officers are here at Tsukiji Market in Tokyo to check the sanitary conditions of the fresh shellfish."

Inspector: "I have some namamushi. One more sample. Let me take some trough shells."

Reporter: "A bacterium called vibrio is one cause of food poisoning. It likes salty water and thrives in the shellfish regardless of its freshness. So these inspection officers visit the market periodically to take samples of shellfish and to check the sanitary conditions.

Food poisoning makes you very sick."

[on screen] Ambulance

Reporter: "There were 37,561 cases of food poisoning in Japan in 1990. Food poisoning causes vomiting, diarrhea, exhaustion, high fever, and headache. It is said that once food poisoning occurs, restaurants suffer loss of business for the next 10 years. So, they are very careful about it at this time of year."

[on screen]

Inspector: "Bacteria called vibrios live in ocean water. They attach themselves to fish and are taken to land in the catch. These are Salmonella. They can be found in the eggs and meat you purchase."

Reporter: "Other bacteria that cause food poisoning are Staphylococci and Colon bacilli. They are also found inside our bodies and can multiply if conditions are right."

[on screen] Five petri dishes: Top left: Salmonella Top right: Staphyiococci

Center: Vibrios Bottom left: Colon bacilli Bottom right: Cereus

[on screen] Scene of people dining at a wedding reception

Reporter: "If the bacteria that cause food poisoning are hiding in the food, this kind of party will not be a very fun experience in a couple of more hours. However, there is no need to worry any more. Strong disinfectant water can now prevent food poisoning."

[onscreen] Nihonkaku

Reporter: "This is Nihonkaku, located in front of Higashi Nakano Station in Tokyo. Here, wedding receptions for 14 couples can be held at the same time. The staff can serve up to 3600 people, preparing over two tons or food a day, including vegetables, meat and fish."

[on screen] Cooks inside the kitchen of Nihonkaku

Cook: "One hundred percent of the food brought into Nihonkaku has some kind of bacteria

on it. So, we have to eliminate the bacteria entirely before we start to prepare the food."

[on screen] Water faucets in the kitchen at Nihonkaku, sixteen faucets with very strong disinfectant water are set up. Raw meat, the cutting boards and everything else is washed with this water.

[on screen] Mr. Ryuichi Ishizuka, Director of the Cooking Dept. at Nihonkaku

Nlr, Ryuichi Ishizuka: "We've been using this hyperoxidized water for washing for about seven months. The bacteria that cause food poisoning have been eliminated. We tried to get rid of these bacteria before, but we were not able to do so completely. Now, as long as we use this disinfectant water, we will be safe."

[on screen] Mr. Nomura of Nick World with two sets of petri dishes

Mr. Nomura: "The easiest way to find out whether there is bacteria or not is to culture them in agar. The colored petri dish contains Colon bacilli and the non-colored one another type of bacteria. A sample culture is taken from a woman' s hands before and after washing. Samples were also taken from the cutting boards and meat."

[on screen] Four petri dishes 24 hours later

Mr. Nomura: "These are the results of the bacteria culture 24 hours later. A big difference is seen.

Left: Hands before washing. Right: Hands after washing."

[on screen] Two petri dishes

Mr. Nomura: " This is the result of the cutting board surface before and after washing. There is absolutely no bacteria seen."

[on screen] Dr. Matsuo of Miura Electronics, the inventor of the machine.

Dr. Matsuo: "First, tap water comes in this way. In order to electrolyte the water easily, we add some salty water which makes it conduct electricity better. Then direct current is applied to the water, and that is how electrolysis is done. When you perform electrolysis on water by adding salt and direct current to it, you can create alkaline water on the negative side and hyperoxidized water at a pH of 2.7 or lower on the positive side. When bacteria come in touch with the hyperoxidized water, they die.

Another condition that effects bacteria is the water's oxidation-reduction potential (ORP). The remaining chlorine and oxygen in the water also help to eradicate bacteria. In the kitchen at Nihonkaku, not even bacteria that causes food poisoning are present anymore."

[on screen] Six petri dishes From left: "Staphylococci, vibrios and Colon bacilli."

Dr. Matsuo: Top: "Before treatment by hyperoxidized water."

Bottom three: "After treatment; you can see that these contain no bacteria."

[on screen] A man at the reception being interviewed

Man: "Is it the water that does the disinfecting? I haven't seen the results of the water analysis, so I cannot really say anything."

Reporter: "Let's have you look at the world's first color laser microscope."

[on screen] Salmonella bacteria moving around

Reporter: "A drop of strongly oxidized (acidic) water is placed on the bacteria. The moment the water contacts the salmonella, they die."

[on screen] Salmonella

Right side: Before hyperoxidized water was added Left: After hyperoxidized water was added.

[on screen] Reporter/cameraman drinking hyperoxidized water

Reporter: "Drinking this water causes no harm at all to the body. Very mysterious water."

Reporter: "Here at Nihonkaku, after the dishes are prepared and ready to serve, the food wagon is covered tightly with plastic wrap to prevent the invasion of bacteria and stored in the refrigerator until serving time."

[on screen] Doors opening to newly weds

Reporter: "Now the wedding reception is in full swing. We hear the sounds of families and friends clapping as they welcome the newly weds. It sounds like noise from the disinfectant water that prevents food poisoning."

Announcer A: "This is great! This is real?"

Announcer B: "Yes, it is real. Normally when we talk about water disinfectant, we are talking about chlorine. But, if you can disinfect water with only water, problems such as the stringent odor and harmful side effects will be solved."

Announcer A: "Tomorrow, we will report on water that is widely used for medical treatment."

2. Electrolyzed Acidic/Alkaline Water in the Medical Field

Announcer A: "Water electrolyzed into acid and alkali has proven to be effective in many areas."

Announcer B: "In our series featuring this so called miracle water, we look at how the water has been used in the medical field." "Athletes foot is a nasty fungal disease and painful condition. It is very difficult to cure. Many people suffer from athletes foot after

wearing shoes for long periods of time, but athletes foot can be cured by electrolyzed water."

Reporter asking a patient: "Do you believe that it is just water that is used in the treatment?"

Patient: "No, I don't believe it."

Reporter: "Do you feel any pain in the infected part?"

Patient: "No, I don't."

Reporter: "This is Kyowa Hospital located about forty minutes from Kobe station. At the hospital athletes feet, hands and bed sore are treated only with water. The doctor says that, unless there is infection, the troubled part will heal completely. It is necessary just to irrigate and apply a bandage. The treatment of this injury, caused in a motor bike accident, was just dipping it in the water for fifteen minutes."

Reporter: "Did you think the water was a disinfectant solution?"

Patient: "Yes I thought so at first, but later I learned that it was just acidic water."

Reporter: "How did you feel about that?"

Patient: "Well, I doubted it would heal the injury."

Doctor: "Don't worry, the water has an excellent sterilizing effect."

The director of the Kyowa Hospital, Sosuke Kawamura says: "The electrolysis of tap water produces alkali water at the cathode and acid water at the anode. We are using the acid water after watering it down to a pH value of 2.6. This high acid water kills fungus, mold and bacteria although perhaps that may seem hard to believe."

Reporter: "You can see at how the bacteria actually died using this laser color microscope, the first to be developed in the world. As you can see, moving here is spirilla bacteria which is similar to a bacteria that causes syphilis. Acid water is poured over it, and as soon as the water covers the bacteria, they stop moving.

Bacteria such as spirilla and many others can only survive in an environment with a pH value of between 3 and 4. Acid water has a pH value of 2.6, which kills everything. The oxidization reduction electrical potential and chlorine and oxygen also help kill these bacteria."

This doctor says: "We don't use antiseptics, we use electrolyzed water. One of the patients allowed us to take pictures of his bed sores and how it has healed. It worked right down to the bone.

Bedsores even this bad are healed by using the water, it works better than any medicine. Electrolyzed water works better especially for bed sores."

Reporter: "We visited Akashi hospital to look at some of the promising results."

The Doctor there says: "Without using disinfectant, ointment or intravenous drip infusion only electrolyzed water for treatment for two weeks there has been no infection, the surface of the ulcer has been recovering drastically, the recovery process seems extremely good, it is very surprising. It is amazing."

Reporter: "While making the report in the hospital, this reporter was told that after giving patients alkaline electrolyzed water, the patient feces becomes odorless. Going into the sick rooms, despite the fact that many patients were wearing paper diapers in bed, there was no fecal odor at all. The patients recovering rate was in fact so rapid that more and more patients are getting around in wheel chairs."

Announcer: "Because of the drastic changes at the hospital, even nurses and doctors are now taking the alkaline water home and drinking it themselves. Our reported went back to Kyowa Hospital to find out the additional advantages of alkaline water."

Nurse: "We boil alkaline water to use for making babies milk. All the employees here usually drink tea made of boiled alkaline water."

Reporter says: "I hear you don't catch colds?"

Nurse: "No, everybody here is fine because they all drink alkaline water."

Reporter: "In the hospital a machine from which patients can drink alkaline water was installed seven years ago. There are people who claim to have cured their scleroses of the liver or diabetes which are very hard to treat with western medicines, simply by drinking electrolyzed alkaline water."

This is Katsumi Nakanishi who recovered from sclerosis of the liver.

Mr. Nakanishi "I drank a lot of the water as I had a bad liver, and it was always burning. My figures went down and down. I am now well."

Shigeru Takahashi recovered from diabetes says: "I could not believe that the water could cure my disease in the beginning. I have been suffering from diabetes for fourteen years but with the electrolyzed water, I cured it."

Reporter: "What happens inside the body? We interviewed a doctor who teaches the effective use of this water on the body. Chief editor of the Water society."

Dr. Hidemitsu Hayashi: "You will have clean feces if you drink alkaline electrolyzed water. Electrolysis has the function of detoxifying or neutralizing toxic substances such as hydrogen sulfide and ammonia contained in the feces. You can see that this toxic substance will start to decrease as you drink the electrolyzed water.

As a result you will have a healthier liver, the organ which has the function of neutralizing toxic substances in the body, and then your whole body will start to feel better since the functions of all the organs in the entire body start to improve."

Announcer: "Numerous diseases including high blood pressure, stomach ulcers and duodenal ulcers improve as a result of using this water.

It is amazing that it has so many incredible results.

Tomorrow we will have another in the series on MICRO WATER."

3. Agricultural Chemicals Replaced by Water!

Announcer A: "Again tonight we are reporting on a wondrous water. We reported that this water is very effective for medical use and for preventing food poisoning. The water is used as a substitute for agricultural chemicals as well."

Announcer: "We asked an agriculture expert what effects does it produce?"

Reporter: "A variety of fruits and vegetables are in this shop and all of them brightly colored. My favorite vegetable is the cucumber, but thinking of agricultural chemicals, I worry about the effects on cucumbers. An agricultural ministry survey shows that cucumbers are vulnerable to diseases especially those grown in a greenhouse which have to be sprayed often. Without chemicals only ten percent of the cucumbers survive."

Reporter: "However, we found a farmer in Oyamacee Tochigi Prefecture who grows cucumbers without using agricultural chemicals. They use water which is not harmful to our health but which does destroy mold."

Farmer: "This machine separates water into alkaline ion oxidized water. We put salt in the water and it is resolved by electricity. At the negative pole you get alkaline water and at the positive pole you get oxidized acidic water. This is done instantly."

"This oxidized water kills germs that cause cucumber diseases. One cucumber plant will yield nearly 100 cucumbers. These plants are suffering from mildew. But on this plant which was treated with acidic oxidized water, the bacteria have been destroyed. It is surprising that the white part suffering from mildew came off due to the sterilizing power of the water. The difference is very clear between the one treated with acid oxidized water and the other one. With oxidized water there is no resistance against mold or chemicals."

Cameraman Matsumoto, eating a cucumber treated with the water says: "If agricultural chemicals are used, I wouldn't want to eat it, but in this case, I decided to try it. Oh, it is fresh and delicious, it also smells good. We can eat these cucumbers with-out any worry even if they are uncooked."

Reporter: "Golf a favorite sport in Japan. On golf courses greens are produced using chemicals and this is causing problems. We conducted an investigation of agricultural chemicals used on golf courses in Chiba Prefecture two years ago and we found that an average of 2.4 tons of agricultural chemicals are used annually per eighteen hole golf courses, more than a 150 types of chemicals are used. Some kinds of agricultural chemicals remain in the soil for a long time, and in some cases they become a source of pollution."

This person says: "What I have picked up is ionized water it records a value of 2.6 pH. At Atsugi International Country Club, they have been trying to reduce the use of agricultural chemicals as much as possible by using strongly oxidized water. A lawn is infected by several kinds of germs, so lawns that are once beautiful can often die this way. If this happens on a golf course the value of the country club decreases.

This difficult situation let to the idea of killing germs with strongly oxidized water created by electrolysis."

Akito Hirano: "Now we spray this strongly oxidized water once a week in warm weather, and when the temperature goes down we spray once or twice a month."

Reporter: "Why does this water kill the germs?"

Akito Hirano: "The germs which kill lawns can't live under a 3 pH level, given more strongly oxidized water they are destroyed. Furthermore, dissolved oxygen and dissolved chlorine will kill the germs."

Akito Hirano: "We are trying to cut agricultural chemical by 80 percent every year. In the near future we hope to dispense with all the agricultural chemicals by using this water."

Reporter: "Most pleased are the farmers who are freed from using agricultural chemicals. Look at this they work in light clothing, sneakers, aprons and jeans."

[on screen] Kazuko Akiyama, a farmerette, user of chemical free agriculture

Kazuko Akiyama: "Once I was so scared to work in a vinyl plastic hothouse, when I was pregnant, so I did my work just leaning in from outside, but now days we are safe."

Reporter: "We asked her to put on the working clothes she used in the days when they used chemicals."

Kazuko Akiyama: "I worked in this raincoat, rubber boots, gloves, sun visor and mask. It was hot and uncomfortable and that made the work even tougher."

Reporter: "Alkaline water produced from electrolysis is also utilized to grow crops."

Yuro Sasaki: "Alkaline water helps suck up nutrition from the soil as a result things grow bigger."

Hirotoshi Tamura Managing director of Yota Ba Kai co-operative: "At this time of the year farmers use agricultural chemicals once a week, but by introducing this method these farmers have not used chemicals at all so far, still delicious cucumbers are being produced. I am sure this method will be "THE" method for chemical free farming in the future."

"Because the water is highly acidic, you might be concerned about causing some bad effects, but according to the staffs experiments, the acid water will change into ordinary

water in the soil."

Announcer: "We reported the story of the miraculous water in a three part story and while reporting we were startled by these wonders. The next report in the special feature about miracle water is coming up tomorrow."

4. Diabetes and Miracle Water

Announcer: "In earlier programs we looked at electrolyzed miracle water that has been used in place of medicines and agricultural chemicals and it has proved very effective."

"Today we have another report concerning this miracle water. We have followed a diabetes patient who faced the possibility of having to have his leg cut off, he recovered and was able to walk again.

We have more from NNN Cameraman Matsumoto."

The diabetic patient: "Because you took up my story on your TV program, my life was saved, I can make a fresh start thanks to you."

Reporter: "One and a half months ago, Mr. K. Abe 56, cut his right toe on a piece of glass. He left the hospital where he was staying, and came to Kyowa Hospital in Kobe two days before the scheduled operation to amputation his foot. He found this hospital through a TV camera man."

Mr. Abe says: "The doctor at the first hospital told me that they had to amputate my foot and the toe on my other foot, if I lost both, I wouldn't be able to work or walk so I left the hospital."

Reporter: "Twenty days ago he entered Kyowa Hospital. The condition of his feet is getting better day by day, at first they were terrible. The color of the cells was dark, most parts were pussy and smelled terrible, both feet were infected with gangrene."

Mr. Abe: "This is the photo at the time I was first diagnosed compared to the more healthy left foot, the bone melted and became thin, this was caused by poor blood circulation and diabetes. This was the way it looked."

Reporter: "Reportedly, there are 5 million diabetics in Japan. Of those over 40 years old, about 1 out of 10 people suffers from this disease. Early on you can control your calories and take insulin pills to treat the disease, but when you are seriously ill, you have to take insulin shots to control your blood level. Mr. Abe was labeled a seriously ill patient."

Doctor: "To control diabetes we use insulin, but to control a locally infected part we use acidic water only. We use no antibiotics. To treat feet medically developed water with a pH of 2.4 and 1100 millivolts of deoxidized potential is used.

This deoxidized electric potential water is very effective to control local infection and granulation, but it is not perfect. So first, we want to control diabetes by dosing with

lots of electrolytic resolved water every day. We think effective treatment of gangrene can be achieved through such an improvement in the patients constitution."

Reporter: "They say the treatment of diabetics is possible using electrolytic resolved water or alkaline ion water, both of which are available to be made at home. Mr. Abe drinks five liters of water per day following the doctors directions. And he says he has been improving day by day."

Mr. Abe: "This water makes me feel light and I am in good shape."

Reporter: "What kind of water is this? I asked the hospital staff to analyze it."

Doctor: " Ordinary water is pH 7 and it's resolved potential is (plus) +330 millivolts. An alkaline solution of pure water and caustic soda is pH 8 and it's resolved potential is (plus) +200 millivolts.

Doctor: "A miracle water that Mr. Abe is taking is pH 8 and it's resolved potential is (minus) -238 millivolts. Is this water with a different electric potential have a good effect on Mr. Abe."

Reporter: "At last the great news Mr. Abe had desperately waited for was conveyed to him by Dr. Kawamura."

Mr. Abe asked: "It isn't necessary to cut of my foot, is it?"

Dr. Kawamura: "As things stand now, I don't think it will be necessary. Congratulations, your foot has been saved."

Mr. Abe: "Thank you, now I think I can work after being released from the hospital and I am looking forward to that. My leg would have been cut off, if it would have been two days later, it might have been hell, but now I will be able to work again after I get out of the hospital."

Dr. Hidemitsu Hayashi: "Diabetes is believed to be caused by insufficient secretions of insulin from beta cells in the pancreas. In modern medical science, an active enzyme called a free radical is said to be involved in insufficient secretions of insulin."

"In the human body there are neutrophils and t-cells fighting again viruses or malignant tumors. What is called active oxygen is fighting. After winning in the fight against a cancer, the enzyme which is called SOD will decompose residuals. But if there are too many residuals they stick to anything and damage cell membranes and nuclei because they are poisonous. It is said that diabetes is caused by this."

"The resolved water obtained by electrolysis extinguishes free radical active oxygen. They are released out of the body that is why Mr. Abe's diabetes and gangrene took a turn for the better."

Mr. Abe: "I used to take 16 units of insulin but they reduced it to 10 units, now. I used to take 1200 calories but now I take 1600. I feel just fine and as they give me more of it I feel better and better."

Reporter: "On the 45th day since Mr. Abe was admitted to the hospital, I happen to witness a scene, I doubted what I saw. Mr. Abe once thought about committing suicide because there was no chance he could save his leg, but I saw him leaving the hospital to go shopping with his sandals on."

Mr. Abe: "I think I am an exception that I didn't have my leg amputated, thought I suffer from diabetes I am surprised myself, over my recovery, it is really a miracle. I feel like I am having a dream when I walk down the street on my two legs, it's almost like floating in the air."

Announcer: "I was really surprised that a seriously diabetic patient recovered only using water."

"This concludes this segment on miracle water. We hope you enjoyed it. For further information about this water please contact the TV station NNN, please refrain from contacting the hospital just to get information."

5. Gangrene Cured by Strongly Oxidized Water

Announcer: "When diabetes becomes serious, a person's feet can become severely infected. This condition is called gangrene. Tonight we will report on a case in which a man whose doctor determined that his foot would be amputated because of gangrene caused by diabetes was cured by strongly oxidized water."

[on screen] Gangrene infected toes.

Reporter: "This patient was told that his foot had to be amputated due to a condition caused by diabetes. His toes were infected very badly and he was cured by soaking his foot in hyperoxidized water twice a day. At the same time, he drank more than five liters of alkaline water daily in about four months, his toes recovered, as you can see, and are normal just like those of a healthy person."

[on screen] Two pictures of the same patient's toes

Right: "Seven days after he was admitted to the hospital Left: "Four months after his discharge from the hospital showing healthy toes."

Reporter: "Mr. Akihiro Ito (58 years old) heard about this water on a TV program called "Kyo no dekigoto" (Today's Events). He left the hospital where he was staying and moved to Kyowa Hospital located in the suburbs of Kobe."

Reporter: "Where exactly were they going to amputate your leg?"

Mr. Ito: "About this area."

Dr. Kawamura, head of Kyowa Hospital: "This discolored part of the leg was completely damaged by very poor blood circulation."

Reporter: "Mr. Ito's condition was severe. It almost sent chills down my back. Diabetes is very scary. Mr. Ito went to the hospital because he had blisters caused by his shoes. There he was treated with vasodilators, antibiotics and disinfectants. Doctors did everything they could, but the condition of his foot did not improve at all and only worsened. Finally, he was told that his leg had to be amputated."

[on screen] Dotted line on Mr. Ito's leg showing the proposed place for amputation proposed by the first hospital.

Reporter: "How did Dr. Kawamura treat Mr. Ito's foot?"

[on screen] Dotted line on Mr. Ito's foot showing where his toes were amputated

Reporter: "At Kyowa Hospital, they cut off only the part where all the cells were already dead."

Reporter: "I visited Mr. Ito at Kyowa Hospital two weeks later."

Mr. Ito: "I feel OK. I was expecting my leg to be cut off below the knee, but it turned out that only my toes needed to be cut off, so I shouldn't feel too bad.

Reporter: "It looks quite pitiful, but Mr. Ito himself is not feeling bad at all."

Mr. Ito: "To begin with, all the swelling is gone."

Dr. Kawamura: "The ideal situation is when all the infected parts are completely healed and the muscle has a chance to rebuild, then we don't have to cut off any more than this, and we can place a skin graft on top of the wound. That is the best."

Reporter: "Except for insulin to control his blood sugar level, Mr. Ito does not use any other drugs at all. To restore his damaged blood vessels, he drinks about five liters of alkaline water daily. This water is created by the electrolysis of tap water using the home electrolysis unit."

[on screen] Mr. Ito drinking alkaline water.

Mr. Ito: "The heavy feeling in my body seems to have gone away, too."

Reporter: "For treatment of his foot, he is using strong hyperoxidized water at pH. 2.5. He soaks his foot in this water for 15 minutes twice a day, once in the morning and once in the afternoon."

Reporter: "I visited him in April and I was amazed to see how clean his foot was. It's hard to imagine how awful it looked before."

Mr. Ito: "See, even my toes are emerging."

Reporter: "Mr. Ito is now very light-hearted. He even jokes like this."

Mr. Ito: "I didn't use any drugs."

Reporter: "Dr. Kawamura talked about the skin graft."

Mr. Ito: "The skin just naturally grew over the wound."

Reporter: "By using only water, his skin and muscle regrew. It's amazing. Unbelievable. Now let us report on another patient."

[on screen] Another patient's foot with date (Oct 7, 1992)

Reporter: "As you can see, this is a pretty large area of infection caused by diabetes. By drinking alkaline water and soaking his foot in hyperoxidized water everyday, new muscles were rebuilt and skin naturally regrew. In about four months, the condition improved this much."

[on screen] Same patient's foot with date (Jan. 20, 1993)

[on screen] Dr. Kawamura

Reporter: "Another infection started at Mr. Ito's ankle and spread up to this area in the calf. It was caused by poor blood circulation. However, Mr. Ito is in good spirits."

Mr. Ito: "Once it starts to heal, it goes quickly. It's fun to watch it change."

Dr. Kameyama, Director of Dermatology at Kitazato Research Medical Center

Hospital: "If Mr. Ito's leg is really healing, this treatment is truly a surprise for us in dermatology."

Reporter: "Dr. Kameyama of Kitazato Research Medical Center Hospital visited Kyowa Hospital in May."

Dr. Kameyama: "We normally use vasodilators and muscle growth stimulants, but they don't work very well. Many patients still suffer despite these drugs. We want to try applying this water treatment by using not only hyperoxidized water but also alkaline water."

[on screen] Mr. Ito's leg

Reporter: "Mr. Ito left the hospital on July 2 and he is resting at home. It is the ninth month since he started water treatment."

Mr. Ito: "The second area of infection has been reduced."

Reporter: "Mr. Ito, isn't it nice to still have your leg?"

Mr. Ito: "Of course, it's better than becoming one-legged, or having no legs at all, like a ghost. Nothing is more wonderful than being able to walk using your own legs. They say that you can have an artificial leg, but it is different from your own leg."

[on screen] Home electrolysis unit

Reporter: "It is amazing that Mr. Ito's leg was cured to this extent by treatment with water. Being greatly encouraged by the progress, Mr. Ito increased the amount of alkaline water he drinks from 6 to 8 liters a day. Now he no longer needs to take insulin shots to control his blood sugar level."

Mr. Ito: "I started out taking 24 units of insulin a day, but now I don't have to take anything. No pills, nothing. My blood sugar level has stabilized between 100 to 110. It's been the same for two weeks. I don't have any problem."

Reporter: "Mt. Ito is now walking up the stairs."

Mr. Ito: "I don't need a cane any more. I feel great. It's all because of the water. Thanks to the water."

Announcer A: "It's amazing."

Announcer B: "He had been told that his foot had to be amputated and now he can walk. An industrial electrolysis machine creates the strongly oxidized water that cures infections. Please note that the home unit cannot create this water.

6. MRSA (Methecillin Resistant Staphylococcus Aureus), Eradicated by Hyperoxidized Water

Announcer: "During a hospital stay, people can be endangered from exposure to MRSA (Methecillin Resistant Staphylococcus Aureus), which is a serious and growing problem. Antibiotics do not work on MRSA. Tonight, we will report on the use of hyperoxidized water made by electrolysis to eradicate MRSA."

[on screen] In a hospital hall way

Mr. Muramatsu: "Stop the cart, please. I have to check it."

Reporter: "Mr. Muramatsu, clinical inspection technician, checks the food cart for the existence of bacteria."

Mr. Muramatsu: "To my amazement, MRSA was found on the wheels of the food delivery cart.

So, we are conducting a follow-up check, and we haven't seen the bacteria so far."

[on screen] MRSA Staphylococcus

Reporter: "MRSA is multiple resistant Staphylococcus aureus on which antibiotics do not

work. These bacteria are very vigorous and multiply on shoe soles, inside the human nose and mouth and on the palms of the hand. That's why they are checking the spread of the bacteria. When older people or those with weakened immune systems become infected with MRSA, it can cause pneumonia and heart palpitations. Since antibiotics do not work, some victims die. People who supervise elderly individuals at nursing homes are facing trouble. Hospitals and nursing homes are trying to find a way to deal with this situation."

[on screen] Electrolysis device

Reporter: "Hyperoxidized water created by electrolysis, which is tap water to which a small amount of salt is added and an electric current applied, was found to kill MRSA, and some hospitals have now acquired an electrolysis system."

Dr. Yoshiko Nakamura of Showa University: "We found that about 30 kinds of bacteria including MRSA and other A-4 types bacteria can be killed instantly by hyperoxidized water."

Reporter: "The disinfectant effect of this water has been confirmed from many different aspects."

Dr. Nakamura: "Both herpes and influenza viruses were killed instantly."

Reporter: "This machine was developed for medical use and is different from the one made for the home. This machine creates hyperoxidized water at a pH of 2.5 and an oxidation-reduction potential of 1100 millivolts."

[ion screen] Graph (pH range of bacteria and viruses)

Reporter: "Why can this water kill viruses and bacteria? Let's look at this chart. The pink part shows the pH range in which viruses and bacteria live. When hyperoxidized water at pH 2.5 comes into contact with them, bacteria living in this range are instantly killed. Further, the oxidation reduction potential is an added element to kill a wider range of bacteria and viruses. The chlorine and oxygen in the water also help to kill the bacteria."

[on screen] Microscope

Reporter: "We want to see whether or not MRSA is really killed by this oxidized water. We are looking into a special microscope for examining water.

[on screen] Living MRSA

Reporter: "You can see small dots all across the screen. These are living MRSA Now we put in the hyperoxidized water."

[on screen] Instantly killed MRSA

Reporter: "The moment the water comes into contact with MRSA the cell membrane is destroyed and the bacteria are killed instantly."

[on screen] Nurse, washing hands

Ms. Moriguchi, head nurse at Nara Prefectural Medical School Hospital: "This is a bucket of hyperoxidized water for washing hands. Before and after treating patients, we wash our hands in this water.

[on screen] Inside ICU of Nara Prefectural Medical School Hospital

Reporter: "Hyperoxidized water is made available at the bedside of each patient, and nurses wash their hands with it often. The nurses are happy about not having dry hands from constantly washing the old way."

[on screen] Dr. Miyamoto

Dr. Miyamoto: "We did have problems with MRSA in this hospital, including in the intensive care unit (ICU), but since we started to use this hyperoxidized water and to wash our hands with it, MRSA infections have definitely decreased. The water has also prevented the spread of MRSA."

[on screen] Bucket of water

Reporter: "What is this?"

Janitorial Woman: "This is hyperoxidized water."

Reporter: "She's using oxidized water to clean the hospital floor. Cultures taken here at Iida Hospital in Nagano Prefecture have shown that MRSA has been completely eradicated by the use of hyperoxidized water."

[on screen] Iida Hospital in Nagano

Reporter: "The hospital holds 540 beds, and 2000 people a day enter and leave the facility carrying MRSA. The bacteria became a serious problem, causing apprehension among hospital officials."

Dr. Muramatsu, head clinical inspection technician: "MRSA is not detected now because MRSA and other bacteria are instantly killed."

Reporter: "Let's look at this slide. On the left side is hyperoxidized water. On the right is sterilized, distilled water. No MRSA is present on the mop soaked in hyperoxidized water. This hospital thoroughly examined the properties of hyperoxidized water and confirmed its effectiveness in eradicating MRSA. Now this type of water is used to disinfect the entire hospital."

[on screen] Surgery room in Hospital

Reporter: "This is Surgery Room No. 1 in the hospital being cleaned by hyperoxidized water."

Dr. Muramatsu: "If MRSA is carried into a surgery room, it can cause serious problems. We clean everything in the room with hyperoxidized water. The cultures taken have all been negative."

[on screen] Test tubes

Reporter: "Not only that, test tubes, dishes and toilets used by patients are washed with hyperoxidized water. Patients' sheets are soaked in hyperoxidized water for ten minutes prior to being mixed with other things and washed. This mixing doesn't cause any problem at all."

Dr. Ham, President of Leda Hospital: "In the beginning, I was a little skeptical about this water, but I found it very effective. The only problem is that the government doesn't acknowledge the use of this water for health insurance purposes. The Ministry of Health and Welfare needs to recognize this water as a kind of drug. This water should be used in every hospital in the country. It will be very effective in preventing the spread of MRSA inside hospitals."

Announcer A: "It is amazing, isn't it? If you use an antiseptic solution to wash your hands, your hands get very dry. This water is really good news."

Announcer B: "Yes, indeed. The fact that you can effectively disinfect with this water without any side effects is wonderful. But the cost of using this water is not covered by health insurance."

7. Wondrous Water Cures Atopic Dermatitis (Children's Atopic)

Announcer: "It was found that atopic dermatitis - whose cause is unknown can be cured by the water. We will report on the amazing effects of this wondrous water."

Announcer A: "Now, it is time for our Special Report. Atopic dermatitis is an illness accompanied by intense itchiness. Its cause is unknown. It was found that this difficult illness is cured by water."

Announcer B: "We have been following patients with atopic dermatitis for six months and will now report on the amazing effects of this wonder water."

Reporter: "Atopic dermatitis is painful, causing young children to cry all night because of the intense itchiness. They scratch so much that sometimes they wake up to their sheets stained with blood."

[on screen] Father and child

Father: "My son gets itchy in the middle of the night and cries and scratches his body intensely. It happens every night. We can hardly sleep. So, we are deprived of sleep all the time."

Reporter: "In order to suppress the severe inflammation, doctors use adrenocortical hormones, or steroids. Even ifs patient recovers temporarily, the condition repeatedly

comes back, and the long time use of large amounts of steroids causes a reduction in immunity, a lowering of the functions of the adrenal gland, cataract problems and other

side effects. Recently, concerned parents of young patients have steered away from steroids. Now, this new water treatment has entered the spotlight many patients visit Akashi Hospital which is 5 minutes by car from Nishi Akashi Station of Shinkansen (Bullet Train)."

[on screen] Dr. Shinkai

Dr. Shinkai: "Recently many patients have turned away from steroids. They go to many different hospitals before finally ending up here."

[on screen] twins

Reporter: "Twin sisters Saki and Yu Matsubara visited Doctor Shinkai at Akashi Hospital. Their parents wanted them to be cured from atopic dermatitis without using steroids. Their bodies are red and covered with rashes."

[on screen] Dr. Shinkai and twins

Dr. Shinkai: "O.K., where do you want it next? How about your hands?"

Reporter: "For intense itchiness and inflammation, this strong hyperoxidized water of pH which was especially developed for medical use is applied. And for curing atopic dermatitis from inside the body, patients drink alkaline water. Both types are created by electrolysis. You can create this water from an electrolyzer for home use."

[on screen] Twins, drinking high alkaline water

Dr. Shinkai: "Although I don't force my patients to drink more than they can, by merely drinking electrolyzed alkaline water everyday, the skin becomes really clean in about 3 to 4 months."

Reporter: "There is an unavoidable problem with this water treatment. When patients stop using steroids, they face withdrawal symptoms and the situation is rough for a while."

[on screen] Mr. Tomita

Reporter: "Mr. Tomita of Kyoto was told by Dr. Shinkai in detail about the withdrawal symptoms, so he was able to consent to the treatment of his one-year old son, Ryuki without hesitation."

[on screen] Ryuki

Reporter: "Look, the area around Ryuki's mouth used to be this bad, but now after five months of water treatment, it has gotten this clean."

[on screen] Left: While using steroids Right: Five months after beginning water treatment

Reporter: "None of the atopic dermatitis remains on his elbows or behind his knees. He now has his clean, transparent, infant skin back."

[on screen] Ryuki's grandfather

Grandfather: "It was really bad when the treatment first began. He was covered with blood. But the bleeding would stop when we'd wipe him with tissue paper soaked in that water we get from Akashi Hospital. I am just amazed that he was cured to this degree just by water."

[on screen] Bottles of high alkaline water

Reporter: "Akashi Hospital is sending electrolyzed alkaline and hyperoxidized water to patients at cost."

[on screen] Ryuki

Reporter: "Eleven months after he started water treatment, Ryuki was doing fine without any recurrence of the illness. He is now healthy enough to be able to eat eggs, which he had not been able to eat because they had previously been identified as allergens."

Mother: "Ryuki has a big appetite. He eats more than adults. He has a lot of energy now, is more active and has more facial expressions."

[on screen] Saki and Yu

Reporter: "It has been four months since Saki and Yu switched from steroids to water treatment. The redness has gradually subsided and the symptoms are improving. They have only mild itchiness."

Reporter: "Their mother purchased this equipment as soon as it was put on the market. This machine creates exactly the same highly disinfectant, hyperoxidized water as that created by the larger equipment for medical use. How much improvement can you see in their atopic dermatitis after treatment with these waters?"

Dr. Shinkai: Since August, I have seen about 2000 new patients. I think that in about 4 months, 80-90% of them will be cured, and if those who take a little longer are included, almost everyone will be cured."

[on screen] Dr. Kameyama, Kitazato Medical Research Center Hospital

Reporter: "Experiments have been conducted to prove that electrolyzed alkaline water is effective in curing rash, too."

[on screen] Mouse

Dr. Kameyama: "Experiments were done in which DNFB (a benzene compound that causes a rash) was applied to the right ears of two rats to see if any difference would be seen between the methods of treatment. As you can see, the rash on the right ear of the mouse that was given alkaline water to drink has clearly gotten better compared to the

rash on the mouse that was given only regular tap water."

[on screen] Saki and Yu

Reporter: "It has been 7 months since Saki and Yu started water treatment."

Doctor Shinkai: "Yes, their skin became so clean. These two girls were really in bad condition. The redness and itchiness were very severe. It would have been clear to anyone that their Condition was serious. Even so, their skin became this clean."

Mother: "Finally, in the last week or so, they stopped waking up in the middle of the night."

Reporter: "For the first time since the twins were bon5 the Matsubara family welcomed in the new year without cries at night. There will be pictures in the album of twins with clean skin from now on."

Announcer A: "As you see, the hyperoxidized water does not have an immediate effect on atopic dermatitis. They say that you should expect to wait for about 6 months before you see the change."

Announcer B: "It may take some time before you see the change, but it is water you are taking during that time, so there are no side effects."

Announcer A: "Yes. And if you were on steroids prior to water treatment, they say that it will take three months longer. This water treatment is also effective on adult cases of atopic dermatitis.

We will report on this in the next report in this series."

8. Wondrous Water Cures Atopic Dermatitis (Adult Atoptic)

Announcer A: "This is the second in a series of Special Reports on curing dermatitis by wonder water. Last week we broadcast a report on water treatment for a case of children's atopic dermatitis. We received a great response from the audience. Today, we will report on an adult case of atopic dermatitis."

Announcer B: "Recently, it is said that there are more cases of atopic dermatitis in adults than there are in children. Water treatment is also being found to be greatly effective on adult patients. This is a report on patients who were observed for almost a year."

[on screen] Kenji Takahashi

Kenji: "It still itches."

Reporter: "You can't sleep at night, can you?"

Kenji: "No, not at all. I wake up every hour."

Reporter: "Atopic dermatitis is a battle against incurable itchiness. Kenji Takahashi has been suffering from rashes since he was a toddler. Recently, his symptoms suddenly grew worse and he visited Kitazato Research Medical Center Hospital in Saitama Prefecture."

Dr. Kameyama: "Kenji Takahashi, right? What bothers you?"

Kenji: "I have atopic dermatitis and it itches really bad."

Doctor: "Can you show it to me? Ah, it is bad, isn't it? It looks very itchy."

[on screen] Graph

Reporter: "Atopic dermatitis used to be considered a child's illness. However, two thirds of the cases are found in adults. Sometimes the adult symptoms are more severe than those of children."

Kenji' mother: "This is when he was three years old and he started to see a doctor. He had rashes on his cheeks and hands where the skin is soft."

Reporter: "Doctors use adrenocortical hormones, or steroids, to treat atopic dermatitis."

Mother: "It becomes much better for a while with this drug, but if you stop using it, the rash becomes worse than before."

Reporter: "Worried about side effects, Kenji stopped using steroids a week ago on his own. In reaction, his itchiness increased and the symptoms worsened. Urged by Dr. Kameyama, he decided to go through the two kinds of water treatment."

[on screen] hyperoxidized water at a pH of 2.5

Reporter: "For severe inflammation, he uses this strong hyperoxidized water, which has been developed for medical use."

Dr. Kameyama: "I want you to drink three liters of this water everyday, five liters if you can."

Reporter: "To treat atopic dermatitis from inside the body, he drinks a second type of water, electrolyzed alkaline water. This water can be produced by an electrolyzing machine for home use. Kenji, eager to be cured, started in drinking five liters of alkaline water a day."

Reporter: "In this positive environment, Kenji has shown great improvement."

[on screen] Kenji's skin after 11 days of water treatment

Dr. Kameyama: "The biggest difference I can see is that the redness all over his body has subsided. I'm amazed myself."

Reporter: "Twenty days after Kenji started the water treatment, a more amazing thing happened."

[on screen] Left: Kenji's skin at the time of hospitalization Right: 20 days later

Doctors, nurses, Kenji: "No rash, nothing at all."

Reporter: "Doctors and nurses alike are completely amazed. Needless to say, Kenji went home in high spirits."

Reporter: "However, after going back to a different environment, that of the work place, pigmentation occurred, darkening his skin. One reason for this regression was stress, which shows how difficult it is to cure atopic dermatitis."

Reporter: "Recently, due to fear of side effects, the number of people who have stopped using steroids has been increasing. This can be harmful."

[on screen] Tomomi Arii

Reporter: "Tomomi Arii suffered from a serious case of a topic dermatitis and was hospitalized four times during her junior high and senior high years. The steroids stopped working and, under her doctor' s guidance, she started to gradually cut down on them and switched over to water treatment.

Reporter: "Even so, withdrawal symptoms appeared. Her face became swollen and she suffered from high fever. Cutting steroids on your own without a doctor's guidance can more than you can handle. It is important that you see a physician."

[on screen] Tomomi, 4 months after water treatment

Reporter: "Since switching to water treatment, Tomomi has been improving. Her face was always swollen when she was using steroids. But this is her face after four months of water treatment."

[on screen] Tomomi, 6 months after water treatment

Reporter: "After six months, her skin greatly improved and the itchiness subsided. Her arms also show great improvement."

Reporter: "How has the itchiness changed now that you've started water treatment compared to when you used steroids?"

Tomomi: "It has absolutely decreased."

[on screen] Mr., Kondo (62 years old)

Reporter: "Who could believe that Mr. Kondo who lives in Kyoto, suffered from atopic dermatitis and its side effects for 30 years? Only nine months ago, he had severe rash even on his abdomen. Since then, he has been drinking alkaline water and now the skin is this clean. His hands looked like an elephant's skin, but now they also look totally different.

His feet, once swollen from the use of steroids, are looking perfectly normal."

Mr. Kondo: "I don't think it will recur. I hope everyone who suffers from atopic dermatitis will be cured by this water."

[on screen] Kenji

Reporter: "Kenji Takahashi, who had skin discoloration or pigmentation, has continued to drink electrolyzed alkaline water. He also purchased an electrolyzer that creates strong hyperoxidized water, and is treating himself. His skin color is coming back to normal little by little."

Reporter: "How has the itchiness changed compared to when you used steroids?"

Kenji: "There is none now."

Reporter: "Kenji says that people don't stare at him like they used to."

Announcer A: "Even those who had suffered for thirty years were cured, weren't they?"

Announcer B: "Yes. There is one thing we have to be careful about. It was reported that when those who have been using steroids for many years suddenly stop, their condition might worsen due to withdrawal symptoms, but if they persevere through that period, about six months in general, their skin condition will improve. Please see a physician for this water treatment."

Announcer A: "The hospital that we introduced today is Kitazato Research Medical Center Hospital at Kitazato City, Saitama Prefecture."

9. The Key is Water for Agriculture

Announcer: "Today for our Special Report, we will visit an orchard in Yamanashi Prefecture where cherries and peaches are produced without using agricultural chemicals. The key is water."

Reporter: "One step into the commercial district here and we see fruits, the taste of autumn, displayed in abundance. Peaches, grapes and pears- in vivid color and perfect shapes - enhances one's appetite. They say that it is necessary to use agricultural chemicals and fertilizers to grow such perfect looking fruits. They know, of course, that bugs and insects don't want to miss out on the delicious food that human beings eat. They bite off the leaves and go inside the fruits."

[on screen] Cherries infected with mildew

Report: "Farmers get into trouble because of mildew. The commercial value of their crops

drop and their income decreases. Therefore, farmers cannot help using agricultural chemicals like pesticides. Cherries need to be sprayed with agricultural chemicals six to seven times before they are harvested. For peaches, that number is 10 to 15 times, and for grapes, 16 times. The dangerous effects of agricultural chemicals have become a concern."

[on screen] Highway

Reporter: "However, after hearing about growing fruits without using such agricultural chemicals, I drove to Shirane-cho, Yamanashi Prefecture where a scene of orchards of cherries and peaches and hills of grape vines spread across the landscape before me."

[on screen] Mr. Tezuka

Reporter: "This is Mr. Yasuhiro Tezuka who is taking up the challenge of growing fruits without chemicals. He is driving a strange vehicle to the Agricultural Coop."

Mr. Tezuka: "This machine makes high alkaline water and hyperoxidized water by electrolysis."

Reporter: "Adding a small amount of salt to tap water and initiating the process of electrolysis, you can create an unlimited amount of strongly disinfectant, hyperoxidized water. Mr. Tezuka came to fetch this water."

Mr. Tezuka: "Today, I'm planning to eliminate gray mildew with this water."

Reporter: "Mr. Tezuka is well known in Shirane-cho as a specialist with a green thumb for growing fruit. For the past thirty years, he has been concerned with the problem of agricultural chemicals. He wondered if he could grow safe fruits that would not harm the human body. His dream came true with this water."

Mr. Tezuka: "This has a pH of 2.6, so you can disinfect with this water."

Reporter: "Will bacteria actually be killed? Hyperoxidized water was sprayed on some infected leaves."

[on screen] Leaf

Reporter: "Did you see that? Let us look at it again in slow motion. The area of the leaf where the water made contact is the only area without bacteria. In the mid-June of this year, the cherries ripened, a scene which had been Mr. Tezuka's dream and many people who heard about it came to visit him."

[on screen] Woman

Woman: "This is my first cherry picking. It tastes just wonderful. Sweet!"

[on screen] Left: Cherries produced in other prefectures Right: Mr. Tenrka's cherries.

Reporter: "Compared with cherries grown in other prefectures, both the size of the fruit and the price are better. Mr. Tezuka's cherries also taste better. Mr. Tezuka operates a 4000 tsubo (about two acres) orchard where he has 180 cherry trees, 110 peach trees and

50 grape vines. Although he realized that he could disinfect his fruit trees with this safe and harmless water, it was not easy for him to make up his mind to use it."

Mr. Tezuka: "I was not 100% sure that I could succeed. I have to make living, you know. I was worried. I spent many sleepless nights."

Reporter: "In the switch from agricultural chemicals to harmless water, how did Mr. Tezuka's farming change?"

Reporter: "First, his attire changed. When using agricultural chemicals, he used to protect his face with a towel over a protective mask, wear long boots, a thick raincoat and gloves, and a hat. Now he works in his regular working clothes."

"He adds a large amount of organic fertilizer and leaves plenty of space in between the plants. He sprays hyperoxidized water up from the underside, aiming to clean out bacteria and insects on the backs of the leaves. He uses both Chinese herbs and hyperoxidized water for eradicating insects."

Mr. Tezuka: "I use Chinese herbs to distract the bugs, to get them to go away."

Reporter: "At last, we have discovered the secret of growing perfect fruit!"

Mt. Tezuka: "This operation inserts alkaline water into the soil. By doing this I intend to grow thick, strong leaves."

Reporter: "Trees that do not receive alkaline water are more infected with mites."

Reporter: "We tested the sweetness of the fruits."

[on screen] "Sweetness measuring device, showing 15.4."

Man: "Wow, this is amazing."

Reporter: "Mr. Tezuka's cherries are rated excellent. How about his grapes? They measure 23.3. Intensely sweet grapes were grown!"

Mr. Nakagome, JA Nishino Agricultural Coop: "Mr. Tezuka grows cherries, peaches and grapes without using agricultural chemicals. Here are the test results of his fruits tested for residues of agricultural chemicals by the Sanitation & Pollution Research Center. They show zero chemical residue."

Mr. Hasebe, Head of JA Nishino Agricultural Coop: "My hope is that our entire area will be able to grow fruits without chemicals."

Reporter: "Mr. Tezuka who realized his dream of growing fruits without using chemicals is now enthusiastic about his new idea to help increase the number of growers like him."

Announcer A: "This water is very effective. Unlike agricultural chemicals, it leaves no

residues, so it appears to be very good for the environment."

Announcer B: "Some people are worried that since it is hyperoxidized water, it could have the same effects as acid rain. This water is said to revert to regular water once it contacts the ground."

10. Stomach and Deodenal Ulcers Treated with Hyperoxidized Water

Announcer A: "It is time for our Special Report. Have you ever heard of a kind of bacteria called Helicobacter pylori? It was long an established theory that the cause of stomach and duodenal ulcers, both of which tend to be seen in Japanese people, were caused by stress and excessive gastrointestinal acid. However, this pylori bacteria has been recently identified as the cause."

Announcer B: "In Japan we are very familiar with the name pylori. What naughty things are they doing inside the stomach?"

[on screen] Pylori bacteria

Reporter: "Have you ever seen this bacteria through an electron microscope? They have several tail-like flagelli and are called Helicobacter pylori. Surprisingly, these bacteria have been found to cause both stomach and duodenal ulcers."

[on screen] Dr. Koei, Tokyo Women's Medical University

Dr. Koei: "Stomach and duodenal ulcers have been thought to be caused by stress or strong acidic conditions in the stomach. Also, drugs, cigarettes, and alcohol that stimulate the secretion of acid have been implicated. However, about ten years ago an organism called Helicobacter pylori was discovered inside the stomach by an Australian scientist. Research done by scientists in the United States and Europe subsequently confirmed that these bacteria are the cause of stomach ulcers."

Reporter: "The Japanese Gastrointestinal Society has begun to study these bacteria. Their results indicate that the bacteria were found in 80% of stomach ulcers and 85 - 90% of duodenal ulcers. But how were these Helicobacter able to live in the strong acidic fluids of the stomach that range from pH 1 to 3?"

Dr. Koei: "One feature of Helicobacter is that it has an enzyme called urease. Urease dissolves uric acid in the lining of the stomach and creates ammonia."

Reporter: "This ammonia neutralizes the strong acid in our digestive organs and changes

the environment, enabling the bacteria to live. The cellular toxins from pylori and ammonia that these bacteria create damage membranes in the body.

These agents together with free radicals created by factors in the immune system create ulcers. You would think antibiotics would kill the bacteria, but it is not that simple."

Dr. Koei: "If you overuse antibiotics, the danger is that antibiotic resistant strains of Helicobacter pylori might emerge."

Reporter: "Doctors say that they don't want to repeat what happened with MRSA."

Dr. Koei: "We have to find out how we can kill Helicobacter without creating resistant bacteria."

[on screen] Functional Water Symposium

Reporter: "In the midst of trial and error experiments to find out how to eradicate Helicobacter, one amazing treatment for ulcers emerged and was publicly presented at the Functional Water Symposium held last year. It was reported that stomach and duodenal ulcers were significantly reduced when they were washed with highly disinfectant, hyperoxidized water."

Dr. Hamahata, Hamahata Clinic: "A first stage ulcer was identified through an endoscope. This is a photo taken seven days after water treatment. The size of the ulcer has been reduced."

Reporter: "We are visiting Hamahata Clinic, located two hours from Kagoshima Airport."

Dr. Hamahata: "Now we are in your esophagus, O.K? Now I'm looking at your duodenum."

[on screen] Series of photos showing different stages of cure for ulcers

Reporter: "Looking at a model of the process for curing ulcers by drugs, you can see improvement about every two weeks and, at the S1 stage, it has entered the range of cure."

Doctor: "I'm looking at the ulcer right now. It's a lot better."

[on screen] Left: Ulcer at the time of initial diagnosis Right: One month later

Reporter: "His ulcer was this bad a month ago, but now the ulcer is small."

[on screen] Dr. Hamahata

Dr. Hamahata: "Why is hyperoxidized water good for treating ulcers? One reason is that ulcers are thought to be caused by bacteria called Helicobacter pylori.

[on screen] Helicobacter pylori

Reporter: "The doctor is using hyperoxidized water with a pH of 2.5 and a redox potential of 1100 millivolt. This water is inserted by tube to rinse the ulcer and affected areas several

times. After every washing, the water is sucked out. Finally, the ulcer is rinsed with weak alkaline water created by electrolysis. Are the Helicobacter killed?"

[on screen] Left: Living Helicobacter pylori Right: Dead Helicobacter pylori

Reporter: "When you look at the bacteria treated with the hyperoxidized water through an electron microscope, it is clear that they are dead."

Dr. Hamahata: " In addition to conventional ulcer treatment, we used hyperoxidized water to wash the ulcer. My impression is that this patient would be cured faster than one that has only undergone conventional treatment."

Reporter: "I was shown the results."

Dr. Hamahata: "This is a case involving an 81 year old woman. She visited us complaining of stomachache. A large ulcer was found in this area in the duodenum, and the bleeding has just stopped. We treated the ulcer with hyperoxidized water. A week later, the large ulcer became this small."

"This is a case in which a 69 year old man who suffered from a liver ailment was hospitalized. He also had a large duodenal ulcer which was spreading deeper into the organ. This is a week after treatment with hyperoxidized water. You can see that the ulcer has been closed. This dramatic cure occurred in just one week."

Reporter: "This presentation of hyperoxidized water treatment made a strong impression on those attending the Functional Water Symposium."

[on screen] Man in audience at the symposium

Man: "I think this is a very practical use of the water and the treatment was well performed."

[on screen] Home electrolysis unit

Reporter: "In this hospital, electrolyzed alkaline water is also used. How many glasses of water do you drink each day?"

Patient (old lady): "I drink many glasses. My stomach is doing better. I could hardly eat at all before I came here. Even rice porridge didn't taste good. But now I have my appetite back. Thanks to the doctors, I feel better now."

Reporter: "Compared to conventional drug treatment, the hyperoxidized water treatment for ulcers has a short history, and this is the only hospital where the water treatment for ulcers is performed. Patients say that they are happy with it and that they seem to be cured faster."

Announcer A: "You would think that it would be good to just drink this hyperoxidized water, wouldn't you? But they say that you cannot eliminate pylori bacteria in the stomach that way."

11. Hyperoxidized Water Effective as a Disinfectant

Announcer: "Time for the Special Report hour. The endoscope is an indispensable piece of medical equipment for internal examination of the stomach and duodenum. Since these invisible bacteria attach to the internal parts of human bodies, great care has to be taken to clean and disinfect the endoscopes. Conventionally, disinfectant chemicals are used to sterilize the endoscopes, but recent attention has focused on water - hyperoxidized water created by electrolysis. We have been following stories that reveal how effective this water is as a disinfectant."

Dr. Hamahata, Hamahata Clinic: "I'm looking at the ulcer, it looks much better than before."

Reporter: "Endoscopes are indispensable for discovering the infected area in the digestive system as well as for examining the ailment."

Reporter: "There has always been a risk that any bacteria that live inside the patient's body, including Helicobacter pylori, which has recently been in the news for causing stomach and duodenal ulcers, can attach themselves to the endoscope during use. Therefore, extreme care must be taken in disinfecting the equipment after each use."

[on screen] 2% solution of glutaraldehyde

Dr. Sakurai: "Generally, endoscopes are disinfected in this yellow green liquid, a 2% solution of glutaraldehyde. It is the most powerful disinfectant, killing a wide range of bacteria and viruses including Helicobacter pylori, hepatitis B virus and AIDS virus."

Dr. Sakurai, Endoscope Center at Kanto Teishin Hospital: "Glutaraldehyde is recommended by the Endoscope Society for disinfecting endoscopes. They have to be soaked in this solution more than twenty minutes at a time."

Reporter: "There are two problems with this chemical. The fist is that, in a larger hospital where many patients are examined daily, it is too time consuming. Secondly, it is highly toxic and classified as a strong poison."

Dr. Sakurai: "Residue of this chemical on endoscopes is cause for some worry. It is also expensive. Another worry is that the use of this chemical can cause skin inflammation or allergic reactions in our staff."

[on screen] Electrolysis unit

Reporter: "At the center of attention is water created by adding a small amount of salt to tap water and applying an electric current. It has the same disinfectant power as glutaraldehyde, except that it is faster and non-toxic. Increasingly, hospitals are using this water to disinfect endoscopes."

[on screen] Endoscope soaked in hyperoxidized water

Nurse: "After we use the endoscope, air is forced out in a container of hyperoxidized water, pushing out materials attached inside the tube, then hyperoxidized water is drawn back

through."

Reporter: "Having developed a good understanding of the properties of both alkaline and hyperoxidized water, Doctor of Hamahata Clinic in Kagoshima Prefecture utilizes them well, taking advantage of the benefits of each."

Dr. Hamahata: "hyperoxidized water is put through the tip and the extractor of the endoscope."

Reporter: "Bacteria are often seen on this tip and extractor area."

Dr. Hamahata: "Then we wash it with high alkaline water that dissolves protein, blood and stomach fluids. Then we soak it in hyperoxidized water. There is ample data to support the fact that hyperoxidized water kills almost any kind of bacteria or virus. It has immediate disinfectant capabilities."

Reporter: "Finally, they wash the unit with tap water. The entire cleaning time takes only about five minutes. The disinfectant property of this water was reported at the Functional Water Symposium held last year."

Doctor: "We took a bacteria culture from the tip of the endoscope and the extractor. No bacteria were seen."

[on screen] Patient being examined with endoscope

Dr. Sakurai: "You feel something large is coming inside of you. Now it is bumping into you a bit."

Reporter: "At Kanto Teishin Hospital, eight minutes walk from Gotanda Station, Tokyo, they started using this hyperoxidized water for cleaning endoscopes three years ago."

Dr. Sakurai: "We examine as many as 40 patients a day, so the more time we use to clean endoscopes, the less efficient we are. We conducted research with other doctors to find the most time-efficient and safe way to clean them."

Reporter: "When word got out about this disinfectant water, the first person in medical field to put together a research team to test it was Dr. Okada, Director of Clinical Examinations."

Dr. Okada: "The director of the Endoscope Department suggested that we look into using this water to clean endoscopes. We experimented with 10 mi., 30 mi. and 50 mi. of hyperoxidized water to be drawn through the endoscopes. We found that with 50 ml, of this water, the bacterial disinfectant rate is the highest. It is wonderful to be able to use this water to disinfect completely."

Reporter: "They showed me the current disinfecting process. After its use, the endoscope is covered with filth and bacteria. First, it is washed with tap water and the extractor is removed from the endoscope and soaked in strong hyperoxidized water."

[on screen] Brushing inside the extractor channel

Dr. Sakurai: "The extractor is set aside to soak. It is also important to clean inside the extractor channel with a brush. Blood, stomach fluids, and so forth are scraped off from inside it in this way as far as possible."

Reporter: "The whole thing is soaked in hyperoxidized water for ten seconds, then this water is injected into the channel and 50 cc of this hyperoxidized water is drawn back through."

Dr. Sakurai: "Hyperoxidized water is being drawn into the extractor channel for disinfecting. A culture shows zero bacteria are present."

Reporter: "Oh, zero."

[on screen] Helicobacter pylori

Dr. Okada: "We also took a bacterial culture to search for the presence Helicobacter pylori and the result was that this bacteria was completely eradicated by this water. As for the side effects of hyperoxidized water, we think that it is completely harmless."

[on screen] Electrolysis unit specially made for Endoscope Center

Reporter: "Dr. Sakurai and his staff at the Endoscope Center wrote a report for a medical journal that declared that using hyperoxidized water for cleaning endoscopes is an easy-to-handle, effective, and fast method for disinfecting. They also noted that the wear and tear on the equipment is less than with conventional sterilization and that it is the most appropriate method for clinical examinations that are conducted on a daily basis."

Reporter: "During these times when the number of powerful enemies such as Helicobacter pylori, hepatitis B and AIDS virus has increased, it was necessary to find the perfect way to disinfect endoscope"

Announcer A: "From the point of view of the patient, we would like a safe and sure method to be available, especially since bacteria and viruses are invisible to the naked eye."

12. Sterilization of Dental Equipment to Prevent Infections

Announcer A: "It's time for our Special Report. They say that in our mouths there are about 80 kinds of bacteria. When your teeth are treated, your blood vessels and gums can be damaged, raising the danger of infection from the hepatitis virus."

Announcer B: "The key to preventing such infection is sterilization of the dental equipment. The power of disinfectant water created by electrolysis is now being studied."

[on screen] Many kinds of bacteria seen through a microscope

Reporter: "You are watching various kinds of bacteria through a microscope. Are these bacteria from ditch water, or from someone's kitchen? Neither. They are in fact bacteria from the mouth that live in small cracks between our teeth.

In our mouth, there are about eighty kinds of bacteria, including Tricomonas candida and MRSA against which even antibiotics do not work any more."

[on screen] Air turbine

Dr. Kashiwada: "This is a heated air turbine. It sounds like this and water comes out from here."

[on screen] Jikei Dental Clinic, Tokyo

Reporter: "When you have an intense toothache, the place you run to is the dentist's office. There, without exception, your will be taken care of by this air turbine. It rotates 500,000 times a minute with compressed air, scraping away at your tooth. When the instrument is employed, water is used to prevent vibration and friction from heat. The trouble is, when the turbine is stopped, it sucks in water."

[on screen] Illustration depicting reverse flow of air turbine

Dr. Kashiwada: "Many kinds of turbines with an attachment to prevent this reverse flow have been brought out on the market lately. When a turbine is stopped, water gets sucked back in along with blood and other things from the patient's mouth."

Reporter: "Are AIDS or hepatitis viruses hiding in this blood?"

Dentist: "It can be very dangerous. So, dentists disinfect the turbine after every use."

Reporter: "Disinfecting a turbine takes time, money and cause wear on the instrument. There is yet another problem in handling an air turbine."

Dentist: "When water is splashed into the patient's mouth, water splashes out."

Reporter: "We experimented with water using red dye to see how far the water splashed."

[on screen] Water splashing experiment with air turbine

Dentist: "The water that splashes off the teeth is mixed with bacteria, blood and saliva. So, it becomes very unsanitary."

Reporter: "There are many bacteria living in our mouths. Not only do the germs splash all over the dental equipment, endangering other patients, but they can infect the staff as well."

Reporter: "The staff could develop an infection, huh?"

Dentist: "Yes, we must be careful."

Reporter: "This office has a side vacuum system now to prevent the splashing of water. It's good equipment, but it is not yet in common use."

Dr. Kashiwada: "In dentistry, we deal with many kinds of bacteria and it has been very difficult to kill them all. But, now we can use a superbly effective disinfectant called hyperoxidized water."

Reporter: "This is the equipment that creates the hyperoxidized water. By adding a small amount of salt to tap water and then applying electrolysis, a powerfully disinfectant water is created."

[on screen] Documentation

Dr, Kashiwada: ""Hyperoxidized water has been studied at universities and research institutes. We gathered the available information and created this chart."

[on screen] Chart

Reporter: "Crosses indicate no disinfecting ability, triangles indicate not effective all the time, and circle indicate effectiveness."

Dr. Kashiwada: "The results show that the hyperoxidized water is very effective in eradicating viruses such as AIDS and hepatitis B. It can be said that strong hyperoxidized water has the same or better disinfectant effectiveness as conventional drugs."

Reporter: "Dr. Kashiwada uses the disinfectant properties of this water to sterilize the air turbine."

Dr. Kashiwada: "The air turbine becomes filthy after use. First, we wipe it off with a towel that is soaked with strong hyperoxidized water. Then the turbine is turned on to push out unclean water from inside. Right before the turbine stops, it is put into hyperoxidized water. In this way, hyperoxidized water is sucked back into the tube, disinfecting the inside of the turbine."

Reporter: "After that, air is bubbled out from the turbine, and finally it is wiped again by a sterilized towel."

Reporter: "Research is being conducted to confirm the effectiveness of hyperoxidized water in preventing in-clinic infections caused by splashing when using an air turbine. The amazing thing is that some dentists now have abandoned conventional sterilization equipment that use ultra sonic waves, heat or gas."

Dr. Kashiwada: "Conventional sterilization has never been perfect. The disinfectant effects of strong hyperoxidized water shortens sterilization time drastically, and we can be sure of its effectiveness. It makes me wonder if it could be an epoch-making method."

Reporter: "There is more to this."

Dr. Kashiwada: "We no longer use any conventional sterilization here. Everything has been replaced by this water."

Reporter: "When administering Novocain, the tooth is now splashed with hyperoxidized water. It should be noted that cleaning the inside of the mouth involves dousing it with plenty of hyperoxidized water, then all the bacteria die just like this." [on screen]

[on screen] Dr. Okamura, dental clinic

Dr. Okamura: "We have just extracted a wisdom tooth at the back of the jaw. Can you see that there is very little bleeding?"

Reporter: "Dr. Okamura started to pay attention to hyperoxidized water three years ago. He purchased a small unit and is using the hyperoxidized water regularly."

Dr. Okamura: "We have found that it is very effective in accelerating the healing of the surgical wound and in arresting the bleeding. It makes it easier to perform surgery."

Reporter: "It was surprising to see that they were using an IV bag for the hyperoxidized water. It is easier to carry them around in this way. The hospital is happy not to have to invest in more equipment."

Reporter: "What happens if you accidentally drink this hyperoxidized water? Doesn't it cause any problem if this water gets into the eyes? We flew to Kyushu to visit the Chemical Inspection Association which tested the toxicity of this hyperoxidized water."

Mr. Imatanaka: "To see if it was toxic when accidentally ingested, we fist conducted acute toxicity tests. Absolutely no toxicity was detected. Then we test it on a rabbit to see if contact with the eye would cause irritability. Nothing unusual was seen in the rabbit's eye."

Reporter: "Powerful disinfectant, hyperoxidized water -- it is non-toxic and can suppress bleeding. It is expected that from now on it will be indispensable in dentistry."

13. Organic Agricultural Method for Safer & More Delicious Produce

Announcer A: "It is time for the Special Report. Vegetables consumed daily, such as cucumbers and tomatoes are, in fact, grown with a large amount of agricultural chemicals -- to the extent that you could say they are soaked in chemicals. These chemicals are also linked to soil and water contamination,"

Announcer B: "Yes. Because of that, farmers are taking another look at sustainable agriculture. It is an agricultural method that uses organic fertilizer like chicken and cow manure and less chemical fertilizers. Water use is also a key to this method of agriculture. Let's take a look."

Mr. Kamon, Tokyo Wholesale Market: "Sweet!!"

Ms. Torisu, food researcher: "They're so fresh. It's the taste of first love! It's delicious!"

Reporter: "Both of these visiting food specialists are extremely impressed with the deliciousness of these strawberries. On this farm, they harvest 250 boxes a day. What grabs your attention the most is the smiting faces of the farmers."

Mr. Fukumoto: "I want to grow even better ones next year."

Reporter: "This is the Aso area in Kumamoto Prefecture, a vast open area, 128 km in circumference. It has been chosen repeatedly as one of Japan's top100 areas for drinking water. Underground water gushes up from the Aso Mountains. It is a place of world-class scenic beauty."

"Not wanting to contaminate any more of this environment, the farmers here want to grow safer and more delicious agricultural produce. These farmers, who live in and around six towns in the southern Aso area, are taking up the challenge of a newly established organic agricultural method. We have followed them for the last six months."

Reporter: "What are you spraying?"

Mr. Matsuda: "This is restructured water."

Reporter: "Is it completely harmless?"

Farmer: "Yes, it is."

Reporter: "How are the prospects for this year's harvest?"

Farmer: "Looks good so far. Because we use restructured water, we have cut down on the use of insecticides and chemical fertilizers by about one third now."

Reporter: "Mr. Matsuda has 37 years of experience in agriculture and is an agricultural instructor for Kumamoto Prefecture. He looks totally content with his tomatoes after the drastic decrease in the use of agricultural chemicals. Success with tomatoes have been rare in recent years."

Mr. Matsuda: "I had a lot of damage from insects last year."

[on screen] A green caterpillar in a tomato

Reporter: "He had a lot of trouble with green caterpillars that year when he didn't use restructured water."

Mr. Matsuda: "If even one green caterpillar gets into the crop, the tomatoes will be spoiled. Even with stronger agricultural chemicals, these bugs don't die."

Reporter: "He even purchased a robot to spray the chemicals for fear of losing his income."

Mr. Matsuda: "Every time you use agricultural chemicals on the field, you are covered by chemicals from head to toe, so I resolutely bought a robot. I used it twice or so last year.

But, because I used restructured water this year, there were not very many bugs and the robot has been kept in storage."

Reporter : "There aren't any blighted crops in this field at all, are there?"

Mr. Matsuda: "No, but there were other areas that were said to be totally destroyed."

Reporter: "I visited a greenhouse near Mr. Matsuda's farm. I was completely amazed to see a pile of dead tomatoes that had wilted and completely lost their commercial value. These tomato vines had received numerous applications of agricultural chemicals."

Farmer: "These tomatoes were grown in a greenhouse in the middle of the hot summer. When harvest time finally came, they wilted. It was too devastating to cry over."

Reporter: "However, Mr. Matsuda's tomatoes look great. We visited another farmer that grows tomatoes in the same way as Mr. Matsuda does."

Mrs. Kochi: "Our tomatoes are shiny and have a good shape. As many as 60% of our tomatoes were rated extra superior."

Reporter: "Here, again, good news came to my ears."

Woman: "We cultivated the soil with Thomas Orga Bacteria and sprayed plants with a mix of tap water and restructured water at a ratio of 500:1. Previously, we had problems with wilt disease and black leaf spot, but not any more."

Reporter: "What are these things called Thomas Orga Bacteria and restructured water that are so greatly beneficial to farmers? We decided to investigate."

Mr. Goto, Thomas Research Center of Japan: "This is Thomas Orga. Bacteria, originally created by Dr. Thomas of the United States."

Reporter: "One gram of this black powder contains two to three billion beneficial bacteria of 40 different kinds. You add rice bran and oil cake to it, mix in chicken and cow manure and saw dust, then rotate it. After 45 days, the mix becomes mature compost."

Mr. Soda, Thomas Research Center of Japan: "Our goal is to bring our soil back to its original state."

[on screen] House in which Dr. Kitazato, a famous bacteriologist, was born

Reporter: "Oguni-cho is the birthplace of Dr. Shibasaburo Kitazato. The JA Compost Center, which ran deficits over the past few years, was revived by the introduction of this bacteria. Was there some kind of karma involved here?"

Mr. Hirose, Restructured Water Research Center: "Restructured water is made by adding a small amount of organic matter to tap water, thereby raising the energy potential of the water."

[on screen] Three plants in different soil mixes

Left: 80% sterile soil, 10% organic compost manufactured by another company

Center: 65% sterile soil, 30 % same organic compost, 5% Thomas compost

Right: 80% sterile soil, 20 % Thomas compost

Reporter: "Does it really make a difference?"

Left: 80% sterile soil, 10% organic compost manufactured by another company. Center: 65% sterile soil, 30 % same organic compost, 5% Thomas compost. Right: 80% sterile soil, 20 % Thomas compost.

Reporter: "The same amount of restructured water was added to these soils. The results show significant differences in the growth of the leaves as well as in the development of the root systems."

[on screen] Two plants grown with the same amount of Thomas compost:

Left: Restructured water was applied twice. Right: Restructured water was applied five times.

Reporter: "Here are two plants grown with the same amount of Thomas compost and watered with restructured water twice (left) and five times (right) over a 20 day period. Great differences are seen in the amount of leaf growth and in the development of the root systems."

Ms. Torisu: "In order to protect our lives, we desire fresh and healthy food that we can consume without worry."

Mr. Kamon: "Being tasty and cheap is not enough in today's market."

Reporter: "Why are conventional agricultural methods demanding so much reflection at a meeting of consumers, producers, distributors and agricultural coop members?"

Reporter: "Another factor in agricultural produce is scavenger water."

Professor Esatoguchi, Nakakyushu Junior College: "The word scavenger is not familiar to our ears. The closest Japanese translation would be "a cleaner that erases free radicals."

Reporter: "Antioxidants such as vitamin C, beta carotene, and flavonoids that kill free radicals are abundant in vegetables, fruits and grain."

Prof, Esatoguchi: "This is another reason why it is important to grow produce without many agricultural chemicals."

Reporter: "The farmers in southern Aso area and the surrounding region have started to actively grow safer and higher quality agricultural produce.

"Some change has started to be seen in major supermarkets and distribution systems.

However, in order to make this change a success, consumer consciousness needs to be changed."

Consumer 1: "I want to eat food that is as safe for the body as possible."

Consumer 2: "Organic produce clearly tastes better. What it looks like on the outside is not important."

Reporter: "The Aso area is now in its second year of a new agricultural method that uses organic fertilizer consisting of microorganisms and water and a decreased amount of agricultural chemical use. The farmers are exited about challenging this new horizon."

Announcer A: "It is amazing that they produce that much without using agricultural chemicals, isn't it?"

Announcer B: "I wanted to learn more about restructured water. Currently, this agricultural method is used only in the Aso area."

Expanding a New Scientific View Of the Functional Properties of Water

Bruce L. Erickson and Richard A. Wullaert, Ph.D.

November 2, 2001

Columbia University, New York City

The Functional Water Society of North America

If we truly honor the sacredness in all life from the humble village to the largest city on Earth. Then we need to honor water for without it life would not exist. We need to fully understand the nature of water and how best to work with it in supporting all life. This will take the synergy of nature, technology, wisdom and ethics toward all mankind! From the philosophy of Rudolph Steiner

Future Vision

In a village in the future, a WaterLife project could be seen as providing a clean central water source, monitored for safety via satellite communications and laser spectral analysis. The pumps are powered utilizing solar arrays, methane gas, wind or pedals. They are equipped with easy to clean filters and the ability to apply magnetic fields and modulated UV light in the water treatment process. Water can be effectively used as a disinfectant for cleaning or as an environmentally safe pesticide when the appropriate electrolyzing tools are applied.

Where appropriate, natural methods of water restoration could also be used such as those proposed by John Todd at Wood's Hole, creating a synergy between nature and technology. All of this exists now; it just needs the bold step of "vision" to view water as a whole system to best serve the needs of mankind.

The Nature of Water

Water is a molecule of wonder and a resource that is taken for granted. The bonding and structure of water give it unique biological and ecological properties. We need a better understanding of water, its uses, and what we're doing to it. We need to merge advanced water research with current water polices and treatment, and use water as an ecological tool in renewing our environment.

We need to provide water as the means to better the health of the villagers and their animals, and to enhance their crops. To do this, we need to step aside from our historical view of water science and consider the possibilities presented by recent research, some of it "outside the box". We need a wholistic vision and policy to ensure that we have clean air, water and proper soil conditions to maintain a healthy planet for its people and all life. We need to approach water from a whole systems perspective, using the new scientific advancements in our understanding of the nature of water and the water of nature!

Wholistic Approach to Water

The current focus on water treatment is on what shouldn't be in the water. This assumes that the removal of "bad' things in water will make the water good (i.e., have a positive health benefit). From an historical point of view, this may be true, except some of the techniques/chemicals used to remove the "bad" things may add new components that reduce the health benefits of the water. Thus, the current concern for the toxic byproducts of chlorine disinfection. The wholistic approach would be to consider what negative functions we are adding to water in our effort to remove or reduce existing components (microbes, toxins, chemicals, etc.) that produce negative functions. The next thing is to consider what we can do to water to produce positive functions. Another way to use the wholistic approach to water is to be concerned with what role the solvent (water) plays in the effectiveness of what's in it (solutes).

Microbiologist has long recognized the import role that biological water plays in the formation of cell membranes, enzymes, and even DNA. Water restructures itself to accommodate biological processes [1]. Thus, nature shows us that altering the structure and properties of the water can have significant effects on what can be accomplished by what is in the water.

Functional Water

There is Functional Medicine and Functional Food, so why not Functional Water?

Functional water can be defined as water that produces a positive health benefit. If we look at the basic functions of water in the body, such as solvent, lubricant, nutrient delivery, waste removal, and most of all, enabling almost all key biological processes (i.e., life), it is clear that water produces a positive health benefit. One example of an historical version of functional water is the mineral water used at spas for internal and external health benefits. Another example is the addition of fluorides to drinking water, which is supposed to produce a positive dental benefit (when calcium fluoride is used, not sodium fluoride, which is the chemical used mostly by local water companies). Not everyone agrees that fluoride in any form is beneficial.

If we want to see the health benefits of water, just look at what the lack of sufficient water in the body (dehydration) can cause [2]:

- Increased risk of kidney stones.

- Increased risk of urinary tract cancers.
- Increased risk of colon cancer.
- Increased risk of breast cancer

Some people feel that many of our health problems are due to chronic dehydration, and that proper hydration alone would cure many of our common diseases [3].

It is clear that water has medicinal and functional value. The key issue is what state should the water be in to provide the optimal medicinal and functional value. Unaltered source water from deep wells or protected springs would be a good start, but there are very few sources of water that are not treated by chemicals such as chlorine, ozone, and other chemicals. Thus, we should consider new treatment concepts that may restore or improve the medicinal/functional properties of conventionally treated water.

The historical way that functional water is produced is for nature or man to add minerals. Recently, man has decided to make aquaceuticals. That is, water with nutraceuticals (vitamins, herbs, minerals, etc.) that presumably produce a health benefit.

Note that in all these cases, water is just the carrier (solvent) and the health benefits are assumed to come from the additives (solutes). Now what if the properties of the solvent (water) could be altered so that it contributed synergistically or catalytically to improve the health benefits of the solutes. This approach to making functional water has been actively pursued in recent years, particularly in Japan and Russia.

The Japanese Functional Water Foundation defines functional water as water that has been exposed to external energy fields. This includes electrical, magnetic, electromagnetic (infrared, microwave, nuclear), ultrasound, and vortex implosion.

The most widely used energy sources to make functional water are electrolysis and magnetic fields. The most scientifically studied functional water process is electrolysis.

The Japanese and Russians have used electrolysis in combination with ion separation to produce functional waters with a wide range of beneficial properties for over 200 applications [4, 5].

For example, since 1966 the Japanese have been drinking electrolyzed alkaline water to increase and enhance calcium absorption. Approximately 15 million Japanese now drink this water.

The Japanese Ministry of Health and Welfare has certified that alkaline electrolyzed water (a reducing water)assists in the alleviation of gastrointestinal disorders, acidosis, chronic diarrhea, and poor digestion.

This same water is used in agriculture for enhancing plant growth. The acid electrolyzed water (an oxidizing water) that is produced by the same process [6] (and at the same time) is used as a disinfectant and pesticide.

Recent research in Japan has shown that electrolyzed alkaline drinking water has a

synergistic effect on antioxidants. For example, the antioxidant strength of vitamin C in electrolyzed alkaline water is several times greater than vitamin C in tap water.

The synergistic effect is due to the higher dissociation/ionization constant of the functional (electrolyzed) water [7]. Other studies have shown that electrolyzed water produces antioxidant behavior and protects DNA from free radical damage [8]. Clinical studies have shown that mice fed electrolyzed alkaline water lived 30% longer. This functional water enhanced the immune system and inhibited autoimmune disease [9].

Future Applications

There are many applications for functional water. Most of them have been subjected to limited testing and verification. A few of them have been extensively tested and are widely used outside the U.S. (human and animal drinking water, plant growth, food processing, disinfectant, pesticide). Based on this database, here are some possible future uses of functional water (used in the generic sense) in areas of interest to WaterLife.

1. Use functional water for drinking to enhance the health benefits of nutrients in the water or taken with the water (humans and animals).

2. Use functional water in cooking to improve the flavor and the nutritional value of foods.

3. Use functional water for plant growth so that nutrients are more absorbable and less water is required.

4. Use functional water for disinfection (water, food processing, medical, and mouth wash).

5. Use functional water for skin problems (dermatitis, bruises, burns, bed sores).

6. Use functional water to reduce gastrointestinal problems (diarrhea, constipation).

FWSNA

The Functional Water Society of North America (FWSNA) is a recently formed non-profit corporation that promotes the science and technology of functional water. It is associated with the Japanese Functional Water Foundation and participates in their annual Functional Water Symposium. The society maintains an extensive database of technical publications, articles and vendor information pertinent to the production and uses of functional water. This information, along with technical support, is provided to manufactures, users, and researchers of functional water.

References

[1] Westhof, E.; *Water and Biological Macromolecules*, CRC Press, Boca Raton, 1993.

[2] Kleiner, S.; *Water: An Essential but Overlooked Nutrient*, J. Amer. Dietetic Assoc. 99 (1999) 200.

[3] Batmanghelidj, F.; *Your Body's Many Cries for Water*, Global Health Solutions, Falls Church, VA, 1992.

[4] *Proceedings of the Functional Water Symposiums*, (1994 – 2000), Tokyo, Japan.

[5] Bakhir, V.; *Electrochemical Activation*, 2 vol., All-Russian Institute for Medical Engineering, Moscow, 1992.

[6] Kumon, K.; *What is Functional Water*, Artif. Organs 21 (1997) 2.

[7] Hanaoka, K.; *Antioxidant Effects of Reduced Water Produced by Electrolysis of Sodium Chloride Solutions*, (to be published in J Applied Electrochemistry, 2001).

[8] Shirahata, S., et al: *Electrolyzed-Reduced Water Scavenges Active Oxygen Species and Protect DNA from Oxidative Damage, Biochem*. Biophys. Res. Comm. 234 (1997) 269.

[9] Fernandes, G.; *Effect of Electrolyzed Water Intake on Lifespan of Autoimmune Disease Prone Mice*, (see below) FASEB Journal 12 (1998) A794

A New Solution For Kitchen Germs

http://www.sciencenews.org/articles/20010217/food.asp

Cooking will kill almost any microbe. But when it comes to serving raw foods, such as the vegetables in a garden salad, neutralizing germs with heat is not an option and washing the greens doesn't reliably disinfect.

Although raw produce can be sanitized in a bath of dilute bleach, a team of Georgia scientists is developing an alternative--**acidic electrolyzed water**--that appears to kill microbes even more effectively and could be just as cheap and easy.

"The technology is not new," explains Yen-Con Hung of the University of Georgia in Griffin. It relies on an electric current between two electrodes sitting in a solution of brine--the same process used to generate chlorine commercially.

The kitchen version of the method differs in that the starting solution is much more dilute, containing a mere 0.1 percent sodium chloride.

With a membrane-based device about half the size of a microwave oven, the researchers separate this dilute salt water into acidic and alkaline fractions. The acidic portion exhibits "strong antiviral and antibacterial properties," Hung reported last year at the American Chemical Society meeting in Washington, D.C.

In one test, he started with 100 million cells of pathogenic bacteria--either *Escherichia coli* O157:H7, *Salmonella*, or *Listeria monocytogenes*--on a palm-size patch of a plastic cutting board. He then immersed the board in tap water for 5 minutes. When it emerged, it still held 10,000 cells.

Another piece of plastic that had started out equally germy but then was dunked in acidic electrolyzed water carried only 100 cells.

"The important thing to realize," Hung says, "is that most foods or surfaces [in the kitchen]will not start out with such heavy contamination." When the starting levels are lower, total elimination of the bacteria is possible, he claims.

Hung says that to slay germs, the new technique employs various reactive agents--especially hypochlorous acid--that form from the salt's chlorine. Water treated with chlorine bleach also sanitizes with hypochlorous acid, but Hung's data suggest that electrolyzed water outper-forms the bleach-based technique and keeps its potency longer.

Hung is now testing the electrolyzed water, which is safe to ingest, for sanitizing egg shells, apples, and lettuce

References:

Hansen, J.N. 2000. Nisin and other antimicrobial peptides (Abstract 144). 220th American Chemical Society National Meeting. August 20-24. Washington, D.C.
Hung, Y.-C., *et al*. 2000. Acidic electrolyzed (EO) water and its antimicrobial effect (Abstract 133). 220th American Chemical Society National Meeting. August 20-24. Washington, D.C.

Kim, C., Y.-C. Hung, and R.E. Brackett. 2000. Roles of oxidation-reduction potential in electrolyzed oxidizing and chemically modified water for the inactivation of food-related pathogens. *Journal of Food Protection* 63:19.

Kim, C., Y.-C. Hung, *et al*. In press. Inactivation of *Listeria monocytogenes* biofilms by electrolyzed oxidizing water. *Journal of Food Processing and Preservation*.

Venkitanarayanan, K.S....Y.-C. Hung, *et al*. 1999. Efficacy of electrolyzed oxidizing water for inactivating *Escherichia coli* O157:H7, *Salmonella enteritidis*, and *Listeria monocytogenes*. *Applied and Environmental Microbiology* 65:4276.

1999. Inactivation of *Escherichia coli* O157:H7 and *Listeria monocytogenes* on plastic kitchen cutting boards by electrolyzed oxidizing water. *Journal of Food Protection* 62:857.

Further Readings:

Raloff, J. 1998. Wash-resistant bacteria taint foods. *Science News* 153(May 30):340.
_____. 1998. A polished approach to food safety. *Science News* (Feb. 14).
_____. 1996. How to disinfect your salad. *Science News Online*. (Sept. 28).

Sources:

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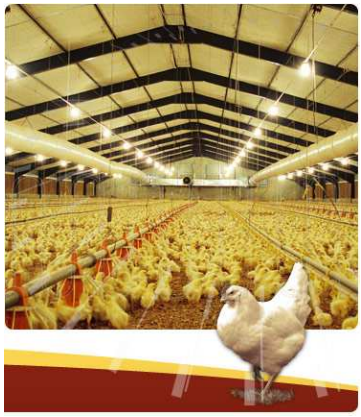
Alkaline Ionized Water and Poultry Processing



[Ed. Note: This report comes from a Poultry magazine I discovered online. It is included here to provide ideas on how alkaline water is currently being used in the Industry.]

This report is not provided for the purpose of suggesting therapeutic result from use of alkaline water. They are displayed purely for the purpose of education.

We do NOT publish the report with the intention of trying to provide or prove a curative or therapeutic recommendation.

Please view and make your own decision about what you read here and elsewhere before making any decision about items recommended here.

Electrolyzed oxidized water sanitizes poultry

24 Jan 2008

Scientists at the University of Georgia are now looking into using electrolyzed oxidized water to sanities fresh chicken meat.

"We wanted to use the water on chicken carcasses to see if it cuts down on the levels of salmonella and campylobacter," said food scientist Yen-Con Hung, at the UGA College of Agricultural and Environmental Sciences.

According to Hung and fellow researchers, using the electrolyzed oxidized water could be 10 times more effective at bacterial elimination than other methods.

To create the water, a saltwater solution undergoes an electrolysis process, which isolates the positive and negative ions, separating the water into: acidic and alkaline.

Hung experimented with both the acidic and alkaline electrolyzed oxidized water on fresh chicken carcasses, together with Scott Russell, associate professor of poultry science. Experiments showed that the acidic electrolyzed oxidized water destroyed food-borne pathogens on the carcass and the alkaline water cleaned the carcass.

"The alkaline stream of electrolyzed oxidized water mixes with the fat on the chicken, cleanses the surface and protects the carcass in the future," said Russell, adding that it is similar to "when your grandmother mixed fat and lye to make soap."

Alkaline Water Reports

from Physicians in Japan

HIGH BLOOD PRESSURE
Prof. Kuninaka Hironage, Head of Kuninaka Hospital

For over 10 years of my experience, my concept towards minerals, especially pertaining to ionic calcium in high blood pressure and other diseases is most significant.

In accordance to the theory of medical Prof. Gato of Kyushu University on Vitamin K (because vitamin K enables the blood calcium to increase), or the consumption of more alkaline ionic water, the effectiveness of the increase in calcium in high blood pressure is most significant.

Most illnesses are caused by too much fat in the diets, which lead to the deposition of cholesterol on the blood vessels, which in turn constrict the blood flow. This results in high blood pressure.

By drinking alkaline ionic water for a period of 2 to 3 months, the blood pressure should slowly drop, because the alkaline ionic water is a good solvent, which dissolves the cholesterol in the blood vessels.

HEART DISEASES
Prof. Kuwata Keijiroo, Doctor of Medicines

In my opinion, the wonder of alkaline ionic water is the ability to neutralize toxins, but it is not a medicine. The difference is that the medicine can only apply to each and individual case, whereas the alkaline ionic water can be consumed generally and its neutralizing power is something which is very much unexpected.

Now, in brief, let me introduce to you a heart disease case and how it was cured.

The patient was a 35 years old male suffering from valvular heart disease. For 5 years, his sickness deteriorated. He was in the Setagays Government Hospital for treatment.

During those 5 years, he had been in and out of the Hospital 5 to 6 times. He had undergone high tech examinations such as angiogram by injecting VINYL via the vein into the heart. He consulted and sought treatment from many good doctors where later he underwent a major surgical operation. Upon his discharge from the hospital, he quit his job to convalesce. However, each time when his illness relapsed, the attack seemed to be even more severe.

Last year, in August, his relatives were in despair and expected he would not live much longer. It so happened at that time that the victim's relative came across the alkaline ionic water ionizer. His illness responded well and he is now on the road to recovery.

KIDNEY DISEASES
Prof. Kuwata Keijiroo, Doctor of Medicine

The difference between drinking alkaline ionic water and the normal water is that the excretion of urine is slightly more than intake. However, for severe kidney failure patients, water intake has to be restricted.

Consuming alkaline ionic water for these patients in controlled amounts proved to be beneficial. Normal tap water contains phosphate, calcium carbonate and the acidic ions. These acidic ions tend to reduce the efficiency of the calcium ions.

Pure alkaline ionic water does not have these problems and it can effectively strengthen the heart and increase urination. After consuming the alkaline ionic water for a month, the amount of urea and uric acid in the blood will show a marked improvement but will not disappear completely.

However, if you continue to drink alkaline ionic water for a period of 6 to 12 months, the urea and uric acid should be grossly reduced. Intake of protein during this period should also be controlled; persistent drinking of alkaline ionic water should eliminate the toxic effect of the urea and uric acid from the body.

According to a foreign paper report, patients undergoing dialysis tend to have their negative ions significantly reduced and the positive ions increased. Hence, according to the above experiment and from my personal clinical experience, drinking alkaline ionic water increases the positive ions which will have a significant effect on various kidney diseases. When kidney diseases do not respond to various drugs, it is good to treat them with alkaline ionic water.

ECZEMA
Prof. Tamura Tatsuji, Keifuku Rehabilitation Centre

Eczema is used to describe several varieties of skin conditions which have a number of common features. The exact cause or causes of eczema are not fully understood. In many cases, eczema can be attributed to external irritants.

Let me introduce a patient who recovered from skin disease after consuming the alkaline ionic water. This patient suffered 10 years of eczema and could be cured effectively even under specialist treatment. This patient, who is 70 years of age, is the President of a vehicle spare parts company. After the war, his lower limbs suffered acute eczema and later became chronic. He was repeatedly treated in a specialist skin hospital.

The left limb responded well to treatment, but not so on the right limb. He suffered severe itchiness, which, when scratched led to bleeding. During the last 10 years, he was seen and treated by many doctors. When I first examined him, his lower limb around the joints was covered with vesicles.

Weeping occurred owing to serum exuding from the vesicles. I advised him to try consuming alkaline ionic water. He bought a water ionize and consumed the alkaline ionic water religiously and used the acidic water to bathe the affected areas. After 2 weeks of treatment, the vesicles dried up. The eczema was completely cleared without any relapse after l ½ months.

ALLERGY
Prof. Kuninaka Hironaga, Head of Kuninaka Hospital

Mr. Yamada, the head of Police Research Institute, suffered from severe allergy. He was treated repeatedly by skin specialist, but with no success.

Then, he started consuming alkaline ionic water. The allergy responded very well and was soon completely cured. No relapse had occurred, although he had taken all kinds of food. He was most grateful and excited about this treatment.

As for myself, I had also suffered severe allergy. Ever since I began to consume alkaline ionic water, the allergy has recovered. Since then, I started a research on the effectiveness of alkaline ionic water. I discovered that most allergy is due to acidification of body condition and is also related to consuming too much meat and sugar.

In every allergy case, the patient's ionic calcium are excessively low which in turn lower the body resistance significantly. The body becomes overly sensitive and develops allergy easily.

To stabilize the sensitivity, calcium solution is injected into the vein. Therefore, it is clear that the alkaline ionic water which has ionic calcium can help to alleviate allergy.

The ionic calcium not only enhances the heart, urination, neutralization of toxins but controls acidity. It also enhances the digestive system and liver function. This will promote natural healing power and hence increase its resistance to allergy. In some special cases of illness which do not respond to drugs, it is found to respond well to alkaline ionic water.

DIGESTIVE SYSTEM PROBLEM
Prof. Kogure Keizoo, Kogure Clinic of Juntendo Hospital

The stomach is readily upset both by diseases affecting the stomach and by other general illnesses. In addition, any nervous tension or anxiety frequently causes gastric upset, vague symptoms when they are under some strain.

The important role of alkaline ionic water in our stomach is to neutralize the secretion and strengthen its functions. Usually, after consuming the alkaline ionic water for 1 to 3 minutes, the gastric juice increase to l l/2 times. For those suffering from hypochlorhydria or achlorhydria (low in gastric juice) the present of alkaline ionic water will stimulate the stomach cells to secrete more gastric juice. This in turn enhances digestion and absorption of minerals.

However, on the other hand, those with hyperchlorhydria (high in gastric juice), the alkaline ionic water neutralizes the excessive gastric juice. Hence, it does not create any adverse reaction.

According to the medical lecturer from Maeba University, the pH of the gastric secretion will still remain normal when alkaline ionic water is consumed. This proved that the ability of the alkaline ionic water is able to neutralize as well as to stimulate the secretion.

Note: According to the Singapore Ministry of Health, Colorectal Cancer is 13% of cancer deaths. Colorectal cancer is one of the fastest spreading cancer in Singapore and is fast overtaking lung cancer as the leading cancer killer. Those in the high-risk group are Chinese and those above 45 years.

One in 25 Chinese has a possibility of being a victim.

The Straits Times
18/7/1992

DIABETES
Prof. Kuwata Keijiroo, Doctor of Medicine

When I was serving in the Fire Insurance Association, I used to examine many diabetic patients. Besides treating them with drugs, I provided them with alkaline ionic water. After consuming alkaline ionic water for one month, 15 diabetic patients were selected and sent to Tokyo University for further test and observations.

Initially, the more serious patients were a bit apprehensive about the treatment. When the alkaline ionic water was consumed for some time, the sugar in the blood and urine ranged from a ration of 300 mg/l to 2 mg/dc. There was a time where the patient had undergone 5 to 6 blood tests a day and detected to be within normal range. Results also showed that even l ½ hours after meals, the blood sugar and urine ration was 100 mg/dc : 0 mg/dc.

The sugar in the urine has completely disappeared.

PRE-ECLAMPTIC TOXAEMIA
Prof. Watanabe Ifao, Watanabe Hospital

Alkaline ionic water improves body constituents and ensures effective healing to many illnesses. The uses of alkaline ionic water in gynecological patients have proved to be very effective. The main reason for its effectiveness is that this water can neutralize toxins.

When given alkaline ionic water to pre-eclamptic toxemia cases, the results are very significant. During my long years of servicing the pre-eclamptic toxemia cases, I found that the women with pre-eclamptic toxemia who consumed alkaline ionic water tend to deliver healthier babies with stronger muscles. A survey report carried out on babies born in this group have intelligence above average.

OBESITY

Prof. Hatori Tasutaroo, Head of Akajiuiji Blood Centre, Yokohama Hospital, Faitama District

Due to a higher standard of living, our eating habits have changed. We consume too much protein, fats and sugar. The excess fats and carbohydrates are in the body as fats. In the present lifestyles, Americans are more extravagant on food compared to the Japanese.

Due to this excessive intake, obesity is a significant problem.

Normally, one out of five males and one out of four females is obese.

The degree of "burnout" in food intake largely depends on the amount of intake of vitamins and minerals. When excessive intake of protein, carbohydrate and fats occurs, the requirement for vitamins and minerals increases. However, there is not much research carried out pertaining to the importance of vitamins and minerals.

Nowadays, many people suffer from acidification that leads to diabetes, heart diseases, cancer, liver and kidney diseases. If our food intake can be completely burned off, then there is no deposition of fats. Obviously, there will be no acidification problem and hence there should not be any sign of obesity. The alkaline ionic water contains an abundance of ionic calcium. This ionic calcium helps in the "burnoff" process.

By drinking alkaline ionic water, it provides sufficient minerals for our body. As a result, we do not need to watch our diet to stay slim. Hence, alkaline ionic water is a savior for those suffering from obesity and many adult diseases, providing good assistance in enhancing good health.

Antibacterial Effect Of Electrolyzed Water On Oral Bacteria

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http://www.ncbi.nlm.nih.gov/pubmed/16953177

Note: This report in no way reflects the opinions of any team or distibutor, the author of this Manual, or Enagic, Inc.

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This study investigated the antibacterial effect of electrolyzed water on oral bacteria both in vitro and in vivo. Tap water was electrolyzed in a water vessel using platinum cell technology.

The electrolyzed tap water was put in contact with five major periodontal pathogens or toothbrushes contaminated with these bacteria for 30 sec.

In addition, the water was used as a mouthwash for 30 sec in 16 subjects and the antibacterial effect on salivary bacteria was evaluated.

Ionized water significantly reduced the growth of all periodontal pathogens in culture and on toothbrushes, and that of aerobic and anaerobic bacteria in saliva, when compared to the effect of tap water.

It also significantly reduced mutans streptococci growing on mitis salivarius bacitracin agar.

Our results demonstrate that the electrolyzed tap water is effective as a mouthwash and for toothbrush disinfection.

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Efficacy of Electrolyzed Oxidizing Water for

Inactivating

Escherichia coli O157:H7, *Salmonella enteritidis*, and *Listeria monocytogenes*

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Efficacy of Electrolyzed Oxidizing Water for Inactivating *Escherichia coli* O157:H7, *Salmonella enteritidis*, and *Listeria monocytogenes*

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ABSTRACT

The efficacy of electrolyzed oxidizing water for inactivating *Escherichia coli* O157:H7, *Salmonella enteritidis*, and *Listeria monocytogenes* was evaluated.

A five-strain mixture of *E. coli* O157:H7, *S. enteritidis*, or *L. monocytogenes* of approximately 10^8 CFU/ml was inoculated in 9 ml of electrolyzed oxidizing water (treatment) or 9 ml of sterile, deionized water (control) and incubated at 4 or 23°C for 0, 5, 10, and 15 min; at 35°C for 0, 2, 4, and 6 min; or at 45°C for 0, 1, 3, and 5 min.

The surviving population of each pathogen at each sampling time was determined on tryptic soy agar. At 4 or 23°C, an exposure time of 5 min reduced the populations of all three pathogens in the treatment samples by approximately 7 log CFU/ml, with complete inactivation by 10 min of exposure.

A reduction of $\geq$7 log CFU/ml in the levels of the three pathogens occurred in the treatment samples incubated for 1 min at 45°C or for 2 min at 35°C. The bacterial counts of all three pathogens in control samples remained the same throughout the incubation at all four temperatures. Results indicate that electrolyzed oxidizing water may be a useful disinfectant, but appropriate applications need to be validated.

TEXT

Enterohemorrhagic *Escherichia coli* O157:H7, *Salmonella enteritidis*, and *Listeria monocytogenes* are food-borne pathogens of major public health concern in the United States. A variety of foods, including poultry, eggs, meat, milk, fruits, and vegetables, have been implicated as vehicles of one or more of these pathogens in outbreaks of food-borne illness (2, 4, 5).

The Pathogen Reduction program of the U.S. Department of Agriculture Food Safety and Inspection Service recommends antimicrobial treatments as a method for reducing or inactivating pathogenic bacteria in foods (13).

Effective methods of reducing or eliminating pathogens in foods are important to the successful implementation of Hazard Analysis and Critical Control Point (HACCP) programs by the food industry and for the establishment of critical control points in restaurants, homes, and other food service units.

Washing of raw agricultural produce with water is practiced in the industry; however, washing alone does not render the product completely free from pathogens. Although many chemicals generally recognized as safe (GRAS), including organic acids, possess antimicrobial activity against food-borne pathogens, none can eliminate high populations of pathogens when they are used individually at concentrations acceptable in foods.

Treatments of fruits and vegetables with water containing sanitizers, including chlorine, may reduce but not eliminate pathogens on the surface of produce (2, 14). Hence, there is a need for, and interest in, developing practical and effective antimicrobial treatments for the inactivation of pathogenic microorganisms on foods.

Electrolyzed oxidizing water (EO water) is the product of a new concept developed in Japan.

Research carried out in Japan revealed that electrolysis of deionized water containing a low concentration of sodium chloride (0.1%) in an electrolysis chamber where anode and cathode electrodes were separated by a diaphragm imparted strong bactericidal and virucidal properties to the water collected from the anode (EO water).

Water from the anode normally has a pH of 2.7 or lower, an oxidation-reduction potential (ORP) greater than 1,100 mV, and a free-chlorine concentration of 10 to 80 ppm (10).

EO water has been experimentally used in Japan by medical and dental professionals for treating wounds or disinfecting medical equipment.

The objective of this study was to evaluate the efficacy of EO water for killing *E. coli* O157:H7, *S. enteritidis*, and *L. monocytogenes* with a view to its potential application to foods and food contact surfaces as an antimicrobial treatment.

Bacterial Culture And Media.

Five strains each of *E. coli* O157:H7, *S. enteritidis*, and *L. monocytogenes* were used for the study. The five strains of *E. coli* O157:H7 (with origins in parentheses following strain designations) were E06 (milk), E08 (meat), E10 (meat), E16 (meat), and E22 (calf feces).

The *S. enteritidis* isolates included SE180 (human), SE457 (egg), SE565 (salad), SE294 (egg), and SE1697 (human). The five strains of *L. monocytogenes* were LM ATCC 19117 (sheep), LM101 (salami), LM109 (pepperoni), LM116 (cheese), and LM201 (milk).

The *E. coli* O157:H7 and *L. monocytogenes* strains, but not ATCC 19117, were isolated by one of the authors, whereas the *S. enteritidis* isolates were obtained from the Centers for Disease Control and Prevention, Atlanta, Ga.

The strains of each pathogen were cultured separately in 100 ml of sterile tryptic soy broth (TSB) (Difco Laboratories, Detroit, Mich.) in 250-ml Erlenmeyer flasks at 37°C for 24 h with agitation (150 rpm).

Following incubation, 10 ml of each culture was sedimented by centrifugation (4,000 × *g* for 20 min), washed, and resuspended in 10 ml of 0.1% peptone water (pH 7.1). The optical density of the suspension was determined and adjusted with 0.1% peptone water to 0.5 at 640 nm (representing approximately 10^9 CFU/ml).

The bacterial population in each culture was confirmed by plating 0.1-ml portions of appropriately diluted culture on tryptic soy agar (TSA) (Difco Laboratories) plates and incubating the plates at 37°C for 48 h. For each pathogen, equal portions from each of the five strains were combined, and 1 ml of the suspension was used as the inoculum (10^9 CFU).

Electrolyzed Oxidizing Water (EO Water)

The current passing through the EO water generator and the voltage between the electrodes were set at 19.8 A and 10 V, respectively. A 12% solution of sodium chloride (Sigma Chemical Co., St. Louis, Mo.) and deionized water from the laboratory supply line were simultaneously pumped into the equipment.

The display indicator was activated and observed until the machine stabilized at a reading of 19.8 A. The EO water was collected from the appropriate outlet in sterile containers and was used within 5 min for the microbial study.

Samples for determination of the pH, ORP, and free-chlorine concentration also were collected simultaneously.

Sample Inoculation And Treatments.

A volume of 9 ml of EO water (treatment) or sterile deionized water (control) was transferred to separate, sterile screw-cap tubes, and the caps were tightly closed.

The tubes were placed in a water bath in order to prewarm the water samples to the desired temperature. To each tube containing 9 ml of EO water or deionized water, 1 ml

(equivalent to 10^9 CFU) of the five-strain mixture of *E. coli* O157:H7, *S. enteritidis*, or *L. monocytogenes* was added, and the samples were incubated in a water bath (Pharmacia LKB, Piscataway, N.J.) at 4°C for 0, 5, 10, and 15 min; at 23°C for 0, 5, 10, and 15 min; at 35°C for 0, 2, 4, and 6 min; and at 45°C for 0, 1, 3, and 5 min.

Following each incubation, the number of viable cells in each sample was determined by plating 0.1-ml portions directly or after serial (1:10) dilutions in 0.1% peptone water on duplicate TSA plates. Colonies of the inoculated pathogen were enumerated on TSA plates after incubation at 37°C for 48 h.

A volume of 1 ml of the inoculated solution (treatment or control) after exposure to each temperature-time combination was also transferred to separate 250-ml Erlenmeyer flasks containing 100 ml of sterile TSB and incubated at 37°C for 24 h. Following enrichment in TSB, the culture was streaked on either sorbitol MacConkey agar no. 3 (Oxoid Division, Unipath Co., Ogdensburg, N.Y.) (for *E. coli* O157:H7), xylose lysine deoxycholate agar (Gene-Trak, Framingham, Mass.) (for *S. enteritidis*), or Oxford agar (Gene-Trak) (for *L. monocytogenes*), and the plates were incubated at 37°C for 24 h.

Representative colonies of *E. coli* O157:H7 and *S. enteritidis* from the respective plates were confirmed by the *E. coli* O157:H7 latex agglutination assay (Remel Microbiology Products, Lenexa, Kans.) and the *Salmonella* latex test (Oxoid), respectively.

The colonies of *L. monocytogenes* on Oxford agar were confirmed by the API-20E diagnostic test kit (Biomerieux, Hazelwood, Mo.).

At least duplicate samples of treatments and controls were assayed at each sampling time, and the entire study with each pathogen was replicated three times.

The pH and ORP of the EO water were measured in duplicate samples immediately after sampling by using pH and ORP electrodes (model 50, ACCUMET meter; Denver Instrument Company, Denver, Colo.). The free-chlorine concentration was determined by an iodometric method using a digital titrator (model 16900; Hach Company, Loveland, Colo.).

The assay was verified periodically by using a 100 ± 0.05 ppm chlorine standard solution (Orion Research Inc., Beverly, Mass.).

Statistical Analysis.

For each treatment, the data from the independent replicate trials were pooled and the mean value and standard deviation were determined (11).

The mean pH, ORP, and free-chlorine concentration of EO water at the different temperatures used for treatment are presented in Tables 1 through 3.

The mean pH and ORP of sterile deionized water were 7.1 ± 0.15 and 355 ± 7.0 mV, respectively. No free chlorine was detected in deionized water.

EO water had major antibacterial activity at 4 and 23°C on the five-strain mixtures of *E. coli* O157:H7, *S. enteritidis*, and *L. monocytogenes* (Table 1).

At time zero, both treatment and control samples for all three pathogens had approximate mean bacterial counts of 8.0 log CFU/ml. At 5 min of exposure at 4°C, the *E. coli* O157:H7 count in the treatment samples was reduced to less than 1.0 log CFU/ml (detected only by enrichment in TSB for 24 h), whereas the populations of *S. enteritidis* and *L. monocytogenes* were slightly greater than 1.0 log CFU/ml.

All three pathogens decreased to undetectable levels (as determined by both plating and enrichment procedures) after 10 min of exposure to EO water at 4°C. However, no differences in bacterial counts were observed in the control samples throughout the study.

At 5 min of exposure at 23°C, the populations of *E. coli* O157:H7 and *S. enteritidis* in the treatment samples decreased to less than 1.0 log CFU/ml, whereas the *L. monocytogenes* count was reduced to 1.25 log CFU/ml.

In agreement with the results obtained at 4°C, all three pathogens were undetectable after 10 min of contact with EO water at 23°C.

TABLE 1. Inactivation of *E. coli* O157:H7, *S. enteritidis*, and *L. monocytogenes* by EO water at 4 or 23°C

Bacterial species	Temp (°C)	Surviving bacterial population (mean log CFU/ml) after exposure for:				EO water property		
		0 min	5 min	10 min	15 min	pH	ORP (mV)	Free chlorine (ppm)
E. coli O157:H7	4	7.98 ± 0.04	<1.0[a]	0[b]	0[b]			
						2.36 ± 0.03	1,153 ± 3	86.3 ± 5.4
Control		7.98 ± 0.04	7.99 ± 0.07	7.96 ± 0.06	7.99 ± 0.04			
S. enteritidis		7.74 ± 0.08	1.06 ± 0.15	0[b]	0[b]			
						2.48 ± 0.03	1,153 ± 2	83.5 ± 7.8
Control		7.74 ± 0.08	7.68 ± 0.09	7.61 ± 0.11	7.60 ± 0.12			
L. monocytogenes		7.91 ± 0.05	1.34 ± 0.37	0[b]	0[b]			
						2.63 ± 0.03	1,160 ± 4	43.0 ± 4.6
Control		7.91 ± 0.05	7.88 ± 0.06	7.87 ± 0.06	7.91 ± 0.03			
E. coli O157:H7	23	8.04 ± 0.07	<1.0[a]	0[b]	0[b]			
						2.37 ± 0.01	1,155 ± 1	82.3 ± 2.2
Control		8.04 ± 0.07	7.97 ± 0.03	7.99 ± 0.07	7.76 ± 0.42			
S. enteritidis		7.76 ± 0.08	<1.0[a]	0[b]	0[b]			
						2.45 ± 0.12	1,151 ± 1	82.0 ± 5.8
Control		7.76 ± 0.08	7.65 ± 0.09	7.73 ± 0.08	7.69 ± 0.10			
L. monocytogenes		7.89 ± 0.10	1.25 ± 0.33	0[b]	0[b]			
						2.63 ± 0.04	1,158 ± 5	48.5 ± 4.1
Control		7.89 ± 0.10	7.83 ± 0.06	7.85 ± 0.04	7.85 ± 0.07			

[a] Positive by enrichment.

[b] Negative by enrichment and no detectable survivors by a direct plating procedure.

E. coli O157:H7, *S. enteritidis*, and *L. monocytogenes* were more rapidly inactivated by EO water at 35 or 45°C (Tables 2 and 3) than at 4 or 23°C. At 35°C, the populations of *E. coli* O157:H7 and *L. monocytogenes* in the treated samples decreased to undetectable levels within 2 min of exposure to EO water, whereas *S. enteritidis* was detected only by enrichment of the treated sample in TSB. After 1 min of exposure to EO water at 45°C, *E. coli* O157:H7 was killed completely (a reduction of approximately 8.0 log CFU/ml), whereas the populations of *S. enteritidis* and *L. monocytogenes* were reduced by approximately 7.0 log CFU/ml.

The bacterial counts of all three pathogens in control samples remained the same throughout the study at both 35 and 45°C.

TABLE 2. Inactivation of *E. coli* O157:H7, *S. enteritidis*, and *L. monocytogenes* by EO water at 35°C

Bacterial species	Surviving bacterial population (mean log CFU/ml) after exposure for:				EO water property		
	0 min	2 min	4 min	6 min	pH	ORP (mV)	Free chlorine (ppm)
E. coli O157:H7	7.97 ± 0.03	0[b]	0[b]	0[b]			
					2.38 ± 0.00	1,154 ± 1	84.3 ± 4.6
Control	7.97 ± 0.03	7.94 ± 0.04	7.96 ± 0.03	7.94 ± 0.04			
S. enteritidis	7.68 ± 0.14	<1.0[a]	0[b]	0[b]			
					2.44 ± 0.04	1,153 ± 1	79.8 ± 3.3
Control	7.68 ± 0.14	7.63 ± 0.06	7.59 ± 0.11	7.64 ± 0.11			
L. monocytogenes	7.91 ± 0.10	0[b]	0[b]	0[b]			
					2.48 ± 0.05	1,159 ± 4	73.3 ± 1.8
Control	7.91 ± 0.10	7.88 ± 0.11	7.86 ± 0.08	7.81 ± 0.12			

[a] Positive by enrichment.

[b] Negative by enrichment and no detectable survivors by a direct plating procedure.

TABLE 3. Inactivation of *E. coli* O157:H7, *S. enteritidis*, and *L. monocytogenes* by EO water at 45°C

TABLE 3. Inactivation of *E. coli* O157:H7, *S. enteritidis*, and *L. monocytogenes* by EO water at 45°C

Bacterial species	Surviving bacterial population (mean log CFU/ml) after exposure for:				EO water property		
	0 min	1 min	3 min	5 min	pH	ORP (mV)	Free chlorine (ppm)
E. coli O157:H7	7.96 ± 0.03	0[b]	0[b]	0[b]			
					2.39 ± 0.02	1,153 ± 4	85.8 ± 2.7
Control	7.96 ± 0.03	7.89 ± 0.03	7.87 ± 0.03	7.86 ± 0.11			
S. enteritidis	7.70 ± 0.12	1.13 ± 0.33	0[b]	0[b]			
					2.44 ± 0.03	1,155 ± 1	79.33 ± 3.0
Control	7.70 ± 0.12	7.63 ± 0.12	7.67 ± 0.15	7.61 ± 0.14			
L. monocytogenes	7.91 ± 0.10	<1.0[a]	0[b]	0[b]			
					2.48 ± 0.05	1,159 ± 4	73.3 ± 1.8
Control	7.91 ± 0.10	7.88 ± 0.10	7.88 ± 0.08	7.83 ± 0.12			

[a] Positive by enrichment.

[b] Negative by enrichment and no detectable survivors by a direct plating procedure.

The theoretical sequence of chemical reactions involved in the production of EO water can be summarized as follows (1). During electrolysis, sodium chloride dissolved in deionized water in the electrolysis chamber dissociates into negatively charged chloride (Cl^-) and hydroxy (OH^-) ions and positively charged sodium (Na^+) and hydrogen (H^+) ions. The chloride and hydroxy ions are adsorbed to the anode, with each ion releasing an electron (e^-) to become a radical.

The chloric and hydroxy radicals combine, forming hypochlorous acid (HOCl), which separates from the anode. Two chloric radicals can also combine to produce chlorine gas. In the cathode section, each positively charged sodium ion receives an electron and becomes metallic sodium. The metallic sodium combines with water molecules, forming sodium hydroxide and hydrogen gas. A bipolar membrane separating the electrodes enhances the electrolysis of water to produce strong acidic and alkali waters from the anode and cathode, respectively.

The antagonistic effects of chlorine and low pH on microorganisms are well documented. Although organic acids (with low pH) and hypochlorite solution (with free chlorine) have been used widely in treatments for killing food-borne bacteria in the food industry, systems involving high ORP values, greater than 1,000 mV, have not normally been used.

The ORP of a solution is an indicator of its ability to oxidize or reduce, with positive and higher ORP values correlated to greater oxidizing strength (6, 8, 9). An ORP of +200 to +800 mV is optimal for growth of aerobic microorganisms, whereas an optimum range of −200 to −400 mV is favored for growth of anaerobic microorganisms (6).

Since the ORP of EO water in this study was greater than 1,100 mV, the ORP likely played an influential role, in combination with low pH and free chlorine, in killing microorganisms.

A possible explanation for the high ORP of EO water is the oxygen released by the rupture of the weak and unstable bond between hydroxy and chloric radicals (1). It is hypothesized that the low pH in EO water sensitizes the outer membranes of bacterial cells, thereby enabling hypochlorous acid to enter the bacterial cells more efficiently.

Acid-adapted cells of *Salmonella typhimurium* were reported to be more sensitive to inactivation by hypochlorous acid than nonadapted cells, due to increased outer membrane sensitivity to hypochlorous acid in acid-adapted cells (7). Experiments to identify the contributions of the different components of EO water to its antimicrobial activity are under way in our laboratory.

The effects of EO water on the three pathogens were evaluated at low and moderate temperatures in the interest of developing potential antibacterial dip treatments for unprocessed agricultural foods. No differences in the inactivation rates of the three pathogens were observed between treatment at 4°C and treatment at 23°C.

However at 35 and 45°C, much higher rates of inactivation were observed for all three pathogens.

Since chlorine is one of the antimicrobial components of EO water, we evaluated the survival of *E. coli* O157:H7 and *L. monocytogenes* in sterile deionized water containing a free-chlorine concentration of 70 to 80 ppm, which was similar to that present in EO water.

Results revealed reductions in the bacterial counts of both pathogens similar to those observed with EO water, indicating that the concentration of free chlorine present in EO water is sufficient to bring about the reductions in bacterial counts achieved by EO water.

Although chlorine is highly effective in killing pathogenic microorganisms in simple aqueous systems, its antibacterial effect on microorganisms on foods is minimal, especially in the presence of organic materials which convert chlorine into inactive forms (3).

For example, treatment of fresh produce with 200 ppm chlorine results in a reduction in the *L. monocytogenes* count of less than 2 log CFU/g (15).

Studies comparing the efficacies of chlorinated water and EO water for inactivating *E. coli* O157:H7 on apples are in progress in our laboratory.

Results revealed that EO water is highly effective in killing *E. coli* O157:H7, *S. enteritidis*, and *L. monocytogenes*, indicating its potential application for decontamination of food

and food contact surfaces. An advantage of EO water is that it can be produced with tap water, with no added chemicals other than sodium chloride.

FOOTNOTES

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REFERENCES

1. **Anonymous.** 1997. Principle of formation of electrolytic water. Hoshizaki Electric Co. Ltd., Sakae, Toyoake, Aichi, Japan.

2. **Beuchat, L. R.** 1995. Pathogenic microorganisms associated with fresh produce. J. Food Prot. **59:**204-216.

3. **Beuchat, L. R., B. V. Nail, B. B. Adler, and M. R. S. Clavero.** 1998. Efficacy of spray application of chlorinated water in killing pathogenic bacteria on raw apples, tomatoes, and lettuce. J. Food Prot. **61:**1305-1311. [Medline]

4. **D'Aoust, J.** 1997. *Salmonella* species, p. 135-137. *In* M. P. Doyle, L. R. Beuchat, and T. J. Montville (ed.), Food microbiology: fundamentals and frontiers. American Society for Microbiology, Washington, D.C.

5. **Doyle, M. P., T. Zhao, J. Meng, and S. Zhao.** 1997. *Escherichia coli* O157:H7, p. 175-178. *In* M. P. Doyle, L. R. Beuchat, and T. J. Montville (ed.), Food Microbiology: fundamentals and frontiers. American Society for Microbiology, Washington, D.C.

6. **Jay, J. M.** 1996. Modern food microbiology, 5th ed., p. 48-49. Aspen Publishers, Gaithersburg, Md.

7. **Leyer, G. J., and E. A. Johnson.** 1997. Acid adaptation sensitizes *Salmonella typhimurium* to hypochlorous acid. Appl. Environ. Microbiol. **63:**461-467[Abstract].

8. **McPherson, L. L.** 1993. Understanding ORP's in the disinfection process. Water Eng. Management **140(11):**29-31.

9. **Robbs, P. G., J. A. Bartz, J. K. Brecht, and S. A. Sargent.** 1995. Oxidation-reduction potential of chlorine solutions and their toxicity to *Erwinia caratovora* subsp. *caratovora* and *Geotrichum candidum*. Plant Dis. **79:**158-162.

10. **Shimizu, Y., and T. Hurusawa.** 1992. Antiviral, antibacterial, and antifungal actions of electrolyzed oxidizing water through electrolysis. Dental J. **37:**1055-1062.

11. **Steel, R. G. D., and J. H. Torrie.** 1980. Principles and procedures of statistics. McGraw-Hill, New York, N.Y.

12. **Tryland, I., M. Pommepuy, and L. Fiksdal.** 1998. Effect of chlorination on β-D-galactosidase activity

of sewage bacteria and *Escherichia coli*. J. Appl. Bacteriol. **85:**51-60.

13. **U.S. Department of Agriculture Food Safety and Inspection Service.** 1995. Pathogen reduction: Hazard Analysis and Critical Control Point (HACCP) systems. Proposal billing code 3410-DM-P. Docket no. 93-016P. U.S. Department of Agriculture, Beltsville, Md.

14. **U.S. Food and Drug Administration.** 1997. Guide to minimize microbial food safety hazards for fresh fruits and vegetables. Center for Food Safety and Applied Nutrition, U.S. Food and Drug Administration, Washington, D.C.

15. **Zhang, S., and J. M. Farber.** 1996. The effects of various disinfectants against *Listeria monocytogenes* on fresh-cut vegetables. Food Microbiol. **13:**311-321.

Applied and Environmental Microbiology, September 1999, p. 4276-4279, Vol. 65, No. 9
0099-2240/99/$04.00+0

Clinical Studies On The Effects Of

Ionized Alkaline Water

Note: This report in no way reflects the opinions of any team or distibutor, the author of this Manual, or Enagic, Inc.

The reports are not displayed for the purpose of suggesting therapeutic result from use of alkaline water. They are displayed purely for the purpose of education.

We do NOT publish them with the intention of trying to prove a curative or therapeutic recommendation. Consult your doctor for specialized medical advice.

Please view and make your own decision about what you read here and elsewhere before making any decision about items for sale on this site.

Ionized water is known by various names:

Reduced water
Hexagonal water
Electrolyzed water
Alkaline /Acid water
Microwater

The following information is sourced from various peer reviewed literature as well as various Internet sites. This information is for educational purposes only and is not meant to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

Adequate fluid replacement helps maintain hydration and, promotes the health, safety, and optimal physical performance of individuals participating in regular physical activity.
Med Sci Sports Exercise
1996 Jan;28(1):i-vii.

American College of Sports Medicine position stand. Exercise and fluid replacement. Convertino VA, Armstrong LE, Coyle EF, Mack GW, Sawka MN, Senay LC Jr, Sherman WM.

1) It is the position of the American College of Sports Medicine that adequate fluid replacement helps maintain hydration and, therefore, promotes the health, safety, and optimal physical performance of individuals participating in regular physical activity. This position statement is based on a comprehensive review and interpretation of scientific literature concerning the influence of fluid replacement on exercise performance and the risk of thermal injury associated with dehydration and hyperthermia. Based on available evidence, the American College of Sports Medicine makes the following general recommendations on the amount and composition of fluid that should be ingested in preparation for, during, and after exercise or athletic competition: 1) It is recommended that individuals consume a nutritionally balanced diet and drink adequate fluids during the 24-hr period before an event, especially during the period that includes the meal prior to exercise, to promote proper hydration before exercise or competition.

2) It is recommended that individuals drink about 500 ml (about 17 ounces) of fluid about 2 h before exercise to promote adequate hydration and allow time for excretion of excess ingested water.

3) During exercise, athletes should start drinking early and at regular intervals in an attempt to consume fluids at a rate sufficient to replace all the water lost through sweating (i.e., body weight loss), or consume the maximal amount that can be tolerated.

4) It is recommended that ingested fluids be cooler than ambient temperature [between 15 degrees and 22 degrees C (59 degrees and 72 degrees F])] and flavored to enhance palatability and promote fluid replacement. Fluids should be readily available and served

in containers that allow adequate volumes to be ingested with ease and with minimal interruption of exercise.

5) Addition of proper amounts of carbohydrates and/or electrolytes to a fluid replacement solution is recommended for exercise events of duration greater than 1 h since it does not significantly impair water delivery to the body and may enhance performance. During exercise lasting less than 1 h, there is little evidence of physiological or physical performance differences between consuming a carbohydrate-electrolyte drink and plain water.

6) During intense exercise lasting longer than 1 h, it is recommended that carbohydrates be ingested at a rate of 30-60 g.h(-1) to maintain oxidation of carbohydrates and delay fatigue. This rate of carbohydrate intake can be achieved without compromising fluid delivery by drinking 600-1200 ml.h(-1) of solutions containing 4%-8% carbohydrates (g.100 ml(-1)). The carbohydrates can be sugars (glucose or sucrose) or starch (e.g., maltodextrin).

7) Inclusion of sodium (0.5-0.7 g.1(-1) of water) in the rehydration solution ingested during exercise lasting longer than 1 h is recommended since it may be advantageous in enhancing palatability, promoting fluid retention, and possibly preventing hyponatremia in certain individuals who drink excessive quantities of fluid. There is little physiological basis for the presence of sodium in n oral rehydration solution for enhancing intestinal water absorption as long as sodium is sufficiently available from the previous meal.

The following information is sourced from various peer reviewed literature as well as

various Internet sites. This information is for educational purposes only and is not meant to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

Electrolyzed-reduced water scavenges active oxygen species and protects DNA from oxidative damage.

Biochem Biophys Res Commun.
1997 May 8;234(1):269-74.
Shirahata S, Kabayama S, Nakano M, Miura T, Kusumoto K, Gotoh M, Hayashi H, Otsubo K, Morisawa S, Katakura Y.

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Active oxygen species or free radicals are considered to cause extensive oxidative damage to biological macromolecules, which brings about a variety of diseases as well as aging. The ideal scavenger for active oxygen should be 'active hydrogen'. 'Active hydrogen' can be produced in reduced water near the cathode during electrolysis of water. Reduced water exhibits high pH, low dissolved oxygen (DO), extremely high dissolved molecular hydrogen (DH), and extremely negative redox potential (RP) values. Strongly electrolyzed-reduced water, as well as ascorbic acid, (+)-catechin and tannic acid, completely scavenged O.-2 produced by the hypoxanthine-xanthine oxidase (HX-XOD) system in sodium phosphate buffer (pH 7.0). The superoxide dismutase (SOD)-like activity of reduced water is stable at 4 degrees C for over a month and was not lost even after neutralization, repeated freezing and melting, deflation with sonication, vigorous mixing, boiling, repeated filtration, or closed autoclaving, but was lost by opened autoclaving or by closed autoclaving in the presence of tungsten trioxide which efficiently adsorbs active atomic hydrogen. Water bubbled with hydrogen gas exhibited low DO, extremely high DH and extremely low RP values, as does reduced water, but it has no SOD-like activity. These results suggest that the SOD-like activity of reduced water is not due to the dissolved molecular hydrogen but due to the dissolved atomic hydrogen (active hydrogen). Although SOD accumulated H2O2 when added to the HX-XOD system, reduced water decreased the amount of H2O2 produced by XOD. Reduced water, as well as catalase and ascorbic acid, could directly scavenge H2O2.
Reduced water suppresses single-strand breakage of DNA b active oxygen species produced by the Cu(II)-catalyzed oxidation of ascorbic acid in a dose-dependent manner, suggesting that reduced water can scavenge not only O2.- and H2O2, but also 1O2 and .OH.

PMID: 9169001 [PubMed - indexed for MEDLINE]

The following information is sourced from various peer reviewed literature as well as various Internet sites. This information is for educational purposes only and is not meant to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

The mechanism of the enhanced antioxidant effects against superoxide anion radicals of reduced water produced by electrolysis.

Biophys Chem. 2004
Jan 1;107(1):71-82.

Hanaoka K, Sun D, Lawrence R, Kamitani Y, Fernandes G.

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We reported that reduced water produced by electrolysis enhanced the antioxidant effects of proton donors such as ascorbic acid (AsA) in a previous paper. We also demonstrated that reduced water produced by electrolysis of 2 mM NaCl solutions did not show antioxidant effects by itself. We reasoned that the enhancement of antioxidant effects may be due to the increase of the ionic product of water as solvent. The ionic product of water (pKw) was estimated by measurements of pH and by a neutralization titration method. As an indicator
of oxidative damage, Reactive Oxygen Species- (ROS) mediated DNA strand breaks were measured by the conversion of supercoiled phiX-174 RF I double-strand DNA to open and linear forms. Reduced water had a tendency to suppress single-strand breakage of DNA induced by reactive oxygen species produced by H2O2/Cu (II) and HQ/Cu (II) systems.

The enhancement of superoxide anion radical dismutation activity can be explained by changes in the ionic product of water in the reduced water.

PMID: 14871602 [PubMed - in process]

The following information is sourced from various peer reviewed literature as well as various Internet sites. This information is for educational purposes only and is not meant to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

Comparison of electrolyzed oxidizing water with various antimicrobial interventions to reduce Salmonella species on poultry.

Poult Sci.
2002 Oct;81(10):1598-605.

Fabrizio KA, Sharma RR, Demirci A, Cutter CN.
Department of Food Science, The Pennsylvania State University, University Park 16802, USA.

Foodborne pathogens in cell suspensions or attached to surfaces can be reduced by electrolyzed oxidizing (EO) water; however, the use of EO water against pathogens associated with poultry has not been explored. In this study, acidic EO water [EO-A; pH 2.6, chlorine (CL) 20 to 50 ppm, and oxidation-reduction potential (ORP) of 1,150 mV], basic EO water (EO-B; pH 11.6, ORP of -795 mV), CL, ozonated water (OZ), acetic acid (AA), or trisodium phosphate (TSP) was applied to broiler carcasses inoculated with Salmonella Typhimurium (ST) and submerged (4 C, 45 min), spray-washed (85 psi, 25 C, 15 s), or subjected to multiple interventions (EO-B spray, immersed in EO-A; AA or TSP spray, immersed in CL). Remaining bacterial populations were determined and compared at Day 0 and 7 of aerobic, refrigerated storage. At Day 0, submersion in TSP and AA reduced ST 1.41 log10, whereas EO-A water reduced ST approximately 0.86 log10. After 7 d of storage, EO-A water, OZ, TSP, and AA reduced ST, with detection only after selective

enrichment. Spray-washing treatments with any of the compounds did not reduce ST at Day 0.

After 7 d of storage, TSP, AA, and EO-A water reduced ST 2.17, 2.31, and 1.06 log10, respectively. ST was reduced 2.11 log10 immediately following the multiple interventions, 3.81 log10 after 7 d of storage. Although effective against ST, TSP and AA are costly and adversely affect the environment. This study demonstrates that EO water can reduce ST on poultry surfaces following extended refrigerated storage.

PMID: 12412930 [PubMed - indexed for MEDLINE]

Treatment of Escherichia coli (O157:H7) inoculated alfalfa seeds and sprouts with electrolyzed oxidizing water.

Int J Food Microbiol.
2003 Sep 15;86(3):231-7.

Department of Agricultural and Biological Engineering, Pennsylvania State University, University Park, PA 16802, USA.

Electrolyzed oxidizing water is a relatively new concept that has been utilized in agriculture, livestock management, medical sterilization, and food sanitation. Electrolyzed oxidizing (EO) water generated by passing sodium chloride solution through an EO water generator was used to treat alfalfa seeds and sprouts inoculated with a five-strain cocktail of nalidixic acid resistant Escherichia coli O157:H7. EO water had a pH of 2.6, an oxidation-reduction potential of 1150 mV and about 50 ppm free chlorine.

The percentage reduction in bacterial load was determined for reaction times of 2, 4, 8, 16, 32, and 64 min. Mechanical agitation was done while treating the seeds at different time intervals to increase the effectiveness of the treatment.

Since E. coli O157:H7 was released due to soaking during treatment, the initial counts on seeds and sprouts were determined by soaking the contaminated seeds/sprouts in 0.1% peptone water for a period equivalent to treatment time. The samples were then pummeled
in 0.1% peptone water and spread plated on tryptic soy agar with 5 microg/ml of nalidixic acid (TSAN). Results showed that there were reductions between 38.2% and 97.1% (0.22-1.56 log(10) CFU/g) in the bacterial load of treated seeds.

The reductions for sprouts were between 91.1% and 99.8% (1.05-2.72 log(10) CFU/g). An increase in treatment time increased the percentage reduction of E. coli O157:H7. However, germination of the treated seeds reduced from 92% to 49% as amperage to make EO water

and soaking time increased. EO water did not cause any visible damage to the sprouts.

PMID: 12915034 [PubMed - indexed for MEDLINE]

Inactivation of Escherichia coli (O157:H7) and Listeria monocytogenes on plastic kitchen cutting boards by electrolyzed oxidizing water.

Venkitanarayanan KS, Ezeike GO, Hung YC, Doyle MP.
Department of Animal Science, University of Connecticut, Storrs 06269, USA.

One milliliter of culture containing a five-strain mixture of Escherichia coli O157:H7 (approximately 10(10) CFU) was inoculated on a 100-cm2 area marked on unscarred cutting boards. Following inoculation, the boards were air-dried under a laminar flow hood for 1 h, immersed in 2 liters of electrolyzed oxidizing water or sterile deionized water at 23 degrees
C or 35 degrees C for 10 or 20 min; 45 degrees C for 5 or 10 min; or 55 degrees C for 5 min. After each temperature-time combination, the surviving population of the pathogen on cutting boards and in soaking water was determined. Soaking of inoculated cutting boards in electrolyzed oxidizing water reduced E. coli O157:H7 populations by > or = 5.0 log /100 cm2 on cutting boards. However, immersion of cutting boards in deionized water decreased the pathogen count only by 1.0 to 1.5 log CFU/100 cm2. Treatment of cutting boards inoculated with Listeria monocytogenes in electrolyzed oxidizing water at selected temperature-time combinations (23 degrees C for 20 min, 35 degrees C for 10 min, and 45 degrees C for 10 min) substantially reduced the populations of L. monocytogenes in comparison to the counts recovered from the boards immersed in deionized water. E. coli O157:H7 and L. monocytogenes were not detected in electrolyzed oxidizing water after soaking treatment, whereas the pathogens survived in the deionized water used for soaking the cutting boards. This study revealed that immersion of kitchen cutting boards in electrolyzed oxidizing water could be used as an effective method for inactivating food borne pathogens on smooth, plastic cutting boards.

PMID: 10456736 [PubMed - indexed for MEDLINE]

The bactericidal effects of electrolyzed oxidizing water on bacterial strains involved in hospital infections.

Vorobjeva NV, Vorobjeva LI, Khodjaev EY.

Artif Organs.
2004 Jun;28(6):590-2.

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The study is designed to investigate bactericidal actions of electrolyzed oxidizing water on hospital infections. Ten of the most common opportunistic pathogens are used for this study. Cultures are inoculated in 4.5 mL of electrolyzed oxidizing (EO) water or 4.5 mL of sterile deionized water (control), and incubated for 0, 0.5, and 5 min at room temperature. At the exposure time of 30 s the EO water completely inactivates all of the bacterial strains, with
the exception of vegetative cells and spores of bacilli which need 5 min to be killed. The results indicate that electrolyzed oxidizing water may be a useful disinfectant for hospital infections, but its clinical application has still to be evaluated.

PMID: 15153153 [PubMed - in process]

Effect of electrolyzed oxidizing water and hydrocolloid occlusive dressings on excised burn-wounds in rats.

Chin J Traumatol.
2003 Aug 1;6(4):234-7.

Xin H, Zheng YJ, Hajime N, Han ZG.

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OBJECTIVE: To study the efficacy of electrolyzed oxidizing water (EOW) and hydrocolloid occlusive dressings in the acceleration of epithelialization in excised burn-wounds in rats.

METHODS: Each of the anesthetized Sprague-Dawley rats (n=28) was subjected to a third-degree burn that covered approximately 10% of the total body surface area. Rats were assigned into four groups: Group I (no irrigation), Group II (irrigation with physiologic saline), Group III (irrigation with EOW) and Group IV (hydrocolloid occlusive dressing after EOW irrigation). Wounds were observed macroscopically until complete epithelialization was present, then the epithelialized wounds were examined microscopically.

RESULTS: Healing of the burn wounds was the fastest in Group IV treated with hydrocolloid occlusive dressing together with EOW. Although extensive regenerative epidermis was seen in each Group, the proliferations of lymphocytes and macrophages

associated with dense collagen deposition were more extensive in Group II, III and IV than in Group I. These findings were particularly evident in Group III and IV. CONCLUSIONS: Wound Healing
may be accelerated by applying a hydrocolloid occlusive dressing on burn surfaces after they are cleaned with EOW.

PMID: 12857518 [PubMed - indexed for MEDLINE]

The following information is sourced from various peer reviewed literature as well as various Internet sites. This information is for educational purposes only and is not meant to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

Effect of electrolyzed water on wound healing.

Artif Organs.
2000 Dec;24(12):984-7.

Yahagi N, Kono M, Kitahara M, Ohmura A, Sumita O, Hashimoto T, Hori K, Ning-Juan C, Woodson P, Kubota S, Murakami A, Takamoto S.

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Electrolyzed water accelerated the healing of full-thickness cutaneous wounds in rats, but only anode chamber water (acid pH or neutralized) was effective. Hypochlorous acid (HOCl), also produced by electrolysis, was ineffective, suggesting that these types of electrolyzed water enhance wound healing by a mechanism unrelated to the well-known antibacterial action of HOCl. One possibility is that reactive oxygen species, shown to be electron spin resonance spectra present in anode chamber water, might trigger early wound healing through fibroblast migration and proliferation.

PMID: 11121980 [PubMed - indexed for MEDLINE]

The following information is sourced from various peer reviewed literature as well as various Internet sites. This information is for educational purposes only and is not meant to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

Decomposition of ethylene, a flower-senescence hormone, with electrolyzed anode water.

Biosci Biotechnol Biochem.
2003 Apr;67(4):790-6.

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Electrolyzed anode water (EAW) markedly extended the vase life of cut carnation flowers. Therefore, a flower-senescence hormone involving ethylene decomposition by EAW with potassium chloride as an electrolyte was investigated. Ethylene was added externally to EAW, and the reaction between ethylene and the available chlorine in EAW was examined.

EAW had a low pH value (2.5), a high concentration of dissolved oxygen, and extremely high redox potential (19.2 mg/l and 1323 mV, respectively) when available chlorine was at a concentration of about 620 microns. The addition of ethylene to EAW led to ethylene decomposition, and an equivocal amount of ethylene chlorohydrine with available chlorine was produced. The ethylene chlorohydrine production was greatly affected by the pH value (pH 2.5, 5.0 and 10.0 were tested), and was faster in an acidic solution. Ethylene chlorohydrine was not produced after ethylene had been added to EAW at pH 2.6 when available chlorine was absent, but was produced after potassium hypochlorite had been added to such EAW.

The effect of the pH value of EAW on the vase life of cut carnations was compatible with the decomposition rate of ethylene in EAW of the same pH value. These results suggest that the effect of EAW on the vase life of cut carnations was due to the decomposition of ethylene to ethylene chlorohydrine by chlorine from chlorine compounds.

PMID: 12784619 [PubMed - indexed for MEDLINE]

Use of Ionized water in hypochlorhydria or achlorhydria

Prof. Kuninaka Hironage, Head of Kuninaka Hospital
"Too many fats in the diets, which lead to the deposition of cholesterol on the blood vessels, which in turn constrict the blood flow, cause most illnesses such as high blood pressure. In accordance with the theory of Professor Gato of Kyushu University on Vitamin K *(because vitamin K enables the blood calcium to increase)*, or the consumption of more antioxidant water, the effectiveness of the increase in the calcium in high blood pressure is most significant.

The consumption of alkaline antioxidant water for a period of 2 to 3 months, I have observed the blood pressure slowly drop, due to the water's solvent ability, which dissolves the cholesterol in the blood vessels."

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to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

Use of Ionized water for gynecological conditions
Prof. Watanabe Ifao, Watanabe Hospital

"Ionized alkaline antioxidant water improves body constituents and ensures effective healing to many illnesses. The uses of antioxidant water in gynecological patients have proved to be very effective. The main reason for its effectiveness is that this water can neutralize toxins.

When given antioxidant water to pre-eclamptic toxemia cases, the results are most significant. During my long years of servicing the pre-eclamptic toxemia cases, I found that the women with pre-eclamptic toxemia who consumed antioxidant water tend to deliver healthier babies with stronger muscles. A survey report carried out on babies in this group showed intelligence above average."

The following information is sourced from various peer reviewed literature as well as various Internet sites. This information is for educational purposes only and is not meant to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

Toxin Neutralization

Prof. Kuwata Keijiroo, Doctor of Medicine

"In my opinion, the wonder of antioxidant water is the ability neutralizes toxins, but it is not a medicine. The difference is that the medicine can only apply to each and individual case, whereas the antioxidant water can be consumed generally and its neutralizing power is something which is very much unexpected. Now, in brief, let me introduce to you a heart disease case and how it was cured.

The patient was a 35 years old male suffering from vascular heart disease. For 5 years, his sickness deteriorated. He was in the Setagays Government Hospital for treatment. During those 5 years, he had been in and out of the hospital 5 to 6 times.

He had undergone high tech examinations such as angiogram by injecting VINYL via the vein into the heart. He consulted and sought treatment from many good doctors where later he underwent a major surgical operation. Upon his discharge from the hospital, he quit his job to convalesce. However, each time when his illness relapsed, the attack seemed to be even more severe.

Last year, in August, his relatives were in despair and expected he would not live much longer. It so happened at that time that the victim's relative came across antioxidant water processor. His illness responded well and he is now on the road to recovery."

(In the United States, cardiovascular diseases account for more than one-half of the approximate 2 million deaths occurring each year.... It is estimated that optimal

conditioning of drinking water could reduce this cardiovascular disease mortality rate by as much as 15 percent in the United States)

From: Report of the Safe Drinking Water Committee of the National Academy of Sciences, 1977

The following information is sourced from various peer reviewed literature as well as various Internet sites. This information is for educational purposes only and is not meant to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

Eczema

Prof. Tamura Tatsuji, Keifuku Rehabilitation Center

"Eczema is used to describe several varieties of skin conditions, which have a number of common features. The exact cause or causes of eczema are not fully understood. In many cases, eczema can be attributed by external irritants.

Let me introduce a patient who recovered from skin disease after consuming the antioxidant water. This patient suffered 10 years of eczema and could not be cured effectively even under specialist treatment. This patient, who is 70 years of age, is the president of a vehicle spare parts company. After the war, his lower limbs suffered acute eczema, which later became chronic. He was repeatedly treated in a specialist skin hospital.

The left limb responded well to treatment, but not so on the right limb. He suffered severe itchiness, which, when scratched led to bleeding. During the last 10 years, he was seen and treated by many doctors. When I first examined him, his lower limb around the joints was covered with vesicles. Weeping occurred owing to serum exuding from the vesicles.

I advised him to try consuming antioxidant water. He bought a unit and consumed the antioxidant water religiously and used the acidic water to bathe the affected areas. After 2 weeks of treatment the vesicles dried up. The eczema was completely cleared without any relapse after 1½ month."

The following information is sourced from various peer reviewed literature as well as various Internet sites. This information is for educational purposes only and is not meant to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

Allergies

Prof. Kuninaka Hironaga, Head of Kuninaka Hospital

"Mr. Yamada, the head of Police Research Institute, suffered from severe allergy. He was treated repeatedly by skin specialist, but with no success. Then he started consuming antioxidant water. The allergy responded very well and was soon completely cured. No relapse had occurred, although he had taken all kinds of food. He was most grateful and excited about this treatment.

As for myself, I had also suffered severe allergy. Ever since I began to consume antioxidant water, the allergy has recovered. Since then, I started a research on the effectiveness of antioxidant water.

I discovered that most allergies are due to acidification of body condition and is also related to consuming too much meat and sugar. In every allergy case, the patient's antioxidant minerals are excessively low which in turn lower the body resistance significantly. The body becomes overly sensitive and develops allergy easily. To stabilize the sensitivity, calcium solution in injected into the vein. Therefore, it is clear that the antioxidant water has ionic calcium, which can help alleviate allergy.

The ionic calcium not only enhances the heart, urination, and neutralization of toxins but controls acidity. It also enhances the digestive system and liver function. This will promote natural healing power and hence increase its resistance to allergy. In some special cases of illness, which do not respond to drugs, it is found, it is found to respond well to antioxidant water."

The following information is sourced from various peer reviewed literature as well as various Internet sites. This information is for educational purposes only and is not meant to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

Digestive Problems

Prof. Kogure Keizou, Kogure Clinic of Juntendo Hospital

"The stomach is readily upset both by diseases affecting the stomach and by other general illnesses. In addition, any nervous tension or anxiety frequently causes gastric upset, vague symptoms when This information is under some strain.

The important role of antioxidant water in our stomach is to neutralize the secretion and strengthen it s functions. Usually, after consuming the antioxidant water for 1 to 3 minutes, the gastric juice increase to 1½ times. For those suffering from hypochlorhydria or achlorhydria (low in gastric juice) the presence of antioxidant water will stimulate the stomach cells to secrete more gastric juice. This in turn enhances digestion and absorption of minerals.

However, on the other hand, those with hyperchlorhydria (high in gastric juice), the antioxidant water neutralizes the excessive gastric juice. Hence, it does not create any adverse reaction.

According to the medical lecturer from Maeba University, the pH of the gastric secretion

will still remain normal when antioxidant water is consumed. This proves that the ability of the antioxidant water is able to neutralize as well as to stimulate the secretion."

The following information is sourced from various peer reviewed literature as well as various Internet sites. This information is for educational purposes only and is not meant to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

Diabetes

Prof. Kuwata Keijiroo, Doctor of Medicine

"When I was serving in the Fire Insurance Association, I used to examine many diabetic patients. Besides treating them with drugs, I provided them with antioxidant water. After drinking antioxidant water for one month, 15 diabetic patients were selected and sent to Tokyo University for further test and observations.

Initially, the more serious patients were a bit apprehensive about the treatment. When the antioxidant water was consumed for some time, the sugar in the blood and urine ranged from a ratio of 300 mg/l to 2 mg / dc. There was a time where the patient had undergone 5 to 6 blood tests a day and detected to be within normal range. Results also showed that even 1 ½ hour after meals, the blood sugar and urine ratio was 100 mg/dc: 0 mg/dc . The sugar in the urine has completely disappeared."

NOTE:
More Americans than ever before are suffering from diabetes, with the number of new cases averaging almost 800,000 each year. The disease has steadily increased in the United States since 1980, and in 1998, 16 million Americans were diagnosed with diabetes (10.3 million diagnosed; 5.4 million undiagnosed). Diabetes is the seventh leading cause of death in the United States, and more than 193,000 died from the disease and its related complication in 1996. The greatest increase - 76 percent - occurred in people age 30 to 30.

From: U. S. Department of Health and Human Services, October 13, 2000 Fact Sheet.

The following information is sourced from various peer reviewed literature as well as various Internet sites. This information is for educational purposes only and is not meant to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

Use of Ionized water in treating Acidosis

Prof. Hatori Tasutaroo, Head of Akajiuiji Blood Centre, Yokohama Hospital, Faitama District

"Due to a higher standard of living, our eating habits have changed. We consume too much proteins, fats and sugar. The excess fats and carbohydrates are in the body as fats. In the present lifestyles, Americans are more extravagant on food compared to the Japanese. Due

to this excessive intake obesity is a significant problem. Normally, one out of five males and one out of four females is obese.

The degree of "burn-out" in food intake largely depends on the amount on intake of vitamins and minerals. When excessive intake of proteins, carbohydrates and fats occurs, the requirement for vitamins and minerals increases. However, there is not much research carried out pertaining to the importance of vitamins and minerals.

Nowadays, many people suffer from acidification that leads to diabetes, heart diseases, cancer, live and kidney diseases. If our food intake can be completely burned off, then there is no deposition of fats. Obviously, there will be no acidification problem and hence there should not be any sign of obesity.

The antioxidant water contains an abundance of ionic calcium. This ionic calcium helps in the "burn-off" process. By drinking antioxidant water, it provides sufficient minerals for our body. As a result, we do not need to watch our diet to stay slim.

Hence, antioxidant water is a savior for those suffering from obesity and many adult diseases, providing good assistance in enhancing good health."

The following information is sourced from various peer reviewed literature as well as various Internet sites. This information is for educational purposes only and is not meant to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

Reduced Water for Prevention of Diseases

Dr.Sanetaka Shirahata
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It has long been established that reactive oxygen species (ROS) cause many types of damage to biomolecules and cellular structures, that, in turn result in the development of a variety of pathologic states such as diabetes, cancer and aging. Reduced water is defined as anti-oxidative water produced by reduction of water. Electrolyzed reduced water (ERW) has been demonstrated to be hydrogen-rich water and can scavenge ROS in vitro (Shirahata et al., 1997).

The reduction of proton in water to active hydrogen (atomic hydrogen, hydrogen radical) that can scavenge ROS is very easily caused by a weak current, compared to oxidation of hydroxyl ion to oxygen molecule.

Activation of water by magnetic field, collision, minerals etc. will also produce reduced water containing active hydrogen and/or hydrogen molecule. Several natural waters such as Hita Tenryosui water drawn from deep underground in Hita city in Japan, Nordenau water in Germany and Tlacote water in Mexico are known to alleviate various diseases.

We have developed a sensitive method by which we can detect active hydrogen existing in reduced water, and have demonstrated that not only ERW but also natural reduced waters described above contain active hydrogen and scavenge ROS in cultured cells. ROS is

known to cause reduction of glucose uptake by inhibiting the insulin-signaling pathway in cultured cells.

Reduced water scavenged intracellular ROS and stimulated glucose uptake in the presence or absence of insulin in both rat L6 skeletal muscle cells and mouse 3T3/L1 adipocytes. This insulin-like activity of reduced water was inhibited by wortmannin that is specific inhibitor of PI-3 kinase, a key molecule in insulin signaling pathways. Reduced water protected insulin-responsive cells from sugar toxicity and improved the damaged sugar tolerance of type 2 diabetes model mice, suggesting that reduced water may improve insulin-independent diabetes mellitus.

Cancer cells are generally exposed to high oxidative stress. Reduced water cause impaired tumor phenotypes of human cancer cells, such as reduced growth rate, morphological changes, reduced colony formation ability in soft agar, passage number-dependent telomere shortening, reduced binding abilities of telomere binding proteins and suppressed metastasis. Reduced water suppressed the growth of cancer cells transplanted into mice, demonstrating their anti-cancer effects in vivo. Reduced water will be applicable to not only medicine but also food industries, agriculture, and manufacturing industries.

Shirahata, S.et al.: Electrolyzed reduced water scavenges active oxygen species and protects DNA from oxidative damage. Biochem. Biophys. Res. Commun., 234, 269174, 1997.

The following information is sourced from various peer reviewed literature as well as various Internet sites. This information is for educational purposes only and is not meant to cure or treat any disease or illness. Consult your doctor for specialized medical advice.

CLINICAL Improvements Obtained From The Intake Of Reduced Water
Extracts from " Presentation At The Eight Annual International Symposium On man And His Environment in Health And Disease" on February 24th 1990, at The Grand Kempinski Hotel, Dallas, Texas, USA by Dr. H. Hayashi, M.D. and Dr. M Kawamura, M.D., on:

(THE CONCEPT OF PREHEPATIC MEDICINES)
Since the introduction of alkaline ionic water in our clinic in 1985, we have had the following interesting clinical experiences in the use of this type of water. By the use of alkaline ionic water for drinking and the preparation of meals for our in-patients, we have noticed :

Declines in blood sugar levels in diabetic patients.

Improvements in peripheral circulation in diabetic gangrene.

Declines in uric acid levels in patients with gout.

Improvements in liver function exams in hepatic disorders.

Improvements in gastroduodenal ulcer and prevention of their recurrences.

Improvements in hypertension and hypotension.

Improvements in allergic disorders such as asthma, urticaria, rhinites and atopic dermatitis.

Improvements in persistent diarrhoea which occurred after gastrectomy.

Quicker improvements in post operative bower paralysis.

Improvements in serum bilirubin levels in new born babies.

Being confirming clinical improvements, we have always observed changes of stools of the patients, with the color of their feces changing from black-brown color to a brighter yellow-brown one, and the odor of their feces becoming almost negligible.

The number of patients complaining of constipation also decreased markedly. The change of stool findings strongly suggests that alkaline ionic water intake can decrease the production of putrefield or pathogenic metabolites.

Devices to produce reduced water were introduced into our clinic in May 1985. Based on the clinical experiences obtained in the past 15 years, it can be said that introduction of electrolyzed-reduced water for drinking and cooking purpose for in-patients should be the very prerequisite in our daily medical practices. Any dietary recipe cannot be a scientific one if property of water is not taken by the patients is not taken into consideration.

The Ministry of Health and Welfare in Japan announced in 1965 that the intake of reduced water is effective for restoration of intestinal flora metabolism.

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Clinical evaluation of alkaline ionized water for abdominal complaints: Placebo controlled double blind tests

by Hirokazu Tashiro, Tetsuji Hokudo, Hiromi Ono, Yoshihide Fujiyama, Tadao Baba (National Ohkura Hospital, Dept. of Gastroenterology; Institute of Clinical Research, Shiga University of Medical Science, Second Dept. of Internal Medicine)

Effect of alkaline ionized water on abdominal complaints was evaluated by placebo controlled double blind tests. Overall scores of improvement using alkaline ionized water

marked higher than those of placebo controlled group, and its effect proved to be significantly higher especially in slight symptoms of chronic diarrhoea and abdominal complaints in cases of general malaise. Alkaline ionized water group did not get interrupted in the course of the test, nor did it show serious side effects nor abnormal test data. It was confirmed that alkaline ionized water is safer and more effective than placebos.

Summary

Effect of alkaline ionized water on abdominal complaints was clinically examined by double blind tests using clean water as placebo. Overall improvement rate was higher for alkaline ionized water group than placebo group and the former proved to be significantly more effective than the other especially in cases of slight symptoms.

Examining improvement rate for each case of chronic diarrhoea, constipation and abdominal complaints, alkaline ionized water group turned out to be more effective than placebo group for chronic diarrhea, and abdominal complaints.

The test was stopped in one case of chronic diarrhoea, among placebo group due to exacerbation, whereas alkaline ionized water group did not stop testing without serious side effects or abnormal test data in all cases.

It was confirmed that alkaline ionized water is more effective than clean water against chronic diarrhoea, abdominal complaints and overall improvement rate (relief of abdominal complaints) and safer than clean water.

Introduction

Since the approval of alkaline ionized water electrolyzers by Pharmaceutical Affairs Law in 1966 for its antacid effect and efficacy against gastrointestinal disorders including hyperchylia, indigestion, abnormal gastrointestinal fermentation and chronic diarrhea, they have been extensively used among patients. However, medical and scientific evaluation of their validity is not established. In our study, we examined clinical effect of alkaline ionized water on gastrointestinal disorders across many symptoms in various facilities. Particularly, we studied safety and usefulness of alkaline ionized water by double-blind tests using clean water as a control group.

Test subjects and methods

163 patients (34 men, 129 women, age 21 to 72, average 38.6 years old) of indigestion, abnormal gastrointestinal fermentation (with abnormal gas emission and rugitus) and abdominal complaints caused by irregular dejection (chronic diarrhea, or constipation) were tested as subjects with good informed consent.

Placebo controlled double blind tests were conducted using alkaline ionized water and clean water at multiple facilities. An alkaline ionized water electrolyzer sold commercially was installed with a pump driven calcium dispenser in each of the subject homes.

Tested alkaline ionized water had pH at 9.5 and calcium concentration at 30ppm.

Each subject in placebo group used a water purifier that has the same appearance as the electrolyzer and produces clean water.

The tested equipment was randomly assigned by a controller who scaled off the key code which was stored safely until the tests were completed and the seal was opened again.

Water samples were given to each patient in the amount of 200ml in the morning with the total of 50OmI or more per day for a month. Before and after the tests, blood, urine and stool were tested and a log was kept on the subjective symptoms, bowel movements and accessory symptoms. After the tests, the results were analyzed based on the log and the test data.

Test Results

1. Symptom
Among 163 tested subjects, alkaline ionized water group included 84 and placebo group 79. Background factors such as gender, age and basal disorders did not contribute to significant difference in the results.

2. Overall improvement rate
As to overall improvement rate of abdominal complaints, alkaline ionized water group had 2 cases of outstanding improvement (2.5%), 26 cases of fair improvement (32.1%), 36 cases of slight improvement (44.4%), 13 cases of no change (16%) and 4 cases of exacerbation (4.9%), whereas placebo group exhibited 4 (5.2%), 19 (24.7%), 27 (35.1%), 25 (32.5%) and 2 cases (2.6%) for the same category.

Comparison between alkaline ionized water and placebo groups did not reveal any significant difference at the level of 5% significance according to the Wilcoxon test, although alkaline ionized water group turned out to be significantly more effective than placebo group at the level of p value of 0.22.

Examining overall improvement rates by a 7, 2 test (with no adjustment for continuity) between the effective and noneffective groups, alkaline ionized water group had 64 (79%) of effective cases and 17 cases (21%) of non effective cases, whereas placebo group had 50 (64.9%) and 27 (35.1%) cases respectively. The result indicated that alkaline ionized water group was significantly more effective than placebo group at the level of p value of 0.0.48.

Looking only at 83 slight cases of abdominal complaints, overall improvement rate for alkaline ionized water group

(45 cases) was composed of 11 cases (242%) of fair improvement, 22 cases (48.9%) of slight improvement, 17 cases (44.7%) of no change and 3 cases (6.7%) of exacerbation, whereas placebo group (38 cases) had 3 (7.8%), 17 (44.7%), 17 (44.7%) and 1 (2.6%) cases for the same category. Alkaline ionized water group was significantly more effective than placebo group according to the comparison between the groups (p value = 0.033).

3. Improvement rate by basal symptom
Basal symptoms were divided into chronic diarrhea, constipation and abdominal complaints (dyspepsia) and overall improvement rate was evaluated for each of them to study effect of alkaline ionized water. In case of chronic diarrhea, alkaline ionized water group resulted in 94.1% of effective cases and 5.9% of non effective cases. Placebo group came up with 64,7% effective and 35.3% non effective. These results indicate alkaline ionized water group proved to be significantly more effective than placebo group. In case of slighter chronic diarrhoea, comparison between groups revealed that alkaline ionized water group is significantly more effective than placebo group (p=0.015). In case of constipation, alkaline ionized water group consisted of 80.5% of effective and 19.5% of non effective cases, whereas placebo group resulted in 73.3% effective and 26.3 non effective. As to abdominal complaints (dyspepsia), alkaline ionized water group had 85.7% of effective and 14.3% non effective cases while placebo group showed 47.1% and 62.9% respectively. Alkaline ionized water group proved to be significantly more effective than placebo group (p=0.025).

4. Safety
Since one case of chronic diarrhoea, in placebo group saw exacerbation, the test was

stopped. There was no such cases in alkaline ionized water group. Fourteen cases of accessory symptoms, 8 in alkaline ionized water group and 6 in placebo group, were observed, none of which were serious. 31 out of 163 cases (16 in alkaline ionized water group, 15 in placebo group) exhibited fluctuation in test data, although alkaline ionized water group did not have any problematic fluctuations compared to placebo group. Two cases in placebo group and one case in alkaline ionized water group have seen K value of serum climb up and resume to normal value after re testing which indicates the value changes were temporary.

Conclusion

As a result of double blind clinical tests of alkaline ionized water and clean water, alkaline ionized water was proved to be more effective than clean water against chronic diarrhoea, abdominal complaints (dyspepsia) and overall improvement rate (relief from abdominal complaints).

Also, safety of alkaline ionized water was confirmed which clinically verifies its usefulness.

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Physiological effects of alkaline ionized water: Effects on metabolites produced by intestinal fermentation

by Takashi Hayakawa, Chicko Tushiya, Hisanori Onoda, Hisayo Ohkouchi, Harul-~to Tsuge (Gifu University, Faculty of Engineering, Dept. of Food Science)

We have found that long-term ingestion of alkaline ionized water (AIW) reduces cecal fermentation in rats that were given highly fermentable commercial diet (MF: Oriental Yeast Co., Ltd.). In this experiment, rats were fed MF and test water (tap water, AIW with pH at 9 and 10) for about 3 months. Feces were collected on the 57th day, and the rats were dissected on the 88th day. The amount of ammonium in fresh feces and cecal contents as well as fecal free-glucose tended to drop down for the AIW group. In most cases, the amount of free-amino acids in cecal contents did not differ except for cysteine (decreased in AIW with pH at 10) and isoleucine (increased in AIW with pH at 10).

Purpose of tests
Alkaline ionized water electrolyzers have been approved for manufacturing in 1965 by the Ministry of Health and Welfare as medical equipment to produce medical substances.

Alkaline ionized water (AIW) produced by this equipment is known to be effective against gastrointestinal fermentation, chronic diarrhea, indigestion and hyperchylia as well as for controlling gastric acid.*1 This is mainly based on efficacy of the official calcium hydroxide.
*2

By giving AIW to rats for a comparatively long time under the condition of extremely high level of intestinal fermentation, we have demonstrated that AIW intake is effective for inhibition of intestinal fermentation when its level is high based on some test results where AIW worked against cecal hypertrophy and for reduction in the amount of short-chain fatty acid that is the main product of fermentation.*3 We have reported that this is caused by the synergy between calcium level generally contained in AIW (about 50ppm) and the value of pH, and that frequency of detecting some anaerobic bacteria tends to be higher in alkaline ionized water groups than the other, although the bacteria count in the intestine does not have significant difference.

Based on these results, we made a judgment that effect of taking AIW supports part of inhibition mechanism against abnormal intestinal fermentation, which is one of the claims of efficacy that have been attributed to alkaline ionized water electrolyzers. *4

On the other hand, under the dietary condition of low intestinal fermentation, AIW uptake does not seem to inhibit fermentation that leads us to believe that effect of AIW uptake is characteristic of hyper-fermentation state. Metabolites produced by intestinal fermentation include indole and skatole in addition to organic acids such as short-chain fatty acid and lactic acid as well as toxic metabolites such as ammonium, phenol and pcresol. We do not know how AIW uptake would affect the production of these materials. In this experiment, we have tested on ammonium production as explained in the following sections.

Testing methods
Four-week-old male Wistar/ST Clean rats were purchased from Japan SLC Co., Ltd. and were divided into 3 groups of 8 each after preliminary breeding. AIW of pH 9 and 10 was produced by an electrolyzer Mineone ROYAL NDX3 1 OH by Omco Co., Ltd. This model produces AIW by electrolyzing water with calcium lactate added. On the last day of testing, the rats were dissected under Nembutal anesthesia to take blood from the heart by a heparin-treated syringe. As to their organs, the small intestines, cecum and colon plus rectum were taken out from each of them. The cecurn was weighed and cleaned with physiological saline after its contents were removed, and the tissue weight was measured after wiping out moisture. Part of cecal contents was measured its pH, and the rest was used to assay ammonium concentration. The amount of ammonium contained in fresh feces and cecal contents was measured by the Nessler method after collecting it in the extracted samples using Conway's micro-diffusion container. Fecal free-glucose was assayed by the oxygen method after extraction by hot water. Analysis of free amino acids contained in cecal contents was conducted by the Waters PicoTag amino acid analysis system.

Test results and analyses
No difference was found in the rats' weight gain, water and feed intake and feeding efficiency, nor was any particular distinction in appearance identified. The length of the small intestines and colon plus rectum tended to decline in AIW groups. PH value of cecal contents was higher and the amount of fecal free-glucose tended to be lower in AIW groups than the control group. Since there was no difference in fecal discharge itself, the amount of free-glucose discharged per day was at a low level. The amount of discharged free-glucose in feces is greater when intestinal fermentation is more intensive, which indicates that intestinal fermentation is more inhibited in AIW groups than the control

group. Ammonium concentration in cecal contents tends to drop down in AIW groups (Fig. 1). This trend was most distinctive in case of fresh feces of one of AIW groups with pH 10 (Fig.2) AIW uptake was found to be inhibitory against ammonium production. In order to study dynamics of amino acids in large intestines, we examined free amino acids in the cecal contents to find out that cysteine level is low in AIW groups whereas isoleucine level is high in one of AIW groups with pH 10, although no significant difference was identified for other amino acids.

Bibliography

1. "Verification of Alkaline Ionized Water" by Life Water Institute, Metamor Publishing Co., 1994, p.46

**2. "Official Pharmaceutical Guidelines of Japan, Vol. IT' by Japan Public Documents Association, Hirokawa PublIshin Co., 1996*

**3. "Science and Technology of Functional Water" (part) by Takashi Hayakawa, Haruffito Tsuge, edited by Water Scienll cc Institute, 1999, pp.109-116*

**4. 'Tasics and Effective Use of Alkaline Ionized Water" by Takashi Hayakawa, Haruhito Tsuge, edited by Tetsuji Hc kudou, 25th General Assembly of Japan Medical Congress 'Tunctional Water in Medical Treatment", Administratio~ Offices, 1999, pp. 10- 11*

Effects of alkaline ionized water on formation & maintenance of osseous tissues

by Rei Takahashi Zhenhua Zhang Yoshinori Itokawa
(Kyoto University Graduate School of Medicine, Dept. of Pathology and Tumor Biology, Fukui Prefectural University)

Effects of calcium alkaline ionized water on formation and maintenance of osseous tissues in rats were examined. In the absence of calcium in the diet, no apparent calcification was observed with only osteoid formation being prominent. Striking differences were found among groups that were given diets with 30% and 60% calcium.

Rats raised by calcium ionized water showed the least osteogenetic disturbance. Tibiae and humeri are more susceptible to calcium deficiency than femora. Theses results may

indicate that calcium in drinking water effectively supplements osteogenesis in case of dietary calcium deficiency. The mechanism involved in osteoid formation such as absorption rate of calcium from the intestine and effects of calcium alkaline ionized drinking water on maintaining bone structure in the process of aging or under the condition of calcium deficiency is investigated.

Osteoporosis that has lately drawn public attention is defined as "conditions of bone brittleness caused by reduction in the amount of bone frames and deterioration of osseous microstructure." Abnormal calcium metabolism has been considered to be one of the factors to contribute to this problem, which in turn is caused by insufficient calcium take in, reduction in enteral absorption rate of calcium and increase in the amount of calcium in urinal discharge.

Under normal conditions, bones absorb old bones by regular metabolism through osteoid formation to maintain their strength and function as supporting structure. It is getting clear that remodeling of bones at the tissue level goes through the process of activation, resorption, reversal, matrix synthesis and mineralization.

Another important function of bones is storing minerals especially by coordinating with intestines and kidneys to control calcium concentration in the blood. When something happens to this osteo metabolism, it results in abnormal morphological changes.

Our analyses have been focusing mostly on the changes in the amount of bones to examine effects of calcium alkaline ionized water on the reaction system of osteo metabolism and its efficiency.

Ibis time, however, we studied it further from the standpoint of histology. In other words, we conducted comparative studies on morphological and kinetic changes of osteogenesis by testing alkaline ionized water, tap water and solution of lactate on rats.

Clinical Studies
On The Effects Of Ionized ACID Water

Note: This report in no way reflects the opinions of any team or distibutor, the author of this Manual, or Enagic, Inc.

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We do NOT publish them with the intention of trying to prove a curative or therapeutic recommendation. Consult your doctor for specialized medical advice.

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1. Effects of electrolyzed oxidizing water on reducing Listeria monocytogenes contamination on seafood processing surfaces.

Int J Food Microbiol. 2005 Oct 7; [Epub ahead of print]
Liu C , Duan J , Su YC .

College of Food Science and Technology, Shanghai Fisheries University, 334 Jungong Road, Shanghai, 200090, P.R. China.

The effects of electrolyzed oxidizing (EO) water on reducing Listeria monocytogenes contamination on seafood processing surfaces were studied. Chips (5x5 cm(2)) of stainless steel sheet (SS), ceramic tile (CT), and floor tile (FT) with and without crabmeat residue on the surface were inoculated with L. monocytogenes and soaked in tap or EO water for 5 min. Viable cells of L. monocytogenes were detected on all chip surfaces with or without crabmeat residue after being held at room temperature for 1 h. Soaking contaminated chips in tap water resulted in small-degree reductions of the organism (0.40-0.66 log cfu/chip on clean surfaces and 0.78-1.33 log cfu/chip on dirty surfaces). Treatments of EO water significantly ($p<0.05$) reduced L. monocytogenes on clean surfaces (3.73 log on SS, 4.24 log on CT, and 5.12 log on FT).

Presence of crabmeat residue on chip surfaces reduced the effectiveness of EO water on inactivating Listeria cells. However, treatments of EO water also resulted in significant reductions of L. monocytogenes on dirty surfaces (2.33 log on SS and CT and 1.52 log on FT) when compared with tap water treatments. The antimicrobial activity of EO water was positively correlated with its chlorine content. High oxidation-reduction potential (ORP) of EO water also contributed significantly to its antimicrobial

activity against L. monocytogenes. EO water was more effective than chlorine water on inactivating L. monocytogenes on surfaces and could be used as a chlorine alternative for sanitation purpose. Application of EO water following a thorough cleaning process could greatly reduce L. monocytogenes contamination in seafood processing environments.

PMID: 16219378 [PubMed - as supplied by publisher]

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2. A clinical study of liver abscesses at the Critical Care and Emergency Center of Iwate Medical University

Nippon Shokakibyo Gakkai Zasshi. 2005 Sep;102(9):1153-60. [Article in Japanese]

Fujino Y , Inoue Y , Onodera M , Yaegashi Y , Sato N , Endo S , Omori H , Suzuki K .

Department of Critical Care Medicine, Iwate Medical University.

We studied 13 emergency cases of liver abscess. Five cases of septic shock or clouding of consciousness were identified on admission. Six patients had diabetes mellitus. Twelve patients met the diagnostic criteria for systemic inflammatory response syndrome, and nine met the criteria for disseminated intravascular coagulation. Plasma endotoxin levels improved rapidly after drainage. Causative organisms were isolated in all patients, and the most common organism was Klebsiella pneumoniae (seven cases). Percutaneous transhepatic abscess drainage (PTAD) was performed not only in single cases but also in multiple cases with main huge abscesses. Surgical treatment was performed in the following three cases: a ruptured abscess, an ineffective PTAD, and a case of peritonitis after PTAD. Irrigation of abscesses with strong acidic electrolyzed water revealed a significant decrease in treatment duration. In the majority of our cases, severe conditions were identified on admission. Strong acidic electrolyzed water was useful for management of PTAD.

PMID: 16180673 [PubMed - indexed for MEDLINE]

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4. Efficacy of ozonated and electrolyzed oxidative waters to decontaminate hides of cattle before slaughter.

J Food Prot. 2005 Jul;68(7):1393-8.

Bosilevac JM , Shackelford SD , Brichta DM , Koohmaraie M .

US Department of Agriculture, Agricultural Research Service, Roman L. Hruska US Meat Animal Research Center, Clay Center, Nebraska 68933-0166, USA. bosilevac@email.marc.usda.gov

The hides of cattle are the primary source of pathogens such as Escherichia coli O157:H7 that contaminate preevisceration carcasses during commercial beef processing. A number of interventions that reduce hide contamination and subsequent carcass contamination are currently being developed. The objective of this study was to determine the efficacy of ozonated and electrolyzed oxidizing (EO) waters to decontaminate beef hides and to compare these treatments with similar washing in water without the active antimicrobial compounds. Cattle hides draped over barrels were used as the model system. Ozonated water (2 ppm) was applied at 4,800 kPa (700 lb in2) and 15 degrees C for 10 s. Alkaline EO water and acidic EO water were sequentially applied at 60 degrees C for 10 s at 4,800 and 1,700 kPa (250 lb in2), respectively. Treatment using ozonated water reduced hide aerobic plate counts by 2.1 log CFU/100 cm2 and reduced Enterobacteriaceae counts by 3.4 log CFU/100 cm2. EO water treatment reduced aerobic plate counts by 3.5 log CFU/100 cm2 and reduced Enterobacteriaceae counts by 4.3 log CFU/100 cm2. Water controls that matched the wash conditions of the ozonated and EO treatments reduced aerobic plate counts by only 0.5 and 1.0 log CFU/100 cm2, respectively, and each reduced Enterobacteriaceae counts by 0.9 log CFU/100 cm2. The prevalence of E. coli O157 on hides was reduced from 89 to 31% following treatment with ozonated water and from 82 to 35% following EO water treatment. Control wash treatments had no significant effect on the prevalence of E. coli O157:H7. These results demonstrate that ozonated and EO waters can be used to decontaminate hides during processing and may be viable treatments for significantly reducing pathogen loads on beef hides, thereby reducing pathogens on beef carcasses.

PMID: 16013376 [PubMed - indexed for MEDLINE]

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5. Enhancing the bactericidal effect of electrolyzed water on Listeria monocytogenes biofilms formed on stainless steel.

J Food Prot. 2005 Jul;68(7):1375-80.
Ayebah B , Hung YC , Frank JF .

Department of Food Science and Technology, University of Georgia, 1109 Experiment Street, Griffin, Georgia 30223, USA.

Biofilms are potential sources of contamination to food in processing plants, because they frequently survive sanitizer treatments during cleaning. The objective of this research was to investigate the combined use of alkaline and acidic electrolyzed (EO) water in the inactivation of Listeria monocytogenes biofilms on stainless steel surfaces.

Biofilms were grown on rectangular stainless steel (type 304, no. 4 finish) coupons (2 by 5 cm) in a 1:10 dilution of tryptic soy broth that contained a five-strain mixture of L. monocytogenes for 48 h at 25 degrees C. The coupons with biofilms were then treated with acidic EO water or alkaline EO water or with alkaline EO water followed by acidic EO water produced at 14 and 20 A for 30, 60, and 120 s. Alkaline EO water alone did not produce significant reductions in L. monocytogenes biofilms when compared with the control. Treatment with acidic EO water only for 30 to 120 s, on the other hand, reduced the viable bacterial populations in the biofilms by 4.3 to 5.2 log CFU per coupon, whereas the combined treatment of alkaline EO water followed by acidic EO water produced an additional 0.3- to 1.2-log CFU per coupon reduction. The population of L. monocytogenes reduced by

treatments with acidic EO water increased significantly with increasing time of exposure. However, no significant differences occurred between treatments with EO water produced at 14 and 20 A. Results suggest that alkaline and acidic EO water can be used together to achieve a better inactivation of biofilms than when applied individually.

PMID: 16013373 [PubMed - indexed for MEDLINE]

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6. Recent advances in epidemiology and prevention of gastrointestinal endoscopy related infections.

Curr Opin Infect Dis. 2005 Aug;18(4):326-30.

Nelson DB .

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PURPOSE OF REVIEW: This article reviews recent publications relevant to endoscope reprocessing and the potential for transmission of infection during gastrointestinal endoscopy.

RECENT FINDINGS: There have been a number of established reprocessing failures of gastrointestinal endoscopes at various healthcare facilities across the US resulting in patient notifications. These episodes have been associated with user errors and reprocessing equipment failures, highlighting the need for increased compliance with established guidelines. Surveillance cultures may be useful to monitor the outcome of reprocessing, although their use is controversial. New technology to allow point-of-use monitoring is promising.

Biofilm accumulation may be an issue when reprocessing gastrointestinal endoscopes. Although peracetic acid has been promoted as superior to aldehyde-type liquid chemical germicides with regard to soil fixation, it may only be a modest improvement. Electrolyzed acid water is an emerging liquid chemical germicide that may be equivalent to currently accepted disinfectants. There appears to be no benefit to an additional reprocessing cycle before use for endoscopes that have been appropriately cleaned, disinfected, and stored.

SUMMARY: With the recent media attention on gastrointestinal endoscope reprocessing failures, despite the absence of documented transmission of infection, increased compliance with existing guidelines and new initiatives to enhance endoscope reprocessing are increasingly important to maintain public confidence.

Publication Types:

- Review

PMID: 15985829 [PubMed - indexed for MEDLINE]

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7. Microbiological evaluation of gastroscope decontamination by electrolysed acid water (Clentop WM-1)

Arq Gastroenterol. 2005 Jan-Mar;42(1):60-2. Epub 2005 Jun 22. [Article in Portuguese]

Machado AP , Fischman O , Geocze S .

Departamento de Microbiologia, Immunologia e Parasitologia, Escola Paulista de Medicina, Universidade Federal de Sao Paulo, Sao Paulo, SP.

BACKGROUND: The manual disinfection of endoscopes with glutharaldeyde is widely employed. The great routine in gastroenteroscopy services, low number of equipment and the lack of technical knowledge about the decontamination processes are factors that stimulate the inadequate endoscope disinfection, intensifying the risk of transmission of microorganisms. The electrolysed acid water has been effective in the inactivation and destruction of microorganisms.

AIM: The purpose of this investigation was to verify the microbicidal efficiency of electrolyzed acid water (Cleantop WM-1) to decontaminate gastroscopes after their using in patients.

MATERIAL AND METHODS: Samples from biopsy channel of flexible endoscopes collected after patient use (n = 20) and after disinfection (n = 20) were cultivated in tryptic soy agar, MacConkey agar and Sabouraud dextrose agar. RESULTS: Seventeen of the 20 samples collected after patients examination yielded gram-negative bacilli, gram-positive coccus and yeast cells in contamination of 3 to 5 log10 ufc/mL. Microbial growth was not verified in samples collected after the decontamination process. Conclusion - In this preliminary study, the mechanical disinfection carried through the Cleantop device with electrolyzed acid water showed satisfactory results for the elimination of microorganisms and time optimization in the reprocessing of gastroscopes.

Publication Types:

- Evaluation Studies

PMID: 15976913 [PubMed - indexed for MEDLINE]

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8. Efficacy of electrolyzed water in inactivating Salmonella enteritidis and Listeria monocytogenes on shell eggs.

J Food Prot. 2005 May;68(5):986-90.
Park CM , Hung YC , Lin CS , Brackett RE .

Department of Food Science and Technology, University of Georgia, Griffin, Georgia 30223-1797, USA.

The efficacy of acidic electrolyzed (EO) water produced at three levels of total available chlorine (16, 41, and 77 mg/ liter) and chlorinated water with 45 and 200 mg/liter of residual chlorine was investigated for inactivating Salmonella Enteritidis and Listeria monocytogenes on shell eggs. An increasing reduction in Listeria population was observed with increasing chlorine concentration from 16 to 77 mg/liter and treatment time from 1 to 5 min, resulting in a maximal reduction of 3.70 log CFU per shell egg compared with a deionized water wash for 5 min. There was no significant difference in antibacterial activities against Salmonella and Listeria at the same treatment time between 45 mg/liter of chlorinated water and 14-A acidic EO water treatment (P > or = 0.05). Chlorinated water (200 mg/liter) wash for 3 and 5 min

was the most effective treatment; it reduced mean populations of Listeria and Salmonella on inoculated eggs by 4.89 and 3.83 log CFU/shell egg, respectively. However, reductions (log CFU/shell egg) of Listeria (4.39) and Salmonella (3.66) by 1-min alkaline EO water treatment followed by another 1 min of 14-A acidic EO water (41 mg/liter chlorine) treatment had a similar reduction to the 1-min 200 mg/liter chlorinated water treatment for Listeria (4.01) and Salmonella (3.81). This study demonstrated that a combination of alkaline and acidic EO water wash is equivalent to 200 mg/liter of chlorinated water wash for reducing populations of Salmonella Enteritidis and L. monocytogenes on shell eggs.

PMID: 15895731 [PubMed - indexed for MEDLINE]

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9. Efficacy of electrolyzed oxidizing water for the microbial safety and quality of eggs.

Poult Sci. 2004 Dec;83(12):2071-8.
Bialka KL , Demirci A , Knabel SJ , Patterson PH , Puri VM .

Department of Agricultural & Biological Engineering, The Pennsylvania State University, University Park, Pennsylvania 16802, USA.

During commercial processing, eggs are washed in an alkaline detergent and then rinsed with chlorine to reduce dirt, debris, and microorganism levels. The alkaline and acidic fractions of electrolyzed oxidizing (EO) water have the ability to fit into the 2-step commercial egg washing process easily if proven to be effective. Therefore, the efficacy of EO water to decontaminate Salmonella Enteritidis and Escherichia coli K12 on artificially inoculated shell eggs was investigated.

For the in vitro study, eggs were soaked in alkaline EO water followed by soaking in acidic EO water at various temperatures and times. Treated eggs showed a reduction in population between > or = 0.6 to > or =2.6 log10 cfu/g of shell for S. Enteritidis and > or =0.9 and > or =2.6 log10 for E. coli K12. Log10 reductions of 1.7 and 2.0 for S. Enteritidis and E. coli K12, respectively, were

observed for typical commercial detergent-sanitizer treatments, whereas log10 reductions of > or =2.1 and > or =2.3 for S. Enteritidis and E. coli K12, respectively, were achieved using the EO water treatment. For the pilot-scale study, both fractions of EO water were compared with the detergent-sanitizer treatment using E. coli K12. Log10 reductions of > or = 2.98 and > or = 2.91 were found using the EO water treatment and the detergent-sanitizer treatment, respectively.

The effects of 2 treatments on egg quality were investigated. EO water and the detergent-sanitizer treatments did not significantly affect albumen height or eggshell strength; however, there were significant affects on cuticle presence. These results indicate that EO water has the potential to be used as a sanitizing agent for the egg washing process.

Publication Types:
PMID: 15615022 [PubMed - indexed for MEDLINE]

- Evaluation Studies

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10. Efficacy of acidic electrolyzed water ice for pathogen control on lettuce.

J Food Prot. 2004 Nov;67(11):2544-9.

Koseki S , Isobe S , Itoh K .

Food Processing Laboratory, National Food Research Institute, 2-1-12 Kannondai, Tsukuba 305-8642, Japan. koseki@nfri.affrc.go.jp

Acidic electrolyzed water (AcEW) was used as frozen AcEW (AcEW-ice) for inactivation of Listeria monocytogenes and Escherichia coli O157:H7 on lettuce. AcEW-ice was prepared from AcEW with 20, 50, 100, and 200 ppm of available chlorine by freezing at -40 degrees C and generated 30, 70, 150, and 240 ppm of chlorine gas (Cl2), respectively. The AcEW-ice was placed into styrene-foam containers with lettuce samples at 20 degrees C for 24 h.

Although AcEW-ice generating 30 ppm Cl2 had no effect on L. monocytogenes cell counts, AcEW-ice generating 70 to 240 ppm of Cl2 significantly ($P < 0.05$) reduced L. monocytogenes by ca. 1.5 log CFU/g. E. coli O157:H7 cell counts were reduced by 1.0 log CFU/g with AcEW-ice generating 30 ppm of Cl2. AcEW-ice generating 70 and 150 ppm of Cl2 reduced E. coli O157:H7 by 2.0 log CFU/g. Further significant reduction of E. coli O157:H7 (2.5 log CFU/g) was demonstrated by treatment with AcEW-ice generating 240 ppm of Cl2.

However, treatment with AcEW-ice generating 240 ppm of Cl2 resulted in a physiological disorder resembling leaf burn. AcEW-ice that generated less than 150 ppm of Cl2 had no effect on the surface color of the lettuce. AcEW-ice, regardless of the concentration of the emission of Cl2, had no effect on the ascorbic acid content in the lettuce. The weight ratio of lettuce to AcEW-ice required was determined to be over 1:10. The bactericidal effect of AcEW-ice appeared within the first 2 h. The use of AcEW-ice provides simultaneously for low temperature storage and inactivation of bacteria.

PMID: 15553639 [PubMed - indexed for MEDLINE]

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11. The efficacy of function water (electrolyzed strong acid solution) on open heart surgery; postoperative mediastinitis due to methicillin-resistant Staphylococcus aureus

Kyobu Geka. 2004 Nov;57(12):1110-2. [Article in Japanese]
Ichihara T , Fujii G , Eda T , Sasaki M , Ueda Y .

Department of Cardiovascular Surgery, Tosei General Hospital, Seto, Japan.

Methicillin-resistant Staphylococcus aureus (MRSA) infection after cardiac surgery has recently increased. We compared the anti-inflammatory effect of an electrolyzed strong acid solution and a warm saline solution in patients with open heart surgery. These solutions were used for mediastinal irrigation before closing the sternum. Group A patients were irrigated by a warm saline solution, and group B patients were irrigated by an electrolyzed strong acid solution, administration of this water is safe, feasible, and easy for the prevention of MRSA infection. Postoperative infection was significantly decreased in the group B as compared in

the group A. An electrolyzed strong acid solution may be effective on postoperative infection, particularly MRSA infection following open heart surgery.

PMID: 15553026 [PubMed - indexed for MEDLINE]

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12. Effects of water source, dilution, storage, and bacterial and fecal loads on the efficacy of electrolyzed oxidizing water for the control of Escherichia coli O157:H7.

J Food Prot. 2004 Jul;67(7):1377-83.
Stevenson SM , Cook SR , Bach SJ , McAllister TA .

Agriculture and Agri-Food Canada Research Centre, Lethbridge, Alberta, Canada T1J 4B1.

To evaluate the potential of using electrolyzed oxidizing (EO) water for controlling Escherichia coli O157:H7 in water for livestock, the effects of water source, electrolyte concentration, dilution, storage conditions, and bacterial or fecal load on the oxidative reduction potential (ORP) and bactericidal activity of EO water were investigated. Anode and combined (7:3 anode:cathode, vol/vol) EO waters reduced the pH and increased the ORP of deionized water, whereas cathode EO water increased pH and lowered ORP. Minimum concentrations (vol/vol) of anode and combined EO waters required to kill 10(4) CFU/ml planktonic suspensions of E. coli O157:H7 strain H4420 were 0.5 and 2.0%, respectively. Cathode EO water did not inhibit H4420 at concentrations up to 16% (vol/vol). Higher concentrations of anode or combined EO water were required to elevate the ORP of irrigation or chlorinated tap water compared with that of deionized water. Addition of feces to EO water products (0.5% anode or 2.0% combined, vol/vol) significantly reduced ($P < 0.001$) their ORP values to < 700 mV in all water types.

A relationship between ORP and bactericidal activity of EO water was observed. The dilute EO waters retained the capacity to eliminate a 10(4) CFU/ml inoculation of E. coli O157:H7 H4420 for at least 70 h regardless of exposure to UV light or storage temperature (4 versus 24 degrees C). At 95 h and beyond, UV exposure reduced ORP, significantly more so ($P < 0.05$) in open than in closed containers. Bactericidal activity of EO products (anode or combined) was lost in samples in which ORP value had fallen to < or = 848 mV. When stored in the dark, the diluted EO waters retained an ORP of > 848 mV and bactericidal efficacy for at least 125 h; with refrigeration (4 degrees C), these conditions were retained for at least 180 h. Results suggest that EO water may be an effective means by which to control E. coli O157:H7 in livestock water with low organic matter content.

PMID: 15270489 [PubMed - indexed for MEDLINE]

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13. Efficacy of electrolyzed acid water in reprocessing patient-used flexible upper endoscopes: Comparison with 2% alkaline glutaraldehyde.

J Gastroenterol Hepatol. 2004 Aug;19(8):897-903.
Lee JH , Rhee PL , Kim JH , Kim JJ , Paik SW , Rhee JC , Song JH , Yeom JS , Lee NY .

Department of Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, 50 Ilwon-Dong. Kangnam-Ku, Seoul 135-710, Korea.

BACKGROUND AND AIM: Two percent glutaraldehyde, the most widely used liquid chemical germicide (LCG), may be hazardous to patients and medical personnel. Alternatives to glutaraldehyde, such as electrolyzed acid water (EAW), are being developed, but data from well-controlled studies with patient-used endoscopes are rare. The purpose of the present paper was to evaluate the high-level disinfection capability of EAW and compare it with glutaraldehyde.

METHODS: A random sample of 125 endoscopes was collected immediately after upper endoscopic examination. After careful manual cleaning, endoscopes were divided into a glutaraldehyde and EAW group. After the disinfection procedure, samples from working channel (S-1), insertion tube (S-2), umbilical cord (S-3), and angulation knob (S-4) were taken and cultured. Another twenty endoscopes were experimentally contaminated with hepatitis B virus (HBV) and samples were collected after contamination (T-1), after manual cleaning (T-2), and after final disinfection (T-3). Polymerase chain reaction (PCR) for HBV-DNA was performed.

RESULTS: In the EAW group, culture-positive rates were 3.2% in S-1, 9.5% in S-2, 3.2% in S-3, and 27.0% in the S-4 samples. There was no significant difference between the EAW and glutaraldehyde groups for all sampling sites. However, in both groups, disinfection of the angulation knobs (S-4) was less efficient than the others. For the T-1 site, HBV-DNA was detected from all of them, and in 95% (19/20) of T-2. However, HBV-DNA was not detected from T-3 samples.

CONCLUSIONS: Electrolyzed acid water is as efficient as glutaraldehyde in eliminating bacteria from patient-used endoscopes. After disinfection procedures using both methods, HBV-DNA was not detected from any endoscopes experimentally contaminated with HBV-positive mixed sera.

However, some bacteria may remain on the surface of the endoscopes. Therefore, more careful precleaning of the endoscopes may help achieve high-level disinfection in the clinical setting.

PMID: 15242493 [PubMed - indexed for MEDLINE]

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14. Efficacy of acidic electrolyzed water for microbial decontamination of cucumbers and strawberries.

J Food Prot. 2004 Jun;67(6):1247-51. Koseki S , Yoshida K , Isobe S , Itoh K .

Food Processing Laboratory, National Food Research Institute, 2-1-12 Kannondai, Tsukuba 305-8642, Japan. koseki@nfri.affrc.go.jp

An examination was made of the efficacy of acidic electrolyzed water (AcEW, 30 ppm free available chlorine), ozonated water (5 ppm ozone), and a sodium hypochlorite solution (NaOCl, 150 ppm free available chlorine) for use as potential sanitizers of cucumbers and

strawberries. AcEW and NaOCl reduced the aerobic mesophiles naturally present on cucumbers within 10 min by 1.4 and 1.2 log CFU per cucumber, respectively. The reduction by ozonated water (0.7 log CFU per cucumber) was significantly less than that of AcEW or NaOCl (P < or = 0.05). Cucumbers washed in alkaline electrolyzed water for 5 min and then treated with AcEW for 5 min showed a reduction in aerobic mesophiles that was at least 2 log CFU per cucumber greater than that of other treatments (P < or = 0.05). This treatment was also effective in reducing levels of coliform bacteria and fungi associated with cucumbers. All treatments offered greater microbial reduction on the cucumber surface than in the cucumber homogenate. Aerobic mesophiles associated with strawberries were reduced by less than 1 log CFU per strawberry after each treatment. Coliform bacteria and fungi associated with strawberries were reduced by 1.0 to 1.5 log CFU per strawberry after each treatment. Microbial reduction was approximately 0.5 log CFU per strawberry greater on the strawberry surface than in the strawberry homogenate. However, neither treatment was able to completely inactivate or remove the microorganisms from the surface of the cucumber or strawberry.

PMID: 15222559 [PubMed - indexed for MEDLINE]

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15. The bactericidal effects of electrolyzed oxidizing water on bacterial strains involved in hospital infections.

Artif Organs. 2004 Jun;28(6):590-2. Vorobjeva NV , Vorobjeva LI , Khodjaev EY .

Department of Physiology of Microorganisms, Biology Faculty, Moscow State University, Lenin Hills 1/12, Moscow 119992, Russia. nvvorobjeva@mail.ru

The study is designed to investigate bactericidal actions of electrolyzed oxidizing water on hospital infections. Ten of the most common opportunistic pathogens are used for this study. Cultures are inoculated in 4.5 mL of electrolyzed oxidizing (EO) water or 4.5 mL of sterile deionized water (control), and incubated for 0, 0.5, and 5 min at room temperature. At the exposure time of 30 s the EO water completely inactivates all of the bacterial strains, with the exception of vegetative cells and spores of bacilli which need 5 min to be killed.

The results indicate that electrolyzed oxidizing water may be a useful disinfectant for hospital infections, but its clinical application has still to be evaluated.

PMID: 15153153 [PubMed - indexed for MEDLINE]

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16. Bactericidal effects of acidic electrolyzed water on the dental unit waterline.

Jpn J Infect Dis. 2004 Apr;57(2):52-4.
Kohno S , Kawata T , Kaku M , Fuita T , Tsutsui K , Ohtani J , Tenjo K , Motokawa M , Tohma Y , Shigekawa M , Kamata H , Tanne K .

Department of Orthodontics and Craniofacial Developmental Biology, Hiroshima University, Hiroshima 734-8553, Japan. acho@hiroshima-u.ac.jp

Many studies have been conducted in the United States regarding the microbial contamination of dental unit waterline, but not in Japan. Recently, acidic electrolyzed water has been used in the medical and dental fields. In this study, we investigated the bactericidal effects of the temporary inflow of acidic electrolyzed water on microbial contamination of the dental unit waterline. First, in order to observe the daily bacterial contamination of the dental unit waterline, water samples were collected at the end of handpieces and three-way syringes before the inflow of acidic electrolyzed water. They were cultured to detect viable bacteria. Later, the inflow of acidic electrolyzed water was conducted through the piping box of the dental unit.

Before starting operation on next day, water samples were collected and cultured, as described above. The mean viable bacteria count was 910 -/+ 190 CFU/ml at the end of handpieces, and 521 -/+ 116 CFU/ml at the end of three-way syringes before the inflow of acidic electrolyzed water. However, bacteria were detected in only small numbers at the end of handpieces and three-way syringes on the next day. These results indicated that acidic electrolyzed water could be applied as an appropriate measure against bacterial contamination of the dental unit waterline.

PMID: 15118209 [PubMed - indexed for MEDLINE]

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17. Evaluation of disinfective potential of reactivated free chlorine in pooled tap water by electrolysis.

J Microbiol Methods. 2004 May;57(2):163-73. Nakajima N , Nakano T , Harada F , Taniguchi H , Yokoyama I , Hirose J , Daikoku E , Sano K .

Department of Microbiology, Osaka Medical College, 2-7 Daigaku-machi Takatsuki, Osaka 569-8686, Japan.

Tap water is one of the causative factors of hospital infections. We examined the disinfective potential of electrolysis and mechanism of disinfection, and clarified the disinfective effect of electrolysis on tap water contaminated with bacteria, and discussed its clinical applications.

Tap waters artificially contaminated with Pseudomonas aeruginosa, Escherichia coli, Legionella pneumophila, and Staphylococcus aureus could be sterilized by electrolysis at 20-30 mA for 5 min. A high-density suspension (10(6) CFU/ml) of a spore forming bacterium,

Bacillus subtilis was not completely sterilized by electrolysis at 50 mA up to 30 min, but a low-density suspension (10(5) CFU/ml) was totally sterilized by electrolysis at 50 mA for 5 min. Electrolyzed P. aeruginosa changed morphologically, that is, there was bleb formation on the cell wall and irregular aggregation of cytoplasmic small granules. Moreover,

cytoplasmic enzyme, nitrate reductase, was inactivated by the electrolysis.

On the other hand, genomic DNA of the electrolyzed bacteria was not degenerated, therefore, their DNA polymerase activity was not completely inactivated. Consequently, the major agent in electrolysis for bactericidal action was considered to be free chlorine, and the possible bactericidal mechanism was by destruction of bacterial membranes, followed by the aggregation of peripheral cytoplasmic proteins.

Electrolysis of tap water for both disinfecting contaminating bacteria and increasing the disinfectant capacity was considered effective with some limitations, particularly against high-density contamination by spore-forming bacteria. In clinical settings, electrolysis of tap water
is considered effective to disinfect water for hand washing in operation theatres, and bathing water for immunocompromised hosts.

PMID: 15063056 [PubMed - indexed for MEDLINE]

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18. Effect of rinsing alginate impressions using acidic electrolyzed water on dimensional change and deformation of stone models.

Dent Mater J. 2003 Dec;22(4):494-506.
Hiraguchi H , Nakagawa H , Uchida H , Tanabe N .

Laboratory of Dental Materials Research, Division of Biomaterials Science, Dental Research Center, Nihon University School of Dentistry 1-8-13 kanda-Surugadai, Chiyoda-ku, Tokyo 101-8310.

This study investigated the effect of rinsing alginate impressions using acidic electrolyzed water on the dimensional change and deformation of stone models. Two brands of alginate impression materials were used. The impressions were rinsed using tap water or acidic electrolyzed water with a pH of 2.3, an oxidation-reduction potential of 1,230 mV, and a residual chlorine concentration of 45.0 ppm for 30 sec or 3 min. The sectional profiles of the stone models obtained from them were measured using a three-dimensional coordinate measuring system.

For the same rinsing time, there was no significant difference in dimensional change between the two types of rinsing water. The change in shape from the master die was approximately the same for the stone models obtained from rinsed impressions using either water. The results suggest that the use of acidic electrolyzed water rather than tap water for rinsing is an acceptable treatment for alginate impressions.

PMID: 15005227 [PubMed - indexed for MEDLINE]

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19. Corrosion behavior of dental alloys in various types of electrolyzed water.

Dent Mater J. 2003 Dec;22(4):482-93.
Dong H , Nagamatsu Y , Chen KK , Tajima K , Kakigawa H , Shi S , Kozono Y .

Pedodontics Research Institute, Tongji University, 2, Lane 158, DaMuQiao Rd., Ste. 402 Shanghai, 200032, PR China.

The corrosion behavior of dental alloys was examined in electrolyzed strong acid water, weak acid water and neutral water using a 7-day immersion test. The precious metal alloys, gold alloy. Au-Ag-Pd alloy and silver alloy showed the greatest surface color change and dissolution of constituents in the strong acid water and the smallest in the neutral water.

The release of Au from gold alloy was especially marked in the strong acid water. Co-Cr alloy showed greater corrosion and tarnish resistance in the strong acid water rather than in the weak acid water and the neutral water. X-ray microanalysis revealed that the corrosion products on the precious metal alloys were silver chloride crystals and the thin brown products on Co-Cr alloy were cobalt and chromium oxides. Ti was sound in all three types of electrolyzed water. The neutral water appeared the least corrosive to metals among the three types showing equivalent bactericidal activity.

PMID: 15005226 [PubMed - indexed for MEDLINE]

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20. Effects of chlorine and pH on efficacy of electrolyzed water for inactivating Escherichia coli O157:H7 and Listeria monocytogenes.

Int J Food Microbiol. 2004 Feb 15;91(1):13-8.
Park H , Hung YC , Chung D .

Department of Food Science and Technology, College of Agricultural and Environmental Sciences, University of Georgia, Griffin, GA 30223 1797, USA.

The effects of chlorine and pH on the bactericidal activity of electrolyzed (EO) water were examined against Escherichia coli O157:H7 and Listeria monocytogenes. The residual chlorine concentration of EO water ranged from 0.1 to 5.0 mg/l, and the pH effect was examined at pH 3.0, 5.0, and 7.0. The bactericidal activity of EO water increased with residual chlorine concentration for both pathogens, and complete inactivation was achieved at residual chlorine levels equal to or higher than 1.0 mg/l. The results showed that both pathogens are very sensitive to chlorine, and residual chlorine level of EO water should be maintained at 1.0 mg/l or higher for practical applications. For each residual chlorine level, bactericidal activity of EO water increased with decreasing pH for both pathogens. However, with sufficient residual chlorine (greater than 2 mg/l), EO water can be applied in a pH range between 2.6 (original pH of EO water) and 7.0 while still achieving complete inactivation of E. coli O157:H7 and L. monocytogenes.

PMID: 14967556 [PubMed - indexed for MEDLINE]

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21. Inactivation of Escherichia coli O157:H7, Salmonella enteritidis and Listeria monocytogenes on the surface of tomatoes by neutral electrolyzed water.

Lett Appl Microbiol. 2003;37(6):482-7.
Deza MA , Araujo M , Garrido MJ .

Institute of Food Research and Analysis, University of Santiago de Compostela, Santiago de Compostela, Spain. madeza@usc.es

AIMS: To determine the efficacy of neutral electrolyzed water (NEW) in killing Escherichia coli O157:H7, Salmonella enteritidis and Listeria monocytogenes, as well as nonpathogenic E. coli, on the surface of tomatoes, and to evaluate the effect of rinsing with NEW on the organoleptic characteristics of the tomatoes. METHODS AND RESULTS: The bactericidal activity of NEW, containing 444 or 89 mg l(-1) of active chlorine, was evaluated over pure cultures (8.5 log CFU ml(-1)) of the above-mentioned strains. All of them were reduced by more than 6 log CFU ml(-1) within 5 min of exposure to NEW. Fresh tomatoes were surface-inoculated with the same strains, and rinsed in NEW (89 mg l(-1) of active chlorine) or in deionized sterile water (control), for 30 or 60 s. In the NEW treatments, independent of the strain and of the treatment time, an initial surface population of about 5 log CFU sq.cm(-1) was reduced to <1 log CFU sq.cm(-1), and no cells were detected in the washing solution by plating procedure. A sensory evaluation was conducted to ascertain possible alterations in organoleptic qualities, yielding no significant differences with regard to untreated tomatoes. SIGNIFICANCE AND IMPACT OF THE STUDY: Rinsing in NEW reveals as an effective method to control the presence of E. coli O157:H7, S. enteritidis and L. monocytogenes on the surface of fresh tomatoes, without affecting their organoleptic characteristics. This indicates its potential application for the decontamination of fresh produce surfaces.

PMID: 14633103 [PubMed - indexed for MEDLINE]

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22. Reduction of Salmonella enterica on alfalfa seeds with acidic electrolyzed oxidizing water and enhanced uptake of acidic electrolyzed oxidizing water into seeds by gas exchange.

J Food Prot. 2003 Nov;66(11):2017-22. Stan SD , Daeschel MA .

Department of Food Science and Technology, Oregon State University, 100 Wiegand Hall, Corvallis, Oregon 97331-8575, USA.

Alfalfa sprouts have been implicated in several salmonellosis outbreaks in recent years. The disinfectant effects of acidic electrolyzed oxidizing (EO) water against Salmonella enterica both in an aqueous system and on artificially contaminated alfalfa seeds were determined. The optimum ratio of seeds to EO water was determined in order to maximize the antimicrobial effect of EO water. Seeds were combined with EO water at ratios (wt/vol) of 1:4, 1:10, 1:20, 1:40, and 1:100, and the characteristics of EO water (pH, oxidation reduction potential [ORP], and free chlorine concentration) were determined. When the ratio of seeds to EO water was increased from 1:4 to 1:100, the pH decreased from 3.82 to 2.63, while the ORP increased from +455 to +1,073 mV. EO water (with a pH of 2.54 to 2.38 and an ORP of +1,083 to +1,092 mV) exhibited strong potential for the inactivation of S. enterica in an aqueous system (producing a reduction of at least 6.6 log CFU/ml). Treatment of artificially contaminated alfalfa seeds with EO water at a seed-to-EO water ratio of 1:100 for 15 and 60 min significantly reduced Salmonella populations by 2.04 and 1.96 log CFU/g, respectively ($P < 0.05$), while a Butterfield's buffer wash decreased Salmonella populations by 0.18 and 0.23

log CFU/g, respectively. After treatment, EO water was Salmonella negative by enrichment with or without neutralization. Germination of seeds was not significantly affected (P > 0.05) by treatment for up to 60 min in electrolyzed water. The uptake of liquid into the seeds was influenced by the internal gas composition (air, N2, or O2) of seeds before the liquid was added.

PMID: 14627277 [PubMed - indexed for MEDLINE]

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23. Influence of inoculation method, spot inoculation site, and inoculation size on the efficacy of acidic electrolyzed water against pathogens on lettuce.

J Food Prot. 2003 Nov;66(11):2010-6.
Koseki S , Yoshida K , Kamitani Y , Itoh K .

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The influence of bacterial inoculation methods on the efficacy of sanitizers against pathogens was examined. Dip and spot inoculation methods were employed in this study to evaluate the effectiveness of acidic electrolyzed water (AcEW) and chlorinated water (200 ppm free available chlorine) against Escherichia coli O157:H7 and Salmonella spp. Ten pieces of lettuce leaf (5 by 5 cm) were inoculated by each method then immersed in 1.5 liters of AcEW, chlorinated water, or sterile distilled water for 1 min with agitation (150 rpm) at room temperature. The outer (abaxial) and inner (adaxial) surfaces of the lettuce leaf were distinguished in the spot inoculation. Initial inoculated pathogen population was in the range 7.3 to 7.8 log CFU/g. Treatment with AcEW and chlorinated water resulted in a 1 log CFU/g or less reduction of E. coli O157:H7 and Salmonella populations inoculated with the dip method. Spot inoculation of the inner surface of the lettuce leaf with AcEW and chlorinated water reduced the number of E. coli O157:H7 and Salmonella by approximately 2.7 and 2.5 log CFU/g, respectively. Spot inoculation of the outer surface of the lettuce leaf with both sanitizers resulted in approximately 4.6 and 4.4 log CFU/g reductions of E. coli O157:H7 and Salmonella, respectively. The influence of inoculation population size was also examined. Each sanitizer could not completely eliminate the pathogens when E. coli O157:H7 and Salmonella cells inoculated on the lettuce were of low population size (10(3) to 10(4) CFU/g), regardless of the inoculation technique.

PMID: 14627276 [PubMed - indexed for MEDLINE]

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24. Effectiveness of electrolyzed acidic water in killing Escherichia coli O157:H7, Salmonella enteritidis, and Listeria monocytogenes on the surfaces of tomatoes.

J Food Prot.
Bari ML , Sabina Y , Isobe S , Uemura T , Isshiki K .

Food Hygiene Laboratory, National Food Research Institute Food Technology Division,

Kannondai-2-1-12, Tsukuba 305-8642, Japan.

A study was conducted to evaluate the efficacy of electrolyzed acidic water, 200-ppm chlorine water, and sterile distilled water in killing Escherichia coli O157:H7, Salmonella, and Listeria monocytogenes on the surfaces of spot-inoculated tomatoes. Inoculated tomatoes were sprayed with electrolyzed acidic water, 200-ppm chlorine water, and sterile distilled water (control) and rubbed by hand for 40 s. Populations of E. coli O157:H7, Salmonella, and L. monocytogenes in the rinse water and in the peptone wash solution were determined. Treatment with 200-ppm chlorine water and electrolyzed acidic water resulted in 4.87- and 7.85-log10 reductions, respectively, in Escherichia coli O157:H7 counts and 4.69- and 7.46-log10 reductions, respectively, in Salmonella counts. Treatment with 200-ppm chlorine water and electrolyzed acidic water reduced the number of L. monocytogenes by 4.76 and 7.54 log10 CFU per tomato, respectively. This study's findings suggest that electrolyzed acidic water could be useful in controlling pathogenic microorganisms on fresh produce.

PMID: 12696675 [PubMed - indexed for MEDLINE] Comment: J Food Prot. 2003 Sep;66(9):1540; author reply 1540.
"Effectiveness of electrolyzed acidic water in killing Escherichia coli O157:H7, Salmonella enteritidis, and Listeria monocytogenes on the surfaces of tomatoes,"
a comment on: J. Food Prot. 66(4):542-548 (2003).

Wilhelmsen E .

Publication Types:
PMID: 14503702 [PubMed - indexed for MEDLINE]

- Comment
- Letter

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25. Stability of electrolyzed oxidizing water and its efficacy against cell suspensions of Salmonella typhimurium and Listeria monocytogenes.

J Food Prot. 2003 Aug;66(8):1379-84.
Fabrizio KA , Cutter CN .

Department of Food Science, 111 Borland Laboratory, The Pennsylvania State University, University Park, Pennsylvania 16802, USA.

Electrolyzed oxidizing (EO) water has proved to be effective against foodborne pathogens attached to cutting boards and poultry surfaces and against spoilage organisms on vegetables; however, its levels of effectiveness against Listeria monocytogenes and Salmonella Typhimurium in cell suspensions have not been compared with those of other treatments. In this study, the oxidation reduction potentials (ORPs), chlorine concentrations, and pHs of acidic and basic EO water were monitored for 3 days at 4 and 25 degrees C after generation. There were no differences between the pHs or ORPs of acidic and basic EO waters stored at 4 or 25 degrees C. However, the free chlorine concentration in acidic EO water stored at 4 degrees C increased after 24 h. In contrast, the free chlorine concentration in acidic EO water

stored at 25 degrees C decreased after one day. Cell suspensions of Salmonella Typhimurium and L. monocytogenes were treated with distilled water, chlorinated water (20 ppm), acidified chlorinated water (20 ppm, 4.5 pH), acidic EO water (EOA), basic EO water (EOB), or acidic EO water that was "aged" at 4 degrees C for 24 h (AEOA) for up to 15 min at either 4 or 25 degrees C. The largest reductions observed were those following treatments carried out at 25 degrees C. EOA and AEOA treatments at both temperatures significantly reduced Salmonella Typhimurium populations by > 8 log10 CFU/ml. EOA and AEOA treatments effectively reduced L. monocytogenes populations by > 8 log10 CFU/ml at 25degrees C. These results demonstrate the stability of EO water under different conditions and that EO water effectively reduced Salmonella Typhimurium and L. monocytogenes populations in cell suspensions.

PMID: 12929823 [PubMed - indexed for MEDLINE]

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26. Treatment of Escherichia coli O157:H7 inoculated alfalfa seeds and sprouts with electrolyzed oxidizing water.

Int J Food Microbiol. 2003 Sep 15;86(3):231-7.
Sharma RR , Demirci A .

Department of Agricultural and Biological Engineering, Pennsylvania State University, University Park, PA 16802, USA.

Electrolyzed oxidizing water is a relatively new concept that has been utilized in agriculture, livestock management, medical sterilization, and food sanitation. Electrolyzed oxidizing (EO) water generated by passing sodium chloride solution through an EO water generator was used to treat alfalfa seeds and sprouts inoculated with a five-strain cocktail of nalidixic acid resistant Escherichia coli O157:H7. EO water had a pH of 2.6, an oxidation-reduction potential of 1150 mV and about 50 ppm free chlorine. The percentage reduction in bacterial load was determined for reaction times of 2, 4, 8, 16, 32, and 64 min. Mechanical agitation was done while treating the seeds at different time intervals to increase the effectiveness of the treatment. Since E. coli O157:H7 was released due to soaking during treatment, the initial counts on seeds and sprouts were determined by soaking the contaminated seeds/sprouts in 0.1% peptone water for a period equivalent to treatment time. The samples were then pummeled in 0.1% peptone water and spread plated on tryptic soy agar with 5 microg/ml of nalidixic acid (TSAN). Results showed that there were reductions between 38.2% and 97.1% (0.22-1.56 log(10) CFU/g) in the bacterial load of treated seeds. The reductions for sprouts were between 91.1% and 99.8% (1.05-2.72 log(10) CFU/g). An increase in treatment time increased the percentage reduction of E. coli O157:H7. However, germination of the treated seeds reduced from 92% to 49% as amperage to make EO water and soaking time increased. EO water did not cause any visible damage to the sprouts.

PMID: 12915034 [PubMed - indexed for MEDLINE]

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27. Effect of electrolyzed oxidizing water and hydrocolloid occlusive dressings on excised

burn-wounds in rats.

Chin J Traumatol. 2003 Aug 1;6(4):234-7.
Xin H , Zheng YJ , Hajime N , Han ZG .

Department of Thoracic Surgery, China-Japan Union Hospital, Jilin University, Jilin 130031, China. xinhua7254@yahoo.com.cn

OBJECTIVE: To study the efficacy of electrolyzed oxidizing water (EOW) and hydrocolloid occlusive dressings in the acceleration of epithelialization in excised burn-wounds in rats. METHODS: Each of the anesthetized Sprague-Dawley rats (n=28) was subjected to a third-degree burn that covered approximately 10% of the total body surface area. Rats were assigned into four groups: Group I (no irrigation), Group II (irrigation with physiologic saline), Group III (irrigation with EOW) and Group IV (hydrocolloid occlusive dressing after EOW irrigation). Wounds were observed macroscopically until complete epithelialization was present, then the epithelialized wounds were examined microscopically. RESULTS: Healing of the burn wounds was the fastest in Group IV treated with hydrocolloid occlusive dressing together with EOW. Although extensive regenerative epidermis was seen in each Group, the proliferations of lymphocytes and macrophages associated with dense collagen deposition were more extensive in Group II, III and IV than in Group I. These findings were particularly evident in Group III and IV. CONCLUSIONS: Wound Healing may be accelerated by applying a hydrocolloid occlusive dressing on burn surfaces after they are cleaned with EOW.

PMID: 12857518 [PubMed - indexed for MEDLINE]

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28. Reduced hemodialysis-induced oxidative stress in end-stage renal disease patients by electrolyzed reduced water.

Kidney Int. 2003 Aug;64(2):704-14.
Huang KC , Yang CC , Lee KT , Chien CT .

Department of Family Medicine, National Taiwan University College of Medicine and National Taiwan University Hospital, Taipei, Taiwan.

BACKGROUND: Increased oxidative stress in end-stage renal disease (ESRD) patients may oxidize macromolecules and consequently lead to cardiovascular events during chronic hemodialysis. Electrolyzed reduced water (ERW) with reactive oxygen species (ROS) scavenging ability may have a potential effect on reduction of hemodialysis-induced oxidative stress in ESRD patients. METHODS: We developed a chemiluminescence emission spectrum and high-performance liquid chromatography analysis to assess the effect of ERW replacement on plasma ROS (H_2O_2 and HOCl) scavenging activity and oxidized lipid or protein production in ESRD patients undergoing hemodialysis. Oxidized markers, dityrosine, methylguanidine, and phosphatidylcholine hydroperoxide, and inflammatory markers, interleukin 6 (IL-6), and C-reactive protein (CRP) were determined. RESULTS: Although hemodialysis efficiently removes dityrosine and creatinine, hemodialysis increased oxidative stress, including phosphatidylcholine hydroperoxide, and methylguanidine. Hemodialysis reduced the plasma ROS scavenging activity, as shown by the augmented reference H_2O_2 and HOCl counts (Rh202 and Rhocl, respectively) and decreased antioxidative activity

(expressed as total antioxidant status in this study). ERW administration diminished hemodialysis-enhanced Rh2o2 and Rhocl, minimized oxidized and inflammatory markers (CRP and IL-6), and partly restored total antioxidant status during 1-month treatment. CONCLUSION: This study demonstrates that hemodialysis with ERW administration may efficiently increase the H2O2- and HOCl-dependent antioxidant defense and reduce H2O2- and HOCl-induced oxidative stress.

PMID: 12846769 [PubMed - indexed for MEDLINE]

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29. Cytotoxic effect of antiseptics: comparison In vitro. In vivo examination of strong acidic electrolyzed water, povidone-iodine, chlorhexidine and benzalkonium chloride

Kansenshogaku Zasshi. 2003 May;77(5):316-22. [Article in Japanese]

Iwasawa A , Nakamura Y .

Showa University Fujigaoka Hospital, Department of Clinical Pathology.

Cytotoxic effect and guinea pig wound cure stage, pus fabrication presence in infected wound were compared with strong acidic electrolyzed water (AcEW) and povidone-iodine solution (PVP-I), chlorhexidine (CHG) and benzalkonium chloride (BAC). It gave the following results: In a cytotoxic test, the toxicity was recognized in 0.1%-0.01% PVP-I, in 0.0002-0.0004% CHG, in 10-0.1 micrograms/ml BAC, but there was no toxicity in AcEW. By a guinea pig wound cure process, no significance was recognized between each pharmaceutical agent in epidermal cell migration, but by an inflammation locus area, the significance was considerable in comparison with no-treatment. The pyopoiesis of P. aeruginosa infected wound was recognized in a ratio of 38.2% physiological saline, 27.3% CHG, 20.6% PVP-I and 12.1% AcEW. When pollution locus includes an infection image of bacteria, while draining AcEW instead of physiological saline, disinfection, indication was expected, and, as for the disorder in cure stage. I do not agree with that mentioned above. As for AcEW, availability by organism use was recognized for the cytotoxic effect of antiseptic instead of action of acceleration for wound cure.

PMID: 12806927 [PubMed - indexed for MEDLINE]

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30. Decomposition of ethylene, a flower-senescence hormone, with electrolyzed anode water.

Biosci Biotechnol Biochem. 2003 Apr;67(4):790-6.
Harada K , Yasui K .

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Electrolyzed anode water (EAW) markedly extended the vase life of cut carnation flowers. Therefore, a flower-senescence hormone involving ethylene decomposition by EAW with potassium chloride as an electrolyte was investigated. Ethylene was added externally to EAW, and the reaction between ethylen and the available chlorine in EAW was examined. EAW had a low pH value (2.5), a high concentration

of dissolved oxygen, and extremely high redox potential (19.2 mg/l and 1323 mV, respectively) when available chlorine was at a concentration of about 620 microns. The addition of ethylene to EAW led to ethylene decomposition, and an equimolar amount of ethylene chlorohydrine with available chlorine was produced. The ethylene chlorohydrine production was greatly affected by the pH value (pH 2.5, 5.0 and 10.0 were tested), and was faster in an acidic solution. Ethylene chlorohydrine was not produced after ethylene had been added to EAW at pH 2.6 when available chlorine was absent, but was produced after potassium hypochlorite had been added to such EAW. The effect of the pH value of EAW on the vase life of cut carnations was compatible with the decomposition rate of ethylene in EAW of the same pH value. These results suggest that the effect of EAW on the vase life of cut carnations was due to the decomposition of ethylene to ethylene chlorohydrine by chlorine from chlorine compounds.

PMID: 12784619 [PubMed - indexed for MEDLINE]

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31. Effect of rinsing hydrocolloid impressions using acidic electrolyzed water on surface roughness and surface hardness of stone models.
J Oral Sci. 2002 Dec;44(3-4):141-6 Nakagawa H , Hiraguchi H , Uchida H , Tanabe N .

Laboratory of Dental Materials Research, Division of Biomaterials Science, Dental Research Center, Nihon University School of Dentistry, Tokyo 101-8310, Japan. nakagawa@dent.nihon-u.ac.jp

The present study investigated the effect on the surface quality of resultant stone models of rinsing hydrocolloid impressions using acidic electrolyzed water. Two brands of alginate impression materials (Aroma Fine DFIII, Jeltrate Plus), an agar impression material (Ajisai) designed for agar/alginate combined impression, and dental stone (New Plastone) were used to make the test specimens. For the rinsing of impressions, acidic electrolyzed water having a pH value of 2.3, an oxidation-reduction potential of 1,230 mV, and a residual chlorine concentration of 45.0 ppm, was prepared. Alginate, agar and agar/alginate combined impressions were rinsed using acidic electrolyzed water or tap water for 30 sec and 3 min, and as a control, these impressions were not rinsed with any water. Disk-shaped stone specimens obtained from rinsed impressions were evaluated with respect to surface roughness (Ra) and surface hardness (scratch depth), and scanning electron microscope (SEM) observations were performed. The stone specimens obtained from rinsed impressions using acidic electrolyzed water showed a surface quality equivalent to that of the stone specimens obtained from the rinsed impression using tap water. This result suggests that the use of acidic electrolyzed water for rinsing is an acceptable treatment for hydrocolloid impressions, so long as the rinsing time is from 30 sec to 3 min.

PMID: 12613503 [PubMed - indexed for MEDLINE]

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32. Efficacy of electrolyzed oxidizing water in inactivating Salmonella on alfalfa seeds and sprouts.

J Food Prot. 2003 Feb;66(2):208-14.
Kim C , Hung YC , Brackett RE , Lin CS .

Department of Food Science and Technology, College of Agricultural and Environmental Sciences, University of Georgia, Griffin, Georgia 30223-1797, USA.

Studies have demonstrated that electrolyzed oxidizing (EO) water is effective in reducing foodborne pathogens on fresh produce. This study was undertaken to determine the efficacy of EO water and two different forms of chlorinated water (chlorine water from Cl2 and Ca(OCl)2 as sources of chlorine) in inactivating Salmonella on alfalfa seeds and sprouts. Tengram sets of alfalfa seeds inoculated with a

five-strain cocktail of Salmonella (6.3 x 10(4) CFU/g) were subjected to 90 ml of deionized water (control), EO water (84 mg/liter of active chlorine), chlorine water (84 mg/liter of active chlorine), and Ca(OCl)2 solutions at 90 and 20,000 mg/liter of active chlorine for 10 min at 24 +/- 2 degrees C. The application of EO water, chlorinated water, and 90 mg/liter of Ca(OCl)2 to alfalfa seeds for 10 min reduced initial populations of Salmonella by at least 1.5 log10 CFU/g. For seed sprouting, alfalfa seeds were soaked in the different treatment solutions described above for 3 h. Ca(OCl)2 (20,000 mg/liter of active chlorine) was the most effective treatment in reducing the populations of Salmonella and non-Salmonella microflora (4.6 and 7.0 log10 CFU/g, respectively). However, the use of high concentrations of chlorine generates worker safety concerns. Also, the Ca(OCl)2 treatment significantly reduced seed germination rates (70% versus 90 to 96%). For alfalfa sprouts, higher bacterial populations were recovered from treated sprouts containing seed coats than from sprouts with seed coats removed. The effectiveness of EO water improved when soaking treatments were applied to sprouts in conjunction with sonication and seed coat removal. The combined treatment achieved 2.3- and 1.5-log10 CFU/g greater reductions than EO water alone in populations of Salmonella and non-Salmonella microflora, respectively. This combination treatment resulted in a 3.3-log10 CFU/g greater reduction in Salmonella populations than the control (deionized water) treatment.

PMID: 12597478 [PubMed - indexed for MEDLINE]

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33. The effect of electrolyzed oxidative water applied using electrostatic spraying on pathogenic and indicator bacteria on the surface of eggs.

Poult Sci. 2003 Jan;82(1):158-62.
Russell SM .

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Research was conducted to compare the effectiveness of electrolyzed oxidative (EO) water applied using an electrostatic spraying system (ESS) for killing populations of bacteria that are of concern to the poultry industry. Populations of pathogenic bacteria (Salmonella typhimurium, Staphylococcus aureus, and Listeria monocytogenes), and the indicator bacterium Escherichia coli were applied to eggs and allowed to attach for 1 h. EO water completely eliminated all Salmonella typhimurium on 3, 7, 1, and 8 out of 15 eggs in Repetitions (Rep) 1, 2, 3, and 4, respectively, even when very high inoculations were used. EO water completely eliminated all Staphylococcus aureus on 12, 11, 12, and 11 out of 15 eggs in Rep 1, 2, 3, and 4, respectively. EO water completely eliminated all Listeria monocytogenes on 8, 13, 12, and 14 out of 15 eggs in Reps 1, 2, 3, and 4, respectively. EO water completely eliminated all Escherichia coli on 9, 11, 15, and 11 out of 15 eggs in Reps 1, 2, 3, and 4, respectively. Even when very high concentrations of bacteria were inoculated onto eggs (many times higher than would be encountered in industrial situations), EO water was found to be effective when used in conjunction with electrostatic spraying for eliminating pathogenic and indicator populations of bacteria from hatching eggs.

PMID: 12580260 [PubMed - indexed for MEDLINE]

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34. Electrochemical removal of bromide and reduction of THM formation potential in drinking water.

Water Res. 2002 Nov;36(19):4902-6.
Kimbrough DE , Suffet IH .

Castaic Lake Water Agency, Santa Clarita, CA 91350, USA. dkimbrough@clwa.org

Trihalomethanes (THMs), a by-product of the chlorination of natural waters containing dissolved organic carbon and bromide, are the focus of considerable public health concern and regulation due to their potential as a carcinogen by ingestion. This paper presents a promising new water treatment process that lowers the concentration of bromide in drinking water and thus, lowers the THM formation potential. Bromide is oxidized by electrolysis to bromine and then the bromine apparently volatilized. The electrolyzed water, when chlorinated, produces measurably lower amounts of THMs and proportionately fewer brominated THMs, which are of greater public health concern than the chlorinated THMs. Removing bromide should also reduce the formation of other disinfection by-products such as bromate and haloacetic acids.

PMID: 12448534 [PubMed - indexed for MEDLINE]

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35. Comparison of electrolyzed oxidizing water with various antimicrobial interventions to reduce Salmonella species on poultry.

Poult Sci. 2002 Oct;81(10):1598-605.
Fabrizio KA , Sharma RR , Demirci A , Cutter CN .

Department of Food Science, The Pennsylvania State University, University Park 16802, USA.

Foodborne pathogens in cell suspensions or attached to surfaces can be reduced by electrolyzed oxidizing (EO) water; however, the use of EO water against pathogens associated with poultry has not been explored. In this study, acidic EO water [EO-A; pH 2.6, chlorine (CL) 20 to 50 ppm, and oxidation-reduction potential (ORP) of 1,150 mV], basic EO water (EO-B; pH 11.6, ORP of -795 mV), CL, ozonated water (OZ), acetic acid (AA), or trisodium phosphate (TSP) was applied to broiler carcasses inoculated with Salmonella Typhimurium (ST) and submerged (4 C, 45 min), spray-washed (85 psi, 25 C, 15 s), or subjected to multiple interventions (EO-B spray, immersed in EO-A; AA or TSP spray, immersed in CL). Remaining bacterial populations were determined and compared at Day 0 and 7 of aerobic, refrigerated storage. At Day 0, submersion in TSP and AA reduced ST 1.41 log10, whereas EO-A water reduced ST approximately 0.86 log10. After 7 d of storage, EO-A water, OZ, TSP, and AA reduced ST, with detection only after selective enrichment. Spray-washing treatments with any of the compounds did not reduce ST at Day 0. After 7 d of storage, TSP, AA, and EO-A water reduced ST 2.17, 2.31, and 1.06 log10, respectively. ST was reduced 2.11 log10 immediately following the multiple interventions, 3.81 log10 after 7 d of storage. Although effective against ST, TSP and AA are costly and adversely affect the environment. This study demonstrates that EO water can reduce ST on poultry surfaces following extended refrigerated storage.

PMID: 12412930 [PubMed - indexed for MEDLINE]

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36. Behavior of hydrogen peroxide in electrolyzed anode water.

Biosci Biotechnol Biochem. 2002 Sep;66(9):1783-91.
Harada K .

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Oxygen electrodes and spectrophotometric analysis have been used to evaluate the contribution of H2O2, in addition to available chlorine, to the high redox potential of electrolyzed anode water (EAW) with potassium chloride as an electrolyte. H2O2 was added externally to EAW, and the reaction between H2O2 and the available chlorine in the water was examined. EAW has a low pH (2.5), a high concentration of dissolved oxygen, and extremely high redox potentials (19 mg/l and 1,319 mV) when the available chlorine is at the concentration of about 580 microM. The addition of H2O2 to EAW led to H2O2 decomposition, and the amount of oxygen produced was equivalent to the amount of available chlorine. Oxygen production was reduced by ascorbic acid, and completely inhibited by 600 microM ascorbate. The rate of oxygen production was much affected by pH, and was slowest at or near pH 5.0. Rates were particularly high in alkaline solution. Absorbance at 235 nm (pH 3.0 and 5.0) and 292 nm (pH 10.0) decreased when H2O2 was added to the EAW at these pHs, and the extent of decrease was similar pH dependency to that of the oxygen production rate. Oxygen was not produced after H2O2 was added to EAW at pH 2.6 when available chlorine was absent, but oxygen was produced after potassium hypochlorite was added to such EAW. The oxygen production rates in EAW without available chlorine at pH 5.0 and 2.0, pH adjustment with KOH and HCl, respectively, were faster than the rate at pH 2.6, and fastest at pH 2.0. These results suggest that H2O2 or hydroxyl radicals derived from Fenton's reaction did not contribute to the high redox potential of EAW prepared with chlorine compounds as an electrolyte, so that the decomposition of H2O2 occurred rapidly with the reactions of chlorine and hypochlorite ions in EAW.

PMID: 12400674 [PubMed - indexed for MEDLINE]

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37. Durability of bactericidal activity in electrolyzed neutral water by storage.

Dent Mater J. 2002 Jun;21(2):93-104.
Nagamatsu Y , Chen KK , Tajima K , Kakigawa H , Kozono Y .

Department of Materials Science, Kyushu Dental College, Kokurakita, Kitakyushu, Japan.

Electrolyzed strong and weak acid waters have been widely used for sterilization in clinical dentistry because of their excellent bactericidal activities. Electrolyzed neutral water was recently developed with a new concept of long-term good durability in addition to the excellent bactericidal activity similar to acid waters. The present study, evaluated the storage life of this water compared with the acid waters in terms of the changes in pH, oxidation-reduction potential (ORP), residual chlorine and bactericidal activity under several conditions using Staphylococcus aureus 209P. The strong acid water showed a rapid deterioration of its bactericidal activity. The weak acid and neutral waters exhibited excellent durability. Although all the bacteria were annihilated by the contact with the waters even stored for 40 days in the uncapped bottle, the neutral water was superior in further long-term duration.

PMID: 12238791 [PubMed - indexed for MEDLINE]

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38. Effectiveness of electrolyzed water as a sanitizer for treating different surfaces.

J Food Prot. 2002 Aug;65(8):1276-80.
Park H , Hung YC , Kim C .

Department of Food Science and Technology, College of Agricultural and Environmental Sciences, University of Georgia, Griffin 30223-1797, USA.

The effectiveness of electrolyzed (EO) water at killing Enterobacter aerogenes and Staphylococcus aureus in pure culture was evaluated. One milliliter (approximately 10(9) CFU/ml) of each bacterium was subjected to 9 ml of EO water or control water (EO water containing 10% neutralizing buffer) at room temperature for 30 s. Inactivation (reduction of > 9 log10 CFU/ ml) of both pathogens occurred within 30 s after exposure to EO water containing approximately 25 or 50 mg of residual chlorine per liter. The effectiveness of EO water in reducing E. aerogenes and S. aureus on different surfaces (glass, stainless steel, glazed ceramic tile, unglazed ceramic tile, and vitreous china) was also evaluated. After immersion of the tested surfaces in EO water for 5 min without agitation, populations of E. aerogenes and S. aureus were reduced by 2.2 to 2.4 log10 CFU/ cm2 and by 1.7 to 1.9 log10 CFU/cm2, respectively, whereas washing with control water resulted in a reduction of only 0.1 to 0.3 log10 CFU/cm2. The washing of tested surfaces in EO water with agitation (50 rpm) reduced populations of viable cells on the tested surfaces to < 1 CFU/cm2. For the control water treatment with agitation, the surviving numbers of both strains on the tested surfaces were approximately 3 log10 CFU/cm2. No viable cells of either strain were observed in the EO water after treatment, regardless of agitation. However, large populations of both pathogens were recovered from control wash solution after treatment.

PMID: 12182480 [PubMed - indexed for MEDLINE]

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39. Antimicrobial effects and efficacy on habitually hand-washing of strong acidic electrolyzed water--a comparative study of alcoholic antiseptics and soap and tap water

Kansenshogaku Zasshi. 2002 May;76(5):373-7. [Article in Japanese]

Sakashita M , Iwasawa A , Nakamura Y .

Department of Nursing, Showa University Fujigaoka Hospital.

The rate of bacterial elimination for the stamp method was compared with regular hand-washing (using soap and tap water), hygienic hand-washing (using alcoholic antiseptics), and hand-washing using strong acidic electrolyzed water (the SAEW method) in routine work. After routine work, the average number of bacteria remaining on the nurse's hands with using the SAEW-method, rubbing method and tap water method, were: 54 +/- 63, 89 +/- 190, 128 +/- 194 CFU/agar plate, respectively (n = 81). In this study. It was clarified that a much larger number of Bacillus sp. were detected for the rubbing method than for the other methods. After further nurse work, the most number of absorbed bacteria on a nurse's hands were counted after cleaning a patient's body. The rate of bacteria elimination for hand-washing with soap and tap water after taking care of a patient was insufficient, especially when before care was provided the number of bacteria on the nurse's hands were less than 100 CFU/agar plate. From these results, the following manual for sanitary hand washing is recommended: 1. At first, dirty hands should be cleaned and the number of bacteria should be reduced using soap and tap water or by scrubbing with disinfectants. 2. After the number of bacteria has been reduced, use the SAEW method routinely. 3. For care requiring a high level of cleanliness or if no tap water facilities are available, use the rubbing method. Finally, routine use of the SAEW method in ICU could be recommended with conventional disinfectants and soap and tap water on a case by case basis for less than adverse reactions, such as in the case of rough-hands or keeping a low level of bacteria on hands.

PMID: 12073573 [PubMed - indexed for MEDLINE]

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40. Bactericidal activity of electrolyzed acid water from solution containing sodium chloride at low concentration, in comparison with that at high concentration.

J Microbiol Methods. 2002 May;49(3):285-93.
Kiura H , Sano K , Morimatsu S , Nakano T , Morita C , Yamaguchi M , Maeda T , Katsuoka Y .

Department of Microbiology, Osaka Medical College, Takatsuki, Osaka 569-8686, Japan.

Electrolyzed strong acid water (ESW) containing free chlorine at various concentrations is becoming to be available in clinical settings as a disinfectant. ESW is prepared by electrolysis of a NaCl solution, and has a corrosive activity against medical instruments. Although lower concentrations of NaCl and free chlorine are desired to eliminate corrosion, the germicidal effect of ESW with low NaCl and free-chlorine concentrations (ESW-L) has not been fully clarified. In this study, we demonstrated that ESW-L possesses bactericidal activity against Mycobacteria and spores of Bacillus subtilis. The effect was slightly weaker than that of ESW containing higher NaCl and free-chlorine concentrations (ESW-H), but acceptable as a disinfectant. To clarify the mechanism of the bactericidal activity, we investigated ESW-L-treated Pseudomonas aeruginosa by transmission electron microscopy, a bacterial enzyme assay and restriction fragment length polymorphism pattern (RFLP) assay. Since the bacterium, whose growth was completely inhibited by ESW-L, revealed the inactivation of cytoplasmic enzyme, blebs and breaks in its outer membrane and remained complete RFLP of DNA, damage of the outer membrane and inactivation of cytoplasmic enzyme are the important determinants of the bactericidal activity.

PMID: 11869793 [PubMed - indexed for MEDLINE]

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41. Observation on the effect of disinfection to HBsAg by electrolyzed oxidizing water

Zhonghua Liu Xing Bing Xue Za Zhi. 2001 Feb;22(1):40-2. [Article in Chinese]

Gao Z , Yin W , Han C , Zhang J , Jin W , Li X .

Nosocomial Infection Department China-Japan Friendship Hospital, Beijing 100029, China.

OBJECTIVE: Observation on the effect of disinfection on gastroscope, contaminated by hepatitis B surface antigen (HBsAg) in the electrolyzed oxidizing water (EOW). METHODS: Contaminated gastric juice and serum was added to EOW for 1 minute. Positive control samples were treated with PBS instead of EOW in the same way. Gastroscopes used for hepatitis patients were immersed in the EOW for 1 minute after cleaning. Samples were collected before and after treatment. ELISA was used to test HBsAg. RESULTS: With mixed samples (average S/N = 42.16) of EOW, HBsAg became negative when diluted in 100 times. However, the HBsAg of positive control samples remained positive. After cleaning the gastroscope (average S/N = 5.99) immersed in EOW, HBsAg became negative. CONCLUSION: EOW was effective in destroying HBsAg which could be used for gastroscope disinfection.

PMID: 11860842 [PubMed - in process]

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42. Decontaminative effect of frozen acidic electrolyzed water on lettuce.

J Food Prot. 2002 Feb;65(2):411-4. Koseki S , Fujiwara K , Itoh K .

Graduate School of Agriculture, Hokkaido University, Sapporo, Japan. koseki@bpe.agr.hokudai.ac.jp

We investigated the effects of frozen acidic electrolyzed water (AcEW) on lettuce during storage in a styrene-foam container. The lettuce was kept at 2 to 3 degrees C for 24 h. Populations of aerobic bacteria associated with lettuce packed in frozen AcEW were reduced by 1.5 log CFU/g after storage for 24 h. With frozen tap water, no microorganism populations tested in this study were reduced. A frozen mixture of AcEW and alkaline electrolyzed water (AlEW) also failed to reduce populations of microorganisms associated with lettuce. Although chlorine gas was produced by frozen AcEW, it was not produced by the AcEW-AlEW mixture. This result indicates that the main factor in the decontaminative effect of frozen AcEW was the production of chlorine gas. Accordingly, low-temperature storage and decontamination could be achieved simultaneously with frozen AcEW during distribution.

PMID: 11848576 [PubMed - indexed for MEDLINE]

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43. Effect of nitrogen gas packaging on the quality and microbial growth of fresh-cut vegetables under low temperatures.

J Food Prot. 2002 Feb;65(2):326-32. Koseki S , Itoh K .

Graduate School of Agriculture, Hokkaido University, Sapporo, Japan. koseki@bpe.agr.hokudai.ac.jp

Nitrogen (N2) gas packaging for fresh-cut vegetables (lettuce and cabbage) has been examined as a means of modified atmosphere packaging (MAP) for extending the shelf life of cut vegetables. Gas composition in enclosed packages that contained cut vegetables and were filled with 100% N2 had an oxygen (O2) concentration of 1.2 to 5.0% and a carbon dioxide (CO2) concentration of 0.5 to 3.5% after 5 days of storage. An atmosphere of low concentrations of O2 and high CO2 conditions occurred naturally in the package filled with N2 gas. Degradation of cut vegetables in terms of appearance was delayed by N2 gas packaging. Because of this effect, the appearance of fresh-cut vegetables packaged with N2 gas remained acceptable at temperatures below 5 degrees C after 5 days. Treatment with acidic electrolyzed water (AcEW) contributed to the acceptability of the vegetables' appearance at 5 and 10 degrees C in the air-packaging system. N2 gas packaging did not significantly affect the growth of microbial populations (total aerobic bacteria, coliform bacteria, Bacillus cereus, and psychrotrophic bacteria) in or on cut vegetables at 1, 5, and 10 degrees C for 5 days. Microbial growth in or on the cut vegetables was inhibited at 1 degrees C for 5 days regardless of atmospheric conditions.

PMID: 11848563 [PubMed - indexed for MEDLINE]

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44. Antimicrobial effect of electrolyzed water for inactivating Campylobacter jejuni during poultry washing.

Int J Food Microbiol. 2002 Jan 30;72(1-2):77-83. Park H , Hung YC , Brackett RE .

Department of Food Science and Technology College of Agricultural and Environmental Sciences, University of Georgia, Griffin 30223-1797, USA.

The effectiveness of electrolyzed (EO) water for killing Campylobacter jejuni on poultry was evaluated. Complete inactivation of C. jejuni in pure culture occurred within 10 s after exposure to EO or chlorinated water, both of which contained 50 mg/l of residual chlorine. A strong bactericidal activity was also observed on the diluted EO water (containing 25 mg/l of residual chlorine) and the mean population of C. jejuni was reduced to less than 10 CFU/ml (detected only by enrichment for 48 h)

after 10-s treatment. The diluted chlorine water (25 mg/l residual chlorine) was less effective than the diluted EO water for inactivation of C. jejuni. EO water was further evaluated for its effectiveness in reducing C. jejuni on chicken during washing. EO water treatment was equally effective as chlorinated water and both achieved reduction of C. jejuni by about 3 log10 CFU/g on chicken, whereas deionized water (control) treatment resulted in only 1 log10 CFU/g reduction. No viable cells of C. jejuni were recovered in EO and chlorinated water after washing treatment, whereas high populations of C. jejuni (4 log10 CFU/ml) were recovered in the wash solution after the control treatment. Our study demonstrated that EO water was very effective not only in reducing the populations of C. jejuni on chicken, but also could prevent cross-contamination of processing environments.

PMID: 11843416 [PubMed - indexed for MEDLINE]

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45. Prediction of microbial growth in fresh-cut vegetables treated with acidic electrolyzed water during storage under various temperature conditions.

J Food Prot. 2001 Dec;64(12):1935-42. Koseki S , Itoh K .

Graduate School of Agriculture, Hokkaido University, Sapporo, Japan. koseki@bpe.agr.hokudai.ac.jp

Effects of storage temperature (1, 5, and 10 degrees C) on growth of microbial populations (total aerobic bacteria, coliform bacteria, Bacillus cereus, and psychrotrophic bacteria) on acidic electrolyzed water (AcEW)-treated fresh-cut lettuce and cabbage were determined. A modified Gompertz function was used to describe the kinetics of microbial growth. Growth data were analyzed using regression analysis to generate "best-fit" modified Gompertz equations, which were subsequently used to calculate lag time, exponential growth rate, and generation time. The data indicated that the growth kinetics of each bacterium were dependent on storage temperature, except at 1 degrees C storage. At 1 degrees C storage, no increases were observed in bacterial populations. Treatment of vegetables with AcEW produced a decrease in initial microbial populations. However, subsequent growth rates were higher than on nontreated vegetables. The recovery time required by the reduced microbial population to reach the initial (treated with tap water [TW]) population was also determined in this study, with the recovery time of the microbial population at 10 degrees C being <3 days. The benefits of reducing the initial microbial populations on fresh-cut vegetables were greatly affected by storage temperature. Results from this study could be used to predict microbial quality of fresh-cut lettuce and cabbage throughout their distribution.

PMID: 11770620 [PubMed - indexed for MEDLINE]

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46. Effects of storage conditions and pH on chlorine loss in electrolyzed oxidizing (EO) water.

J Agric Food Chem. 2002 Jan 2;50(1):209-12. Len SV , Hung YC , Chung D , Anderson JL , Erickson MC , Morita K .

Department of Food Science and Technology, University of Georgia, Griffin, GA 30223-1797, USA.

The chlorine loss of electrolyzed oxidizing (EO) water was examined during storage under different light, agitation, and packaging conditions. The chlorine loss of pH-adjusted EO water was also examined. Under open conditions, the chlorine loss through evaporation followed first-order kinetics. The rate of chlorine loss was increased about 5-fold with agitation, but it was not significantly affected by diffused light. Under closed conditions, the chlorine loss did not follow first-order kinetics, because the primary mechanism of chlorine loss may be self-decomposition of chlorine species rather than

chlorine evaporation. The effect of diffused light was more significant compared to agitation after two months of storage under closed conditions. The chlorine loss of EO water and commercial chlorinated water decreased dramatically with the increase of pH from the acidic (pH 2.5) to the alkaline (pH 9.0) region.

PMID: 11754569 [PubMed - indexed for MEDLINE]

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47. Application of electrolyzed acid water to sterilization of denture base part 1. Examination of sterilization effects on resin plate.

Dent Mater J. 2001 Jun;20(2):148-55.
Nagamatsu Y , Tajima K , Kakigawa H , Kozono Y .

Department of Materials Science, Kyushu Dental College, Kokurakita, Kitakyushu, Japan.

Bactericidal activities of electrolyzed strong and weak acid waters for acrylic denture base resin were evaluated in order to discuss the applicability of these waters for sterilization of denture base. Only 1-minute immersion in the electrolyzed strong or weak acid water could completely eliminate the attached bacteria, Staphylococcus aureus 209P, on the resin plate. When the resin was relined with tissue conditioner, 5-minute immersion or 1- to 2-minute ultrasonic cleaning reduced the number of the bacteria from 10(5)/cm2 level to 10(1)/cm2 and no surviving bacteria could be detected after 10-minute treatment. These findings suggest that both the electrolyzed strong and weak acid waters are well applicable to the disinfectant for acrylic denture base showing excellent bactericidal activities in a significantly shorter treatment as compared with the conventional denture cleaning.

PMID: 11523978 [PubMed - indexed for MEDLINE]

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48. Decontamination of lettuce using acidic electrolyzed water.

J Food Prot. 2001 May;64(5):652-8.
Koseki S , Yoshida K , Isobe S , Itoh K .

Graduate School of Agricultural Science, Hokkaido University, Sapporo, Japan.
koseki@bpe.agr.hokudai.ac.jp

The disinfectant effect of acidic electrolyzed water (AcEW), ozonated water, and sodium hypochlorite (NaOCl) solution on lettuce was examined. AcEW (pH 2.6; oxidation reduction potential, 1140 mV; 30 ppm of available chlorine) and NaOCl solution (150 ppm of available chlorine) reduced viable aerobes in lettuce by 2 log CFU/g within 10 min. For lettuce washed in alkaline electrolyzed water (AIEW) for 1 min and then disinfected in AcEW for 1 min, viable aerobes were reduced by 2 log CFU/g. On the other hand, ozonated water containing 5 ppm of ozone reduced viable aerobes in lettuce 1.5 log CFU/g within 10 min. It was discovered that AcEW showed a higher disinfectant effect than did ozonated water significantly at $P < 0.05$. It was confirmed by swabbing test that AcEW, ozonated water, and NaOCI solution removed aerobic bacteria, coliform bacteria, molds, and yeasts on the surface of lettuce. Therefore, residual microorganisms after the decontamination of lettuce were either in the inside of the cellular tissue, such as the stomata, or making biofilm on the surface of lettuce. Biofilms were observed by a scanning electron microscope on the surface of the lettuce treated with AcEW. Moreover, it was shown that the spores of bacteria on the surface were not removed by any treatment in this study. However, it was also observed that the surface structure of lettuce was not damaged by any treatment in this study. Thus, the use of AcEW for decontamination of fresh lettuce was suggested

to be an effective means of controlling microorganisms.

PMID: 11347995 [PubMed - indexed for MEDLINE]

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50. Effect of electrolyzed water on wound healing.

Artif Organs. 2000 Dec;24(12):984-7.
Yahagi N , Kono M , Kitahara M , Ohmura A , Sumita O , Hashimoto T , Hori K , Ning-Juan C , Woodson P , Kubota S , Murakami A , Takamoto S .

Department of Anesthesiology, Teikyo University Mizonokuchi Hospital, Tokyo, Japan. naokiyah@aol.com

Electrolyzed water accelerated the healing of full-thickness cutaneous wounds in rats, but only anode chamber water (acid pH or neutralized) was effective. Hypochlorous acid (HOCl), also produced by electrolysis, was ineffective, suggesting that these types of electrolyzed water enhance wound healing by a mechanism unrelated to the well-known antibacterial action of HOCl. One possibility is that reactive oxygen species, shown to be electron spin resonance spectra present in anode chamber water, might trigger early wound healing through fibroblast migration and proliferation.

PMID: 11121980 [PubMed - indexed for MEDLINE]

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51. The use of electrolyzed solutions for the cleaning and disinfecting of dialyzers.

Artif Organs. 2000 Dec;24(12):921-8. Tanaka N , Tanaka N , Fujisawa T , Daimon T , Fujiwara K , Yamamoto M , Abe T .

Kiyokai Tanaka-Kitanoda Hospital, Sakai-shi, Osaka, Japan.

Recently, the use of electrolyzed solutions has attracted considerable interest in Japan. This study investigates the efficiency of electrolyzed solutions as disinfecting agents (DA) in the reuse of dialyzers and compares their efficiency to that of other disinfectants currently in use. The following 3 methods were employed. First, the rinsing time and rebound release of reused dialyzers were measured and compared after electrolyzed solutions, electrolyzed strong acid aqueous solution (ESAAS) and electrolyzed strong basic aqueous solution (ESBAS), made from reverse osmosis (RO) water (ESAAS, ESBAS; Generating apparatuses: Super Oxseed alpha 1000, Amano Corporation, Yokohama, Japan), 2% Dialox-cj (Teijin Gambro Medical, Tokyo, Japan), and 3.8% formalin were used as DAs. This involved performing dialysis with 2 types of dialyzers: a cellulose acetate membrane (CAM) dialyzer and a polysulfone membrane (PSM) dialyzer. The dialyzers were cleaned and disinfected using the different DA and left for 48 h. Next, after performing dialysis the dialyzer membranes were cleaned with a saline solution (0.9% NaCl) and RO water and then cleaned with the various DA. These membranes were observed using a scanning electron microscope (SEM) to check for the presence of physical and biological contaminants. Finally, in vitro tests were performed to determine the level of dialyzer clearance when PSM dialyzers were reused after having been cleaned and disinfected with the electrolyzed solutions. The rinsing time results for both the CAM and PSM dialyzers showed the electrolyzed solutions (ESBAS and ESAAS) as being undetectable within 10 min. With regard to the rebound release, for both the CAM and PSM dialyzers, the electrolyzed solutions were undetectable at all checking times between 30 and 240 min. Observation by SEM showed that cleaning with both ESAAS and ESBAS left the fewest contaminants, and cleaning with 2% Dialox-cj left the highest level of contaminants in the CAM dialyzers. With regard to experiments concerning use in vitro, no major changes in the dialyzer clearance were noticed after 6 uses. In every experiment, the previous investigations showed the electrolyzed solutions to be superior to 3. 8% formalin and 2% Dialox-cj DA

for the reuse of dialyzers.
PMID: 11121970 [PubMed - indexed for MEDLINE]

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52. Ultraviolet spectrophotometric characterization and bactericidal properties of electrolyzed oxidizing water as influenced by amperage and pH.

J Food Prot. 2000 Nov;63(11):1534-7.
Len SV , Hung YC , Erickson M , Kim C .

Department of Food Science and Technology, College of Agricultural and Environmental Sciences, University of Georgia, Griffin 30223-1797, USA.

To identify the primary component responsible in electrolyzed oxidizing (EO) water for inactivation, this study determined the concentrations of hypochlorous acid (HOCl) and hypochlorite ions (OCl-) and related those concentrations to the microbicidal activity of the water. The ultraviolet absorption spectra were used to determine the concentrations of HOCl and OCl- in EO water and the chemical equilibrium of these species with change in pH and amperage. EO water generated at higher amperage contained a higher chlorine concentration. The maximum concentration of HOCl was observed around pH 4 where the maximum log reduction (2.3 log10 CFU/ml) of Bacillus cereus F4431/73 vegetative cells also occurred. The high correlation (r = 0.95) between HOCl concentrations and bactericidal effectiveness of EO water supports HOCl's role as the primary inactivation agent. Caution should be taken with standard titrimetric methods for measurement of chlorine as they cannot differentiate the levels of HOCl present in EO water of varying pHs.

PMID: 11079696 [PubMed - indexed for MEDLINE]

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53. Efficacy of electrolyzed oxidizing (EO) and chemically modified water on different types of foodborne pathogens.

Int J Food Microbiol. 2000 Nov 1;61(2-3):199-207.
Kim C , Hung YC , Brackett RE .

Center for Food Safety and Quality Enhancement, Department of Food Science and Technology, College of Agricultural anid Environmental Sciences, University of Georgia, Griffin 30223-1797, USA.

This study was undertaken to evaluate the efficacy of electrolyzed oxidizing (EO) and chemically modified water with properties similar to the EO water for inactivation of different types of foodborne pathogens (Escherichia coli O157:H7, Listeria monocytogenes and Bacillus cereus). A five-strain cocktail of each microorganism was exposed to deionized water (control), EO water and chemically modified water. To evaluate the effect of individual properties (pH, oxidation-reduction potential (ORP) and residual chlorine) of treatment solutions on microbial inactivation, iron was added to reduce ORP readings and neutralizing buffer was added to neutralize chlorine. Inactivation of E. coli O157:H7 occurred within 30 s after application of JAW EO water with 10 mg/l residual chlorine and chemically modified solutions containing 13 mg/l residual chlorine. Inactivation of Gram-positive and -negative microorganisms occurred within 10 s after application of ROX EO water with 56 mg/l residual chlorine and chemically modified solutions containing 60 mg/l residual chlorine. B. cereus was more resistant to the treatments than E. coli O157:H7 and L. monocytogenes and only 3 log10 reductions were achieved after 10 s of ROX EO water treatment. B. cereus spores were the most resistant pathogen. However, more than 3 log10 reductions were achieved with 120-s EO water treatment.

PMID: 11078171 [PubMed - indexed for MEDLINE]

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54. Effectiveness of electrolyzed oxidized water irrigation in a burn-wound infection model.

J Trauma. 2000 Sep;49(3):511-4.
Nakae H , Inaba H .

Department of Emergency and Critical Care Medicine, Akita University School of Medicine, Japan.

OBJECTIVE: The purpose of the study was to determine whether electrolyzed oxidized water (EOW) functions as a bactericide in burn injury with Pseudomonas aeruginosa infection in a rat burn-wound model. METHODS: Anesthetized Sprague-Dawley rats (n = 31) were subjected to third-degree burns to 30% of total body surface area. Two days after injury, all rats were infected with P. aeruginosa using 1 mL of a suspension containing 1 x 10(8) colony-forming units. Rats were assigned to one of three groups: no irrigation (group I), irrigation with physiologic saline (group II), or irrigation with EOW (group III). Blood culture, endotoxin levels, and survival rates were determined. RESULTS: Survival rate was significantly higher in group III than in groups I or II ($p < 0.0001$). Serum endotoxin levels on day 3 after infection in group III were significantly lower than the levels in group I ($p < 0.01$) and group II ($p < 0.01$). There were significant differences between the three groups in the culture of P. aeruginosa ($p < 0.05$). CONCLUSION: Irrigation and disinfection with EOW may become useful in preventing burn-wound sepsis.

PMID: 11003331 [PubMed - indexed for MEDLINE]

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55. Disinfection potential of electrolyzed solutions containing sodium chloride at low concentrations.

J Virol Methods. 2000 Mar;85(1-2):163-74.
Morita C , Sano K , Morimatsu S , Kiura H , Goto T , Kohno T , Hong WU , Miyoshi H , Iwasawa A , Nakamura Y , Tagawa M , Yokosuka O , Saisho H , Maeda T , Katsuoka Y .

Department of Microbiology, Osaka Medical College, Japan.

Electrolyzed products of sodium chloride solution were examined for their disinfection potential against hepatitis B virus (HBV) and human immunodeficiency virus (HIV) in vitro. Electrolysis of 0.05% NaCl in tap water was carried out for 45 min at room temperature using a 3 A electric current in separate wells installed with positive and negative electrodes. The electrolyzed products were obtained from the positive well. The oxidation reduction potential (ORP), pH and free chlorine content of the product were 1053 mV, pH 2.34 and 4.20 ppm, respectively. The products modified the antigenicity of the surface protein of HBV as well as the infectivity of HIV in time- and concentration-dependent manner. Although the inactivating potential was decreased by the addition of contaminating protein, recycling of the product or continuous addition of fresh product may restore the complete disinfection against bloodborne pathogens.

PMID: 10716349 [PubMed - indexed for MEDLINE]

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56. Newer technologies for endoscope disinfection: electrolyzed acid water and disposable-component endoscope systems.

Gastrointest Endosc Clin N Am. 2000 Apr;10(2):319-28.
Nelson D .

Department of Gastroenterology, Minneapolis Veterans Affairs Medical Center, Minnesota 55417, USA.

Novel technologies have been designed to improve or replace more conventional methods of endoscope disinfection. Electrolyzed acid water has the potential to decrease the time, toxicity, and cost of endoscope disinfection. Disposable-component endoscope systems have the potential to improve the ease of cleaning and disinfection, or eliminate the need altogether.

Publication Types:

- Review

PMID: 10683217 [PubMed - indexed for MEDLINE]

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57. Roles of oxidation-reduction potential in electrolyzed oxidizing and chemically modified water for the inactivation of food-related pathogens.

J Food Prot. 2000 Jan;63(1):19-24.
Kim C , Hung YC , Brackett RE .

Center for Food Safety and Quality Enhancement, Department of Food Science and Technology, College of Agricultural and Environmental Sciences, University of Georgia, Griffin 30223-1797, USA.

This study investigates the properties of electrolyzed oxidizing (EO) water for the inactivation of pathogen and to evaluate the chemically modified solutions possessing properties similar to EO water in killing Escherichia coli O157:H7. A five-strain cocktail (10(10) CFU/ml) of E. coli O157:H7 was subjected to deionized water (control), EO water with 10 mg/liter residual chlorine (J.A.W-EO water), EO water with 56 mg/liter residual chlorine (ROX-EO water), and chemically modified solutions. Inactivation (8.88 log10 CFU/ml reduction) of E. coli O157:H7 occurred within 30 s after application of EO water and chemically modified solutions containing chlorine and 1% bromine. Iron was added to EO or chemically modified solutions to reduce oxidation-reduction potential (ORP) readings and neutralizing buffer was added to neutralize chlorine. J.A.W-EO water with 100 mg/liter iron, acetic acid solution, and chemically modified solutions containing neutralizing buffer or 100 mg/liter iron were ineffective in reducing the bacteria population. ROX-EO water with 100 mg/liter iron was the only solution still effective in inactivation of E. coli O157:H7 and having high ORP readings regardless of residual chlorine. These results suggest that it is possible to simulate EO water by chemically modifying deionized water and ORP of the solution may be the primary factor affecting microbial inactivation.

PMID: 10643764 [PubMed - indexed for MEDLINE]

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58. Cytotoxicity and microbicidal activity of electrolyzed strong acid water and acidic hypochlorite solution under isotonic conditions.

Kansenshogaku Zasshi. 1999 Oct;73(10):1025-31.
Okubo K , Urakami H , Tamura A .

Department of Pharmacy, Koseiren Murakami General Hospital, Murakami City, Japan.

The cytotoxic effects of electrolyzed strong acid water and acidic hypochlorite solution, as well as these solutions after isotonization, against cultivated L cells were compared along with their

microbicidal activities. Isotonization was accompanied by a reduction in the cytotoxic effects of these solutions against L cells. Microbicidal activity was also reduced somewhat but was still retained after isotonization. No difference was observed in these properties between these antiseptic solutions. The results obtained indicate that acidic hypochlorite solution may be useful as well as acidic electrolyzed water.

PMID: 10565117 [PubMed - indexed for MEDLINE]

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59. Effectiveness of acidic oxidative potential water in preventing bacterial infection in islet transplantation.

Cell Transplant. 1999 Jul-Aug;8(4):405-11.
Miyamoto M , Inoue K , Gu Y , Hoki M , Haji S , Ohyanagi H .

Department of Organ Reconstruction, Institute for Frontier Medical Sciences, Kyoto University, Japan.

At a number of points in the current procedures of islet isolation and islet culture after the harvesting of donor pancreata, microorganisms could potentially infect the islet preparation. Furthermore, the use of islets from multiple donors can compound the risks of contamination of individual recipients. Acidic oxidative potential water (also termed electrolyzed strong acid solution, function water, or acqua oxidation water), which was developed in Japan, is a strong acid formed on the anode in the electrolysis of water containing a small amount of sodium chloride. It has these physical properties: pH, from 2.3 to 2.7; oxidative-reduction potential, from 1,000 to 1,100 mV; dissolved chlorine, from 30 to 40 ppm; and dissolved oxygen, from 10 to 30 ppm. Because of these properties, acidic oxidative potential water has strong bactericidal effects on all bacteria including methicillin-resistant Staphylococcus aureus (MRSA), viruses including HIV, HBV, HCV, CMV, and fungi as a result of the action of the active oxygen and active chlorine that it contains. We conducted this study to evaluate the effect of acidic oxidative potential water irrigation on bacterial contamination on the harvesting of porcine pancreata from slaughterhouses for islet xenotransplantation by counting the number of pancreatic surface bacteria using the Dip-slide method, and on the results of islet culture; and to evaluate the direct effect on isolated islets when it is used to prevent bacterial contamination by the static incubation test and by morphological examination. Direct irrigation of the pancreas by acidic oxidative potential water was found to be very effective in preventing bacterial contamination, but direct irrigation of isolated islets slightly decreased their viability and function.

PMID: 10478721 [PubMed - indexed for MEDLINE]

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60. Efficacy of electrolyzed oxidizing water for inactivating Escherichia coli O157:H7, Salmonella enteritidis, and Listeria monocytogenes.

Appl Environ Microbiol. 1999 Sep;65(9):4276-9.
Venkitanarayanan KS , Ezeike GO , Hung YC , Doyle MP .

Department of Animal Science, University of Connecticut, Storrs, Connecticut 06269, USA.

The efficacy of electrolyzed oxidizing water for inactivating Escherichia coli O157:H7, Salmonella enteritidis, and Listeria monocytogenes was evaluated. A five-strain mixture of E. coli O157:H7, S. enteritidis, or L. monocytogenes of approximately 10(8) CFU/ml was inoculated in 9 ml of electrolyzed oxidizing water (treatment) or 9 ml of sterile, deionized water (control) and incubated at 4 or 23 degrees C for 0, 5, 10, and 15 min; at 35 degrees C for 0, 2, 4, and 6 min; or at 45 degrees C for 0, 1, 3, and 5 min. The surviving population of each pathogen at each sampling time was determined on tryptic soy agar. At 4 or 23 degrees C, an exposure time of 5 min reduced the populations of all three pathogens in the treatment samples by approximately 7 log CFU/ml, with complete inactivation by 10

min of exposure. A reduction of >/=7 log CFU/ml in the levels of the three pathogens occurred in the treatment samples incubated for 1 min at 45 degrees C or for 2 min at 35 degrees C. The bacterial counts of all three pathogens in control samples remained the same throughout the incubation at all four temperatures. Results indicate that electrolyzed oxidizing water may be a useful disinfectant, but appropriate applications need to be validated.

PMID: 10473453 [PubMed - indexed for MEDLINE]

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61. Inactivation of Escherichia coli O157:H7 and Listeria monocytogenes on plastic kitchen cutting boards by electrolyzed oxidizing water.

J Food Prot. 1999 Aug;62(8):857-60.
Venkitanarayanan KS , Ezeike GO , Hung YC , Doyle MP .

Department of Animal Science, University of Connecticut, Storrs 06269, USA.

One milliliter of culture containing a five-strain mixture of Escherichia coli O157:H7 (approximately 10(10) CFU) was inoculated on a 100-cm2 area marked on unscarred cutting boards. Following inoculation, the boards were air-dried under a laminar flow hood for 1 h, immersed in 2 liters of electrolyzed oxidizing water or sterile deionized water at 23 degrees C or 35 degrees C for 10 or 20 min; 45 degrees C for 5 or 10 min; or 55 degrees C for 5 min. After each temperature-time combination, the surviving population of the pathogen on cutting boards and in soaking water was determined. Soaking of inoculated cutting boards in electrolyzed oxidizing water reduced E. coli O157:H7 populations by > or = 5.0 log CFU/100 cm2 on cutting boards. However, immersion of cutting boards in deionized water decreased the pathogen count only by 1.0 to 1.5 log CFU/100 cm2. Treatment of cutting boards inoculated with Listeria monocytogenes in electrolyzed oxidizing water at selected temperature-time combinations (23 degrees C for 20 min, 35 degrees C for 10 min, and 45 degrees C for 10 min) substantially reduced the populations of L. monocytogenes in comparison to the counts recovered from the boards immersed in deionized water. E. coli O157:H7 and L. monocytogenes were not detected in electrolyzed oxidizing water after soaking treatment, whereas the pathogens survived in the deionized water used for soaking the cutting boards. This study revealed that immersion of kitchen cutting boards in electrolyzed oxidizing water could be used as an effective method for inactivating foodborne pathogens on smooth, plastic cutting boards.

PMID: 10456736 [PubMed - indexed for MEDLINE]

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62. Bactericidal effect of electrolyzed neutral water on bacteria isolated from infected root canals. 64. The physiological property and function of the electrolyzed-ionized calcium Aquamax on water molecular clusters fractionization.

Artif Organs. 1997 Jan;21(1):43-9.
Hatto M , Sakai Y , Ohtsuka H .

Aquamax Co., Ltd., Tokyo, Japan.

Aquamax, the ionized mineral (Ca, 21 mg/ml; MG, 0.068 mg/ml; Na 0.13 mg/ml; K, 0.006 mg/ml) is a fermented organic mineral extract. The fundamental physiological property and function of this mineral is to promote the molecular level mineral supply to the cell inside. The contained minerals exist at a molecular level to fractionize the molecular clusters of water and to make water's penetration ratio into objects higher only at 0.1-0.2% concentration. Existing minerals, especially the calcium, were barely dissolved in water, and its low penetration was caused by its low electrolyzed behavior plus the effects

from an anion mineral, such as phosphorous, sulfur, nitrogen, or any oxalic acid combining with a colloidal calcium to construct and crystallize as the calcium phosphate and the calcium sulfate. Aquamax minerals penetrate into objects to fractionize water molecular clusters and to make water functional, neutralize in the anion mineral and oxalic acid elements, raise the object's electric conductivity, and preserve perishables.

PMID: 9012906 [PubMed - indexed for MEDLINE]

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65. Trial of electrolyzed strong acid aqueous solution lavage in the treatment of peritonitis and intraperitoneal abscess.

Artif Organs. 1997 Jan;21(1):28-31
Inoue Y , Endo S , Kondo K , Ito H , Omori H , Saito K .

Critical Care and Emergency Center, Iwate Medical University, Morioka, Japan.

Electrolyzed strong acid aqueous solution is acidic water that contains active oxygen and active chlorine and possesses a redox potential. We performed peritoneal and abscess lavages with an electrolyzed strong acid aqueous solution to treat 7 patients with peritonitis and intraperitoneal abscesses, who were seen in our department between December 1994 and April 1995. The underlying disease was duodenal ulcer perforation in 4 of these 7 patients and gastric ulcer perforation, acute enteritis, and intraperitoneal perforation of pyometrium in 1 patient each. Irrigation was performed twice a day. Microbiological studies of the paracentesis fluid were negative in 3 cases, and the irrigation period was 2-4 days. Anaerobic bacteria were isolated in 3 of the 4 positive cases (Bacteroides in 2, Prevotella in 1), and a fungus (Candida) was isolated in the remaining patient. The period of irrigation in these patients ranged from 9 to 12 days, but conversion to a microorganism negative state was observed in 3-7 days.

Publication Types:

- Clinical Trial

PMID: 9012903 [PubMed - indexed for MEDLINE]

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66. Bactericidal effect of acidic electrolyzed water--comparison of chemical acidic sodium hydrochloride (NaOCl) solution

Kansenshogaku Zasshi. 1996 Sep;70(9):915-22. [Article in Japanese]

Iwasawa A , Nakamura Y .

Department of Clinical Pathology, Showa University Fujigaoka Hospital, Kanagawa.

Acidic electrolyzed water is made recently by various kinds of machines and is widely utilized. In this study, we intended to clarify the relationship between the concentration of chloride and pH in the bactericidal effects with acidic electrolyzed water. The effects of weak or strong acidic electrolyzed water were compared with a pseudo-acidic water of pH adjusted by diluted hydrochloric acid and sodium hydroxide, on Staphylococcus aureus, Staphylococcus epidermidis and Pseudomononas aeruginosa. At pH 5.0 approximately 6.0, 3 bacterial strains were killed soon after being exposed to the acidic water containing chloride 50 mg/liter, and the amount of chloride did not change after allowing to stand open for 6 hours. At pH 2.67 approximately 2.80, the bactericidal effects was observed at the concentration of chloride 5 mg/liter, and 80% of chloride remained after allowing to

stand for 6 hours. These results indicated that newly made strong acidic water is more effective under a smaller amount of chloride at pH 2.7, and that weak acidic electrolyzed water should be used, if stable bactericidal effect is expected in cleaning the surroundings.

PMID: 8921674 [PubMed - indexed for MEDLINE]

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67. Preliminary study of microbiocide effect and its mechanism of electrolyzed oxidizing water

Zhonghua Liu Xing Bing Xue Za Zhi. 1996 Apr;17(2):95-8. [Article in Chinese]

Li XW , Sun SH , Li T .

Institute of Epidemiology and Microbiology, Chinese Academy of Preventive Medicine, Beijing.

Electrolyzed Oxidizing water (EO Water) is characterized by possessing higher oxidizing reduction potential (ORP), lower pH value and oxidizing potential. Under conditions of free organic matter, it was tested for microbiocide efficacy in laboratory. The results showed that EO water could completely kill all of the staphylococcus aureus and E. coli within 15 seconds, while for completely killing of spores of Bacillus subtilis Var. niger it would take 10 min. When it was used to destroy the antigenicity of HBsAg, 30 seconds was needed. The ORP and pH values of EO water were not obviously changed when stored in room-temperature with, airtight and light-free conditions for three weeks. Distilled water and physiological saline had little influence on the ORP and pH value of EO water, but organic matters and phosphates had greater influence upon the two values.

PMID: 8758404 [PubMed - indexed for MEDLINE]

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68. Effect of rinsing hydrocolloid impressions using acidic electrolyzed water on surface roughness and surface hardness of stone models.
J Oral Sci. 2002 Dec;44(3-4):141-6.
Nakagawa H , Hiraguchi H , Uchida H , Tanabe N .

Laboratory of Dental Materials Research, Division of Biomaterials Science, Dental Research Center, Nihon University School of Dentistry, Tokyo 101-8310, Japan. nakagawa@dent.nihon-u.ac.jp

The present study investigated the effect on the surface quality of resultant stone models of rinsing hydrocolloid impressions using acidic electrolyzed water. Two brands of alginate impression materials (Aroma Fine DFIII, Jeltrate Plus), an agar impression material (Ajisai) designed for agar/alginate combined impression, and dental stone (New Plastone) were used to make the test specimens. For the rinsing of impressions, acidic electrolyzed water having a pH value of 2.3, an oxidation-reduction potential of 1,230 mV, and a residual chlorine concentration of 45.0 ppm, was prepared. Alginate, agar and agar/alginate combined impressions were rinsed using acidic electrolyzed water or tap water for 30 sec and 3 min, and as a control, these impressions were not rinsed with any water. Disk-shaped stone specimens obtained from rinsed impressions were evaluated with respect to surface roughness (Ra) and surface hardness (scratch depth), and scanning electron microscope (SEM) observations were performed. The stone specimens obtained from rinsed impressions using acidic electrolyzed water showed a surface quality equivalent to that of the stone specimens obtained from the rinsed impression using tap water. This result suggests that the use of acidic electrolyzed water for rinsing is an acceptable treatment for hydrocolloid impressions, so long as the rinsing time is from 30 sec to 3 min.

PMID: 12613503 [PubMed - indexed for MEDLINE]

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69. Bactericidal effect of electrolyzed neutral water on bacteria isolated from infected root canals.

Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1999 Jan;87(1):83-7.
Horiba N, Hiratsuka K, Onoe T, Yoshida T, Suzuki K, Matsumoto T, Nakamura H.

Department of Endodontics, School of Dentistry, Aichi-Gakuin University, Nagoya, Japan.

OBJECTIVE: The purposes of this study were to examine the time-related changes in pH, oxidation-reduction potential, and concentration of chlorine of electrolyzed neutral water and to evaluate the bactericidal effect of electrolyzed neutral water against bacteria from infected root canals. STUDY DESIGN: Various properties of electrolyzed neutral water--pH value, oxidation-reduction potential, and concentration of chlorine--were measured at different times after storage of the water in the open state, the closed state, or the closed-and-dark state. The bactericidal effect of the various electrolyzed neutral water samples was then tested against 17 strains of bacteria, including 15 strains isolated from infected canals, as well as against 1 strain of fungus. Each bacterial or fungal suspension was mixed with electrolyzed neutral water, and the 2 substances were reacted together for 1 minute. After incubation for 1 to 7 days, the bactericidal effect of the electrolyzed neutral water was determined. RESULTS: The pH value and oxidation-reduction potential of electrolyzed neutral water remained almost unchanged when the water was stored in a dark, closed container. However, the concentration of chlorine decreased from 18.4 ppm to 10.6 ppm. Electrolyzed neutral water showed a bactericidal or growth-inhibitory effect against the bacteria. CONCLUSIONS: The results indicate that electrolyzed neutral water maintains a constant pH and oxidation-reduction potential when kept in a closed container without light and that it exhibits a bacteriostatic/bactericidal action against isolates obtained from infected root canals.

PMID: 9927086 [PubMed - indexed for MEDLINE]

[Editors Note: this study is not about ionized water. I have included it as it is very relevant to the topic. Cola's are just acid and sugar waters. JK]
70. Cola beverage consumption induces bone mineralization reduction in ovariectomized rats.

Arch Med Res. 2000 Jul-Aug;31(4):360-5. Garcia-Contreras F , Paniagua R , Avila-Diaz M , Cabrera-Munoz L , Martinez-Muniz I , Foyo-Niembro E , Amato D .

Unidad de Investigacion Medica en Enfermedades Nefrologicas, Hospital de Especialidades, Mexico, D.F., Mexico. dantea@cim.spin.com.mx

BACKGROUND: A significant association of cola beverage consumption and increased risk of bone fractures has been recently reported. The present study was carried out to examine the relationship of cola soft drink intake and bone mineral density in ovariectomized rats. METHODS: Study 1. Four groups of 10 female Sprague-Dawley rats were studied. Animals from groups II, III, and IV were bilaterally ovariectomized. Animals from groups I and II received tap water for drinking, while animals from groups III and IV each drank a different commercial brand of cola soft drink. After 2 months on these diets, the following were measured: solid diet and liquid consumption; bone mineral density; calcium in bone ashes; femoral cortex width; calcium; phosphate; albumin; creatinine; alkaline phosphatase; 25-OH hydroxyvitamin D, and PTH. RESULTS: Study 2. Two groups of seven ovariectomized rats were compared. Group A animals received the same management as the group III animals from study 1 (cola soft drink and rat chow ad libitum), while rats from group B received tap

water for drinking and pair-feeding. After 2 months plasmatic ionized calcium, phosphate, creatinine, albumin, calcium in femoral ashes, and femoral cortex width were measured.Study 1. Rats consuming cola beverages (groups III and IV) had a threefold higher liquid intake than rats consuming water (groups I and II). Daily solid food intake of rats consuming cola soft drinks was one-half that of rats consuming water. Rats consuming soft drinks developed hypocalcemia and their femoral mineral density measured by DEXA was significantly lower than control animals as follows: group I, 0.20 +/- 0.02; group II, 0.18 +/- 0.01; group III, 0.16 +/- 0.01, and group IV, 0.16 +/- 0.01 g/cm(2). Study 2. To rule out the possibility that these calcium and bone mineral disorders were caused by decreased solid food intake, a pair-fed group was studied. Despite a lower body weight, pair-fed animals consuming tap water did not develop bone mineral reduction or hypocalcemia. CONCLUSIONS: These data suggest that heavy intake of cola soft drinks has the potential of reducing femoral mineral density.

PMID: 11068076 [PubMed - indexed for MEDLINE]

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71. Treatment of Escherichia coli (O157:H7) inoculated alfalfa seeds and sprouts with electrolyzed oxidizing water.

Int J Food Microbiol.
2003 Sep 15;86(3):231-7.
Department of Agricultural and Biological Engineering, Pennsylvania State University, University Park, PA 16802, USA.
Electrolyzed oxidizing water is a relatively new concept that has been utilized in agriculture, livestock management, medical sterilization, and food sanitation. Electrolyzed oxidizing (EO) water generated by passing sodium chloride solution through an EO water generator was used to treat alfalfa seeds and sprouts inoculated with a five-strain cocktail of nalidixic acid resistant Escherichia coli O157:H7. EO water had a pH of 2.6, an oxidation-reduction potential of 1150 mV and about 50 ppm free chlorine. The percentage reduction in bacterial load was determined for reaction times of 2, 4, 8, 16, 32, and 64 min. Mechanical agitation was done while treating the seeds at different time intervals to increase the effectiveness of the treatment. Since E. coli O157:H7 was released due to soaking during treatment, the initial counts on seeds and sprouts were determined by soaking the contaminated seeds/sprouts in 0.1% peptone water for a period equivalent to treatment time. The samples were then pummeled in 0.1% peptone water and spread plated on tryptic soy agar with 5 microg/ml of nalidixic acid (TSAN). Results showed that there were reductions between 38.2% and 97.1% (0.22-1.56 log(10) CFU/g) in the bacterial load of treated seeds. The reductions for sprouts were between 91.1% and 99.8% (1.05-2.72 log(10) CFU/g). An increase in treatment time increased the percentage reduction of E. coli O157:H7. However, germination of the treated seeds reduced from 92% to 49% as amperage to make EO water and soaking time increased. EO water did not cause any visible damage to the sprouts.
PMID: 12915034 [PubMed - indexed for MEDLINE]

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72. Comparison of electrolyzed oxidizing water with various antimicrobial interventions to reduce Salmonella species on poultry.

Poult Sci. 2002 Oct;81(10):1598-605.
Fabrizio KA, Sharma RR, Demirci A, Cutter CN.
Department of Food Science, The Pennsylvania State University, University Park 16802, USA.
Foodborne pathogens in cell suspensions or attached to surfaces can be reduced by electrolyzed oxidizing (EO) water; however, the use of EO water against pathogens associated with poultry has not been explored. In this study, acidic EO water [EO-A; pH 2.6, chlorine (CL) 20 to 50 ppm, and oxidation-reduction potential (ORP) of 1,150 mV], basic EO water (EO-B; pH 11.6, ORP of -795 mV), CL, ozonated water (OZ), acetic acid (AA), or trisodium phosphate (TSP) was applied to broiler carcasses inoculated with Salmonella Typhimurium (ST) and submerged (4 C, 45 min), spray-washed

(85 psi, 25 C, 15 s), or subjected to multiple interventions (EO-B spray, immersed in EO-A; AA or TSP spray, immersed in CL). Remaining bacterial populations were determined and compared at Day 0 and 7 of aerobic, refrigerated storage. At Day 0, submersion in TSP and AA reduced ST 1.41 log10, whereas EO-A water reduced ST approximately 0.86 log10. After 7 d of storage, EO-A water, OZ, TSP, and AA reduced ST, with detection only after selective enrichment. Spray-washing treatments with any of the compounds did not reduce ST at Day 0. After 7 d of storage, TSP, AA, and EO-A water reduced ST 2.17, 2.31, and 1.06 log10, respectively. ST was reduced 2.11 log10 immediately following the multiple interventions, 3.81 log10 after 7 d of storage. Although effective against ST, TSP and AA are costly and adversely affect the environment. This study demonstrates that EO water can reduce ST on poultry surfaces following extended refrigerated storage.
PMID: 12412930 [PubMed - indexed for MEDLINE]

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73. Effects of water flow rate, salt concentration and water temperature on efficiency of an electrolyzed oxidizing water generator
Journal of Food Engineering, Volume 60, Issue 4, December 2003, Pages 469-473
S. Y. Hsu
A three-factor central composite design was adopted to investigate the effects of water flow rate, water temperature and salt concentration on electrolysis efficiency and separation efficiency of an electrolyzed oxidizing water generator. Results indicated that electric potential (7.9–15.7 V) and power consumption (16–120 W) of the electrolysis cell were not affected by water flow rate, water temperature or salt concentration in the feed solution. Electric current of the cells changed in between two levels (7.41 ± 0.1 and 7.68 ± 0.1 A) depending on water temperature and water flow rate. Electrolysis efficiency of the electrolysis cell, represented by the reduction ratio of chloride ions, varied in the range of 23–51%. Separation efficiency of the cation ion-exchange membrane, represented by the reduction ratio of sodium ions, varied in the range of 2–40%. Both efficiency rates were significantly reduced by increases in water flow rate and/or salt concentration in the feed solution.

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74. Dissolution of hydrogen and the ratio of the dissolved hydrogen content to the produced hydrogen in electrolyzed water using SPE water electrolyzer
Electrochimica Acta, Volume 48, Issue 27, 30 November 2003, Pages 4013-4019
Yoshinori Tanaka, Sakae Uchinashi, Yasuhiro Saihara, Kenji Kikuchi, Takuji Okaya and Zempachi Ogumi
Concentration of dissolved hydrogen in electrolyzed water using a solid polymer electrolyte (SPE) water electrolyzer was investigated using a DH-meter. A ratio of the dissolved hydrogen content to an amount of hydrogen concentration calculated from charge passed during electrolysis was estimated. The ratio increased from 10 to 20% with a decrease in current density from 3.0 to 0.3 A dm−2. The effect of the linear velocity of water on the ratio of dissolved hydrogen was studied. The cross-sectional area of the water channel was changed to change the linear velocity of water. The ratio of dissolved hydrogen increased with increasing the velocity. Due to the fast mass transport by high velocity, the small hydrogen bubbles are fast transferred by the diffusion into the bulk water and dissolved. The population density of the small hydrogen bubbles is found to have an effect on the ratio of the dissolving hydrogen.

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75. Electrolyzed oxidizing water treatment for decontamination of raw salmon inoculated with Escherichia coli O157:H7 and Listeria monocytogenes Scott A and response surface modeling
Journal of Food Engineering, Volume 72, Issue 3, February 2006, Pages 234-241
Nil P. Ozer and Ali Demirci
Raw fish is prone to the risk of microbial outbreaks due to contamination by pathogenic microorganisms, such as Escherichia coli O157:H7 and Listeria monocytogenes. Therefore, it is essential to treat raw fish to inactivate pathogenic microorganisms. Electrolyzed Oxidizing Water (EO)

is a novel antimicrobial agent containing acidic solution with a pH of 2.6, Oxidation Reduction Potential (ORP) of 1150 mV, and 70–90 ppm free chlorine, and alkaline solution with a pH of 11.4 and ORP of −795 mV. This study was undertaken to evaluate the efficacy of acidic EO water treatment and alkaline EO water treatment followed by acidic EO water treatment at various temperatures for the inactivation of E. coli O157:H7 and L. monocytogenes Scott A on the muscle and skin surfaces of inoculated salmon fillets. Inoculated salmon fillets were treated with acidic EO water at 22 and 35 ℃ and 90 ppm free-chlorine solution as control at 22 ℃ for 2, 4, 8, 16, 32, and 64 min. The acidic EO water treatments resulted in a reduction of L. monocytogenes Scott A population in the range of 0.40 log10 CFU/g (60%) at 22 ℃ to 1.12 log10 CFU/g (92. 3%) at 35 ℃. Treatment of inoculated salmon fillets with acidic EO water reduced E. coli O157:H7 populations by 0.49 log10 CFU/g (67%) at 22 ℃ and 1.07 log10 CFU/g (91.1%) at 35 ℃. The maximum reduction with chlorine solution (control) was 1.46 log10 CFU/g (96.3%) for E. coli O157:H7 and 1.3 log10 CFU/g (95.3%) for L. monocytogenes Scott A at 64 min. A response surface model was developed for alkaline treatment followed by acidic EO water treatment to predict treatment times in the range of 5–30 min and temperatures in the range of 22–35 ℃ for effective treatment with alkaline E O water followed by acidic water, alkaline and acidic water treatments. Response surface analysis demonstrated maximum log reductions of 1.33 log10 CFU/g (95.3%) for E. coli O157:H7 and 1.09 log10 CFU/g (91.9%) for L. monocytogenes Scott A. Data collected from the treatments was used to develop empirical models as a function of treatment times and temperature for prediction of population of E. coli O157:H7 and L. monocytogenes Scott A. Correlations (R2) of 0.52 and 0.77 were obtained between model predicted and experimental log10 reduction for E. coli O157:H7 and L. monocytogenes Scott A reductions, respectively. These results clearly indicated that EO water has a potential to be used for decontamination of raw fish.

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76. Application of electrolyzed oxidizing water to reduce Listeria monocytogenes on ready-to-eat meats
Meat Science, Volume 71, Issue 2, October 2005, Pages 327-333
K.A. Fabrizio and C.N. Cutter
Experiments were conducted to determine the effectiveness of acidic (EOA) or basic electrolyzed oxidizing (EOB) water, alone or in combination, on ready-to-eat (RTE) meats to reduce Listeria monocytogenes (LM). Frankfurters or ham surfaces were experimentally inoculated with LM and subjected to dipping or spraying treatments (25 or 4 ℃ for up to 30 min) with EOA, EOB, and other food grade compounds. LM was reduced the greatest when frankfurters were treated with EOA and dipped at 25 ℃ for 15 min. A combination spray app lication of EOB/EOA also resulted in a slight reduction of LM on frankfurters and ham. However, reductions greater than 1 log CFU/g were not observed for the duration of the study. Even with a prolonged contact time, treatments with EOA or EOB were not enough to meet regulatory requirements for control of LM on RTE meats. As such, additional studies to identify food grade antimicrobials to control the pathogen on RTE meats are warranted.

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77. Application of electrolyzed oxidizing water on the reduction of bacterial contamination for seafood
Food Control, In Press, Corrected Proof, Available online 8 September 2005,
Yu-Ru Huang, Hung-Sheng Hsieh, Shin-Yuan Lin, Shin-Jung Lin, Yen-Con Hung and Deng-Fwu Hwang
For reducing bacterial contamination, electrolyzed oxidizing water (EO water) has been used to reduce microbial population on seafood and platform of fish retailer. The specimens of tilapia were inoculated with Escherichia coli and Vibrio parahaemolyticus, and then soaked into EO water for up to 10 min. EO water achieved additional 0.7 log CFU/cm2 reduction than tap water on E. coli after 1 min treatment and additional treatment time did not achieved additional reduction. EO water treatment also reduced V. parahaemolyticus, by 1.5 log CFU/cm2 after 5 min treatment and achieved 2.6 log CFU/cm2 reduction after 10 min. The pathogenic bacteria were not detected in EO water after soaking

treatment. In addition, EO water could effectively disinfect the platform of fish retailer in traditional markets and fish markets.

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78. Effects of flow rate, temperature and salt concentration on chemical and physical properties of electrolyzed oxidizing water
Journal of Food Engineering, Volume 66, Issue 2, January 2005, Pages 171-176
Shun-Yao Hsu
This study adopted a three-factor-three-level factorial design to study the effects of water flow rate, salt concentration and water temperature on pH, oxidation–reduction potential (ORP), total residual chlorine, dissolved oxygen, electrical conductivity and salinity of electrolyzed oxidizing water (EOW). Results indicated that pH and dissolved oxygen concentration were not affected by these processing factors. Increasing water flow rate decreased total chlorine concentration and ORP of the EOW. Increasing salt concentration increased total chlorine concentration and electrical conductivity of the EOW. Water temperature had minor effect on total chlorine concentration. The variations can be well described by linear or quadratic polynomial models.

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79. Effects of storage conditions on chemical and physical properties of electrolyzed oxidizing water
Journal of Food Engineering, Volume 65, Issue 3, December 2004, Pages 465-471
Shun-Yao Hsu and Hsiao-Yuan Kao
Electrolyzed oxidizing waters (EOWs) were generated at different water flow rates, salt concentrations and water temperatures. The EOWs were stored in closed dark-brown glass bottles at room temperature for 21 days. Another duplicated set of the EOWs were stored for 12 days with four periodical openings of the screw caps. The effects of these treatments on pH, oxidation–reduction potential (ORP), electrical conductivity, total residual chlorine, dissolved oxygen (DO), sodium ion and chloride ion concentrations of the EOWs were investigated. Results indicated that pH, ORP, conductivity and chloride ion concentration did not change much under the storage conditions. Sodium ion concentration decreased 10–13% during storage. Total residual chlorine and DO decreased 24% and 21%, respectively, in the 21-day closed storage and decreased 81% and 47%, respectively, in the 12-day semi-open storage. This indicated that exposure to the atmosphere reduced more of these compounds than prolongation of the storage time.

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80. Effect of mild heat pre-treatment with alkaline electrolyzed water on the efficacy of acidic electrolyzed water against Escherichia coli O157:H7 and Salmonella on Lettuce
Food Microbiology, Volume 21, Issue 5, October 2004, Pages 559-566
Shigenobu Koseki, Kyoichiro Yoshida, Yoshinori Kamitani, Seiichiro Isobe and Kazuhiko Itoh
Cut lettuce dip-inoculated with Escherichia coli O157:H7 and Salmonella was treated with alkaline electrolyzed water (AlEW) at 20℃ for 5 min, and su bsequently washed with acidic electrolyzed water (AcEW) at 20℃ for 5 min. Pre-treatment with AlEW r esulted in an approximate 1.8 log10 cfu/g reduction of microbial populations, which was significantly (pless-than-or-equals, slant0.05) greater than microbial reductions resulting from other pre-treatment solutions, including distilled water and AcEW. Repeated AcEW treatment did not show a significant bacterial reduction. Mildly heated (50℃) sanitizers were compared with normal (20℃) or chil led (4℃) sanitizers for their bactericidal effect. Mildly heated AcEW and chlorinated water (200 ppm free available chlorine) with a treatment period of 1 or 5 min produced equal reductions of pathogenic bacteria of 3 log10 and 4 log10 cfu/g, respectively. The procedure of treating with mildly heated AlEW for 5 min, and subsequent washing with chilled (4℃) AcEW for period of 1 or 5 min resulted in 3–4 log10 cfu/g reductions of both the pathogenic bacterial counts on lettuce. Extending the mild heat pre-treatment time increased the bactericidal effect more than that observed from the subsequent washing time with chilled AcEW. The appearance of the mildly heated lettuce was not deteriorated after the treatment. In this study, we have illustrated the efficacious application of AlEW as a pre-wash agent, and the effective combined use of AlEW and AcEW.

Endoscopic Disinfection: Comparison Between Electrolyzed Acid Water and 2% Glutaraldehyde
Gastrointestinal Endoscopy, Volume 59, Issue 5, April 2004, Page P118
Giancarlo Spinzi, Alessandro Rampoldi, Luca Ferlin, Riccardo Terramocci, Giancarlo Butti and Giorgio Minoli

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81. Comparison of electrolyzed oxidizing water with other antimicrobial interventions to reduce pathogens on fresh pork
Meat Science, Volume 68, Issue 3, November 2004, Pages 463-468
K. A. Fabrizio and C. N. Cutter
To date, the effectiveness of electrolyzed oxidizing (EO) water against bacteria associated with fresh pork has not been determined. Using a hand-held, food-grade garden sprayer, distilled water (W), chlorinated water (CL; 25 ppm), 2% lactic acid (LA), acidic EO water (EOA), or "aged" acidic EO water (AEOA; stored at 4 ℃ for 24 h) was sprayed (15 s) onto pork bellies inoculated with feces containing Listeria monocytogenes (LM), Salmonella typhimurium (ST), and Campylobacter coli (CC). Remaining bacterial populations were determined immediately following treatment, after 2 days of aerobic storage, and again after 5 days of vacuum-packaged, refrigerated storage (day 7). While LA and EOA significantly reduced ($p<0.05$) populations of CC at days 0 and 7, there was no significant difference ($p>0.05$) between antimicrobial treatments when applied to pork inoculated with ST or LM. This study demonstrates that a 15-s spray with EOA has the ability to reduce CC associated with fresh pork surfaces. However, longer contact times may be necessary to reduce other microbial contaminants.

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82. Microbial reduction and storage quality of fresh-cut cilantro washed with acidic electrolyzed water and aqueous ozone
Food Research International, Volume 37, Issue 10, 2004, Pages 949-956
Hua Wang, Hao Feng and Yaguang Luo
Efficacy of decontamination treatments in reducing microbial populations on cilantro and in improving its storage quality was investigated. Fresh-cut cilantro samples were washed with one of the five treatments: tap water, acidic electrolyzed water (AEW), aqueous ozone, chlorinated water, and aqueous ozone followed by AEW (sequential wash). Treated cilantro was packaged in polyethylene bags prepared with films of selected oxygen transmission rate of 6200 mL/(d m2) and stored at 0 ℃ for 14 days. The total aerobic bacterial population, total enterobacteriaceae, electrolyte leakage and sensory qualities were examined every 4 days. Test results indicated that the sequential wash is effective in initial microbial count reduction. This treatment also maintained low microbial growth during storage. However, the higher electrolyte leakage may indicate cilantro tissue damage in this treatment. Using AEW alone also resulted in moderate control of aerobic bacterial growth during storage. Ozone treatment, on the other hand, achieved the highest overall quality of cilantro during storage and also maintained the typical cilantro aroma.

Notes

Notes

Clinical Uses of Kangen Water™ in Japanese Hospital Treatments

Note: This report in no way reflects the opinions of any team or distibutor, the author of this Manual, or Enagic, Inc.

The reports are not displayed for the purpose of suggesting therapeutic result from use of alkaline water. They are displayed purely for the purpose of education.

We do NOT publish them with the intention of trying to prove a curative or therapeutic recommendation. Consult your doctor for specialized medical advice.

Please view and make your own decision about what you read here and elsewhere before making any decision about items for sale on this site.

There are now hundreds of hospitals - big and small - in Japan that use Kangen Water™ as a part of their medical practices. The following list illustrates some most common usage scenarios with different illness cases.

1. Various Types of Cancer
The Kangen Water™ phenomenon. It just seems to work very effectively, whatever type and stage your cancer situation might be.

A few years ago, there was even a public project, organized by a veteran nurse who helped ALL of 30 terminal cancer patients she took on recover from the death bed, all within months, by simply giving them this Kangen Water™. While the amount of water the patients had to drink (4 to 10 liters a day) and the types of cancer (from breast, bladder, lung, liver, stomach, intestines, prostate to even leukemia) varied, all of the patients had been diagnosed as terminal from their previous doctors. Simply awe-inspiring!

2. Rapid Reduction in Blood Sugar Level in Diabetes Patients
It is observed that about 80% of diabetes patients who started intake of Kangen Water™ showed lower blood sugar levels within 2 weeks.

3. Rapid healing of Gangrene of the Lower Limbs, due to Diabetes
At Kyowa hospital in Kobe, Japan, at least 2 diabetics with lower limbs gangrene, who had not shown signs of recovery despite months of pharmaceutical treatment, saved their limbs within a month after they turned to drinking of Kangen water™ and soaking in strong oxidized water.

4. Rapid Improvement in Patients with Hepatitis and Cirrhosis
A representative case was that of a 60-year old male patient. Improvement was noted in his hepatitis and cirrhosis one month after starting intake of Kangen water™. Thereafter, all treatments, including medications, IV's and diet were discontinued and after 6 months of Kangen Water™ as a sole treatment, his liver function had returned to normal.

5. Rapid Healing of Stomach and Duodenal Ulcers
A 40-year old patient had endured repeated attacks of duodenal ulcers over the last 12 years. After an incident of attack, she started to drink Kangen Water™ (1-2 liters a day). Within a week, improvement was noted. An inspection with a gastric camera showed no remaining ulceration. The result surprised the hospital director, who personally attended the testing, as well as the patient herself.

Clinical Uses Of Kangen Water™ In Hospital Treatment:

- Abnormal gastrointestinal fermentation
- Rapid Reduction in Blood Sugar Levels in Diabetes Patients
- Rapid Healing of Stomach and Duodenal Ulcers
- Rapid Improvement in High and Low Blood Pressure Levels
- Improvements in Asthma, Skin Rashes, and Dermatitis
- Rapid Improvement in Nasal Allergies
- Improvements in Chronic diarrhea
- Indigestion, Excess Gastric Acid
- Improved Kidney Function and more....

Electrolyzed Water Gives Boost to Eliminating Food-Borne Bacteria Such as Salmonella, E. coli and Listeria

Murray's Chicken to be First Poultry Processor to Utilize New Technology in its Food Sanitation Process

Wed, 16 Apr 2008 13:34:34 GMT

http://www.earthtimes.org/articles/show/electrolyzed-water-gives-boost-to,354638.shtml

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Please view and make your own decision about what you read here and elsewhere before making any decision about items for sale on this site.

[Ed. Note: EAU Technologies appears to be our competitor. However...these new test results are important. Definitely food for thought! ☺]

"Clean" Process Coincides with Murray's Chicken's Green and Sustainable Commitment as it partners with EAU Technologies for Empowered Water(TM)

ATLANTA, April 16 /PRNewswire-FirstCall/ -- In keeping with their commitment to producing the healthiest, sustainable and most natural chicken possible, Murray's Chicken, a family-run poultry processor based in So. Fallsburg, New York, is switching to

electrolyzed water as its primary processing cleaning agent. Murray's Chicken has signed a contract with EAU Technologies Inc.

("EAU" or "Company") (BULLETIN BOARD: EAUI) , a leading provider of Electrolyzed Water -- EMPOWERED WATER(TM) -- for high-volume, business-to-business applications, to use EAU's technology in creating electrolyzed water for food sanitization at its processing facility. Murray's Chicken will be the first poultry processor in the United States to utilize the technology on an industrial scale. Successful trials, including several at the University of Georgia, have shown that electrolyzed water is highly effective at killing food-borne bacteria such as Salmonella, E. coli and Listeria, without affecting the quality of the food.

"Our goal has always been to provide our customers with the healthiest, safest poultry while maintaining an eye on social responsibility. We grow our chickens without administering any antibiotics, and our chickens are fed a 100% vegetarian feed free of any animal fats or animal by-products. EAU's electrolyzed water is created using natural ingredients and has been proven non-toxic in addition to being effective," said Steve Gold, Vice President of Marketing for Murray's Chicken.

Electrolyzed water, marketed as Empowered Water(TM) by EAU, is created by combining salt and water with an electrical charge. The process separates the positive and negative ions of water, creating two forms of water, one very acidic and one very alkaline. The alkaline EO water is used to clean the chicken, followed by a rinse of the electrolyzed acidic water to kill any remaining food-borne pathogens. Empowered Water(TM) has been proven non-toxic and environmentally friendly when used at approved concentrations.

"We have conducted extensive research, including a study trial at Murray's, to validate our belief that Empowered Water(TM) can be an effective cleaning agent in industrial settings. In addition, research conducted with the University of Georgia has shown electrolyzed water to be as much as 10 times more effective at killing bacteria than other tested methods, including the use of heat," said Wade Bradley, President and CEO of EAU Technologies. "We are confident that Empowered Water(TM) will be beneficial in assisting processing plants with meeting the new standards announced by the U.S. Department of Agriculture."

The U.S. Department of Agriculture's Food Safety and Inspection Service (FSIS) announced earlier this year new policies and practices targeting its Salmonella verification sampling program. The proposal is part of an overall initiative to raise performance standards among poultry and beef processing plants in testing and eliminating Salmonella, E. coli, Campylobacter and Listeria within the plant.

EAU's industrial application is able to produce large volumes of electrolyzed water, scaling from 0.5 up to 90 gallons per minute. Installation is expected to be completed with Murray's utilizing Empowered Water(TM) as part of its sanitation process by May.

About Murray's Chicken:

Murray Bresky, Murray's Chicken's namesake, took over his family poultry business, Falls Kosher Poultry, in the early seventies. Since then he has remained committed to the chickens he raises and to those who eat them.

In 1993, Murray's Chicken began providing consumers with all natural poultry, raised in Pennsylvania's Amish Country, without the use of antibiotics, growth drugs or hormones, earning it the Certified Humane Label.

Murray Chickens has a big personal commitment to producing natural poultry products, supporting local family-farmers and encouraging a healthy environment. Now consumers can learn more about their chicken with the Farm Source Verification System -- visit http://www.murrayschicken.com/ .

About EAU:

EAU Technologies, Inc. (EAU) is a supplier of Electrolyzed Water Technology (EW Technology marketed as Empowered Water(TM)) and other complementary technologies with applications in diverse industries.

EAU's water-based and non-toxic solutions (at application concentration, the solutions are non-toxic to humans and live animals) may replace many of the traditional methods now used to clean, disinfect and nourish in large industries such as agriculture and food processing.

EAU has solutions for existing bacteria, virus and mold proliferation threats. EAU continues to add innovative and efficacious products that offer a systemic approach to pathogen elimination in food processing plants and related industries, thereby producing safer foods while protecting the environment through "Green Technology."

EAU has developed patent pending systems that are being used on dairies to process drinking water for dairy herds. Studies and trials are showing promising results at improving animal digestion which shows signs of improved animal health and production.

EAU uses terms like "green", "natural", "non-toxic" and "organic" based on our NAMSA studies that show no toxicity or cytotoxicity at levels as high as 70 ppm of HOCl. EAU uses only water, food grade electrolytes and electricity to create all of its solutions. The active ingredients in the solutions EAU creates through electrolysis are GRAS (generally regarded as safe) approved. Please visit our website and sign up to be emailed our press releases and public announcements. http://www.eau-x.com/

"Safe Harbor" Statement under the Private Securities Litigation Reform Act of 1995 Statements in this press release relating to plans, strategies, economic performance and trends, projections of results of specific activities or investments, and other statements that are not descriptions of historical facts may be forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995, Section 27A of the

Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934. Such forward- looking statements may include without limitation, our expectations about the growth and the potential for the company, and Mr. Bradley's abilities to lead the company in that growth.

Forward-looking information is inherently subject to risks and uncertainties, and actual results could differ materially from those currently anticipated due to a number of factors, which include, but are not limited to, risk associated with successfully developing our business in evolving markets, our need for additional capital, our continuing operating losses, the ability of our management to conduct distribution activities and sell products, possible failure to successfully develop new products, vulnerability to competitors due to lack of patents on our products, and other risk factors listed in our annual report on Form 10-KSB for the year ended December 31, 2005 and our other SEC reports.

Forward-looking statements may be identified by terms such as "may," "will," "should," "could," "expects," "plans," "intends," "anticipates," "believes," "estimates," "predicts," "forecasts," "potential," or "continue," or similar terms or the negative of these terms. Although we believe that the expectations reflected in the forward-looking statements are reasonable, we cannot guarantee future results, levels of activity, performance or achievements. The company has no obligation to update these forward-looking statements.

EAU Technologies

Finland Study on effect of Hard (alkaline) Water on Chronic Heart Disease

This study was done in 2003 and used around 100,000 death certificates to correlate cause of death with water the person drank during their lifetime.

It showed that drinking alkaline (hard) water gave drinkers a 22% better chance of resisting chronic heart disease.

Put another way, one degree of hardness increase caused a corresponding one-degree or percent of decrease in acute myocardial infarction.

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Geochemistry of ground water and the incidence of acute myocardial infarction in Finland

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Study objective: To examine the association of spatial variation in acute myocardial infarction (AMI) incidence and its putative environmental determinants in ground water such as total water hardness, the concentration of calcium, magnesium, fluoride, iron, copper, zinc, nitrate, and aluminum.

Design: Small area study using Bayesian modeling and the geo-referenced data aggregated into 10 kmx10 km cells.

Setting: The population data were obtained from Statistics Finland, AMI case data from the National Death Register and the Hospital Discharge Register, and the geochemical data from hydrogeochemical database of Geological Survey of Finland.

Participants: A total of 18 946 men aged 35–74 years with the first AMI attack in the years 1983, 1988, and 1993.

Main results: One unit (in German degree °dH) increment in water hardness decreased the risk of AMI by 1%. Geochemical elements in ground water included in this study did not show a statistically significant effect on the incidence and spatial variation of AMI, even though suggestive findings were detected for fluoride (protective), iron and copper (increasing).

Conclusions: The results of this study with more specific Bayesian statistical analysis confirm findings from earlier observations of the inverse relation between water hardness and coronary heart disease. The role of environmental geochemistry in the geographical variation of the AMI incidence should be studied further in more detail incorporating the individual intake of both food borne and water borne nutrients.

Geochemical-spatial analysis provides a basis for the selection of areas suitable for such research.

Keywords: Bayesian approach; acute myocardial infarction; geochemistry; ground water; small area analysis

Abbreviations: CVD, cardiovascular disease; AMI, acute myocardial infarction; CHD, coronary heart disease

Cardiovascular disease (CVD) is the major cause of death in most developed countries including Finland.[1–3] The occurrence of coronary heart disease (CHD) varies between populations[14] but also within populations inside a country.[5]

Already in 1947 Kannisto found that CHD mortality was much higher in the eastern part than in the western part of Finland. In the 1980s the CHD risk was still 40% higher in eastern Finland than that in western and southern parts of the country.[6]

The major CHD risk factors do not fully explain the geographical variation of CHD risk in Finland.[7–9] Although the geographical differences have long been known, the reasons are still partly ambiguous.[10] Besides a genetic predisposition[11–13] several lifestyle and environmental factors have been implicated in the pathogenesis of CHD.[14–16]

Availability of trace elements in soil and ground water may be a cause of certain chronic ailments.[17] Soils and rocks in the countries of northern Europe are poor sources of many essential trace elements.[1718]

Our recent study of the spatial distribution of the first acute myocardial infarction (AMI) event showed that despite the decreasing trend in AMI incidence, the geographical difference in incidence and high risk areas has remained within Finland.[19] The presence of high risk areas for AMI suggests that genetic or environmental risk factors have accumulated in certain geographical locations in Finland. Our aim was to examine the possible association of spatial variation of AMI incidence with geochemical compounds in ground water.

METHODS

Finnish ground water is slightly acidic and very soft (1–4°dH) or soft (4–8°dH).[20] Besides the geological factors affecting trace element composition, atmospheric, anthropogenic, and marine factors also contribute to the chemical composition of the ground water.[21]

The data on men aged 35–74 years with the first attack of AMI (18946 cases) were obtained from the nationwide Death Register and the Hospital Discharge Register. The national personal identification number was used to perform a computerised records linkage of the data for deaths and hospitalisation attributable to AMI (ICD-8 and ICD-9 codes 410–414).

Both fatal and non-fatal events from the years 1983, 1988, and 1993 were included in the study. Cases with a previous hospitalisation for AMI were excluded. Data for these three years have been pooled. The data on population at risk, provided by coordinates of the place of residence, were obtained from Statistics Finland. The data were aggregated into 10 kmx10 km grid cells to ensure the protection of privacy of the individuals.

Geochemical data were obtained from the hydrogeochemical database of the Geological Survey of Finland.[21] The data on total water hardness (°dH), Ca, Mg, Fe, F^-, NO_3^-(mg/l) and Cu, Zn, and Al (μg/l) were available. Element concentrations were determined with different methods, for example, ICP-MS, ICP-AES, iconography, and AAS. The original data contained from 3621 up to 12 407 ground water samples.

The geochemical data were interpolated into a regular grid by using the ALKEMIA software developed at Geological Survey of Finland.[22] In the ALKEMIA Smooth interpolation method, the nearest samples to the grid cell receive greater weight. The value of the cell is a weighted median of sample values.[23–26]

Bayesian spatial conditional autoregressive model (CAR) with covariates, which is currently in wide use in the field of the disease mapping, was applied in this study.[27–30]

Because Finland is sparsely inhabited, we propose one modification, which is pertinent to the sparsely populated areas. In the case of the 10 kmx10 km grid over Finland (excluding Lapland), some grid cells are empty and have to be omitted from the analysis; thus 5% of cells would be omitted.

However, once we take environmental factors into account, assuming that the disease risk is influenced by both demographic factors (that is, people who actually live within the grid cell) and environmental factors in each cell whether or not it is inhabited, the omission of unpopulated cells results in a loss of information. The covariates included in the model were the age of onset of AMI and the levels of geochemical compounds in the ground water. The following modification is thus proposed.

Let Y_{ik} denote the number of cases in the cell i and age group k. Furthermore, let N_{ik} denote the respective population at risk. The proposed probability distribution is then as follows: that is, the Poisson distribution is assigned to the inhabited cells and the uninhabited cells naturally have no cases of the disease with the unit probability.

Also we assign common regression structure to the μ_{ik}: where
α, is the baseline risk
λ_i, is the local unexplained spatial random effect
β_k, is the effect of age group k on the risk level
K, is the age group, $k = 0,\ldots,K$
ξ, is a vector of environmental covariate effects
Z_i, is a vector of environmental covariates for area i

In this analysis, the age axis was divided into eight, five year age groups: 35–39, 40–44, 45–49, 50–54, 55–59, 60–64, 65–69, and 70–74. A non-proportional hazard model described their effect, which for AMI is more appropriate than the proportional hazards. As outlined in the preceding section seven geochemical covariates were included in the analysis.

The regression coefficients ß and were given non-informative Normal priors N(0,0.00001), the background level was given an improper flat prior

and the were given a CAR structure: where
λ_{-i}, are spatial variation parameters in the neighbourhood of i
m_i, is the number of neighbors for cell i
, is the overall level of spatial precision (inverse spatial variation)

In the CAR models a neighbourhood structure needs to be defined.

The neighbors were defined to be all those cells adjacent to the cell i through side or corner. Thus each cell could have at most eight (8) neighbours.

The model was fitted using WinBUGS. A total of 10000 iterations with 5000 burn-in were run. "Burn-in" denotes iterations, which were discarded because of non-convergence of the model at the early stages of the algorithm. The evaluation of the test results showed that a satisfactory convergence was reached.

The posterior joint and marginal distributions of the parameters of interest were estimated and summarised. The p% highest density regions (HDR), defined as most compact set of parameter values the posterior density mass over which is p/100, is used in Bayesian statistics to describe the variability of the estimate. It is thus by its nature somewhat similar to the frequentist confidence interval.

RESULTS

Age group and the total water hardness, Ca, Mg, Fe, F^-, Cu, Al, Zn, and NO_3^- concentrations in the ground water were included in the analyses as covariates. The overall age adjusted incidence of AMI among men aged 35–74 year was 480/100 000/year (posterior 95% HDR 473, 487). Table 1 gives information on the chemical contents of ground water.

Table 2 illustrates the number of AMI cases, population at risk, and AMI incidence by age and water hardness. One unit (°dH) increment in water hardness decreased the risk of AMI by 1% (table 3). The levels of other geochemical elements included in this study did not have any additional effect on the spatial variation of the incidence of AMI.

DISCUSSION

The large geographical variation and changes in the incidence of AMI in Finland cannot be explained by individual lifestyle or genetic factors alone; environmental exposures must also contribute to the development of the disease. The classic risk factors and socioeconomic status provide only a partial explanation for the excess CHD risk in eastern Finland.[731]

The age distribution of the population did not have an effect on the geographical variation of the incidence of AMI. The results support the early observations of the inverse relation between the AMI incidence and total water hardness.

An inverse relation between water hardness and CVD mortality has been detected in several studies.[32–37] They have suggested that CHD mortality can be related to the amount of magnesium and calcium in drinking water.[3638–44]

In some studies an association between CVD and water hardness was not found.[45–48] Much of the disagreement in earlier studies may be related to the complexity of the ecological analysis and the difficulty to apply results from ecological studies at the individual level.

In the general population, the magnesium intake has decreased over the years especially in the western world.[49] Some previous studies have shown that a large number of subjects had a lower intake of magnesium than the recommended dietary amount (350 mg/day).[42] It has been suggested that magnesium in water, appearing as hydrated ions, has a higher bioavailability than magnesium in food, which is bound in different compounds that are less easily absorbed.[50]

Fluoride concentrations of around one mg/l in household water may be beneficial.[4041]

Recent studies have also provided evidence that high serum iron and copper concentrations are associated with the CHD.[5152]

In this study one mg/l increment in the fluoride concentration in the drinking water was associated with a 3% decrease in the risk of AMI. In our study one μg/l increment in copper and one mg/l increment in iron on average increased the risk of AMI by 4% and 10%, respectively. The differences were not, however, statistically significant.

The non-significant results in our study may be attributable to excessive smoothing technique.

Thus, our study provides further supportive evidence for the importance of the ground water fluoride, iron and, copper concentrations for the risk of AMI.

CHD has a multifactorial aetiology. The method of spatial analysis used in this study is especially useful for testing the impact of several factors simultaneously. The validity of the Bayesian method used in this study has been also demonstrated earlier studies.[192753]

Additional simulations have been run to check the validity of the proposed changes to it regarding the inclusion of the uninhabited cells in the analysis.

Ground water reflects the contents of trace elements in soil and bedrock[2154] but only a small proportion of the population use locally produced food supplies, cereals, and vegetables. Individual studies on the role of intake of both food and water-borne nutrients should incorporate environmental exposure or control for it.

FOOTNOTES

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Conflicts of interest: none declared.

REFERENCES

1. Thom TJ, Epstein FH, Feldman JJ, *et al. Total mortality and mortality from heart disease, cancer, and stroke from 1950 to 1987 in 27 countries: highlights of trends and their interrelationships among causes of death*. Washington, DC: US DHHS PHS, National Institutes of Health, NIH Publication, 1992:92–3088.

2. Murray CJL, Lopez AD. Evidence-based health policy-lessons from the global burden of disease study. *Science* 1996;274:740–3.[Free Full Text]

3. Uemura K, Pisa Z. Trends in cardiovascular disease mortality in industrialized countries since 1950. *World Health Stat Q* 1988;41:155–78.[Medline]

4. Tunstall-Pedoe H, Kuulasmaa K, Amouyel P, *et al.* Myocardial infarction and coronary deaths in the World Health Organization MONICA Project. Registration procedures, event rates and case fatality in 38 populations from 21 countries in 4 continents. *Circulation* 1994;90:583–612.[Medline]

5. Kannisto V. The causes of death as demographical factors in Finland. [In Finnish, English summary]. Helsinki: Kansantaloudellisia tutkimuksia-Economic studies XV, 1947.

6. Tuomilehto J, Arstila M, Kaarsalo E, *et al.* Acute myocardial infarction (AMI) in Finland—baseline data from the FINMONICA AMI register in 1983–1985. *Eur Heart J* 1992;13:1153.[Abstract/Free Full Text]

7. Jousilahti P, Vartiainen E, Tuomilehto J, *et al.* Role of known risk factors in explaining the difference in the risk of coronary heart disease between eastern and southwestern Finland. *Ann Med* 1998;50:481–7.

8. Vartiainen E, Jousilahti P, Alfthan G, *et al.* Cardiovascular risk factor changes in Finland, 1972–1997. *Int J Epidemiol* 2000;29:49–56.[Abstract/Free Full Text]

9. Forsen T, Eriksson J, Qiao Q, *et al.* Short stature and coronary heart disease: a 35-follow-up of the Finnish cohorts of the Seven Countries Study. *J Intern Med* 2000;248:326–32.[CrossRef][Medline]

10. Koskinen S. *Origins of regional differences in mortality from ischaemic heart disease in Finland*. Jyväskylä: NAWH, Research reports 41, 1994:204.

11. Kontula K, Koivisto U- M, Miettinen H, *et al.* Suomalaiset sepelvaltimotautigeenit. [The Finnish IHD-genes, in Finnish]. *Duodecim* 1994;110:721–9.[Medline]

12. Koskenvuo M, Kaprio J, Romanov K. Twin studies in metabolic diseases. *Ann Med* 1992;24:379–81.[Medline]

13. MacCluer J, Kammerer C. Dissecting the genetic contribution to coronary heart disease. *Am J Hum Genet* 1991;49:1139–44.[Medline]

14. Tuomilehto J, Puska P, Korhonen H, *et al.* Trends and determinants of ischaemic heart disease mortality in Finland: with special reference to a possible levelling off in the early 1980s. *Int J Epidemiol* 1989;18 (3 suppl 1) :109–17.

15. Vartiainen E, Puska P, Pekkanen J, *et al.* Changes in risk factors explain changes in mortality from ischaemic heart disease in Finland. *BMJ* 1994;309:23–7.[Abstract/Free Full Text]

16. Jousilahti P, Tuomilehto J, Vartiainen E, *et al.* Importance of risk factor clustering in coronary heart disease mortality and incidence in eastern Finland. *J Cardiovasc Risk* 1995;2:63–70.[CrossRef][Medline]

17. Masironi R. Geochemistry, soils and cardiovascular diseases. *Experientia* 1987;43:68–74.[CrossRef][Medline]

18. Koljonen T. Bedrock and associated geophysical and other features. In: Koljonen T, ed. *The geochemical atlas of Finland*. Vol part 2. Till: Geological Survey of Finland, 1992.

19. Karvonen M, Moltchanova E, Viik-Kajander M, *et al.* Regional inequality in the risk of acute myocardial infarction in Finland: a case study of 35- to 74-year-old men. *Heart Drug* 2002;2:51–60.

20. Tarvainen T, Lahermo P, Hatakka T, *et al. Chemical composition of well water in Finland—main results of the "One thousand wells" project*. In: Autio S, ed. Special paper 31. Espoo: Geological Survey of Finland, 2001:57–76.

21. Lahermo P, Ilmasti M, Juntunen R, *et al. The geochemical atlas of Finland, Part 1. The hydrogeochemical mapping of Finnish ground water*. Espoo: Geological Survey of Finland 1990:66.

22. Ahlsved C, Lampio E, Tarvainen T. ALKEMIA—a VAX minicomputer database and program package for geochemical exploration. *J Geochem Explor* 1991;41:23–8.[CrossRef]

23. Björklund A, Lummaa M. Representation of regional, local and residual variability of geochemical data by means of filtering techniques. Proceedings 2nd international symposium on methods of prospecting geochemistry, Irkutsk, USSR, 1983:25–34.

24. Björklund A, Gustavsson N. Visualization of geochemical data on maps: new options. *J Geochem Explor* 1987;29:89–103.[CrossRef]

25. Tarvainen T. *Environmental applications of geochemical databases in Finland*. [PhD Thesis]. Espoo: Geological Survey of Finland, 1996.

26. Gustavsson N, Lampio E, Tarvainen T. Visualization of geochemical data on maps at the Geological Survey of Finland. *J Geochem Explor* 1997;59:197–207.[CrossRef]

27. Ranta J, Penttinen A. Probabilistic small area risk assessment using GIS-based data: a case study on Finnish childhood diabetes. *Stat Med* 2000;19:2345–59.[CrossRef][Medline]

28. Osnes K, Aalen OO. Spatial smoothing of cancer survival: a Bayesian approach. *Stat Med* 1999;18:2087–99.[CrossRef][Medline]

29. Clayton DG, Bernardinelli L, Montomoli C. Spatial correlation in ecological analysis. *Int J Epidemiol* 1993;22:1193–202.[Abstract/Free Full Text]

30. Besag J, York J, Mollié A. Bayesian image restoration, with two applications in spatial statistics. *Annals of the Institute of Statistical Mathematics* 1991;43:1–59.

31. Salomaa V, Niemelä M, Miettinen H, *et al*. Relationship of socioeconomic status to the incidence and prehospital, 28-day, and 1-year mortality rates of acute coronary events in the FINMONICA Myocardial Infarction Register Study. *Circulation* 2000;101:1913–18.[Medline]

32. Crawford MD, Gardner MJ, Morris JN. Mortality and hardness of local water-supplies. *Lancet* 1968;i:827–31.

33. Masironi R, Pisa Z, Clayton D. Myocardial infarction and water hardness in European towns. *Environ Pathol Toxicol* 1980;4:77–87.

34. Karppanen H, Pennanen R, Passinen L. Minerals, coronary heart disease and sudden coronary death. *Adv Cardiol* 1978;25:9–24.[Medline]

35. Nerbrand CH, Svärdsudd K, Ekland J, *et al*. Cardiovascular mortality and morbidity in seven counties in Sweden in relation to water hardness and geological settings. *Eur Heart J* 1992;13:721–7.[Abstract/Free Full Text]

36. Rylander R, Bonevik H, Rubenowitz E. Magnesium and calcium in drinking water and cardiovascular mortality. *Scand J Work Environ Health* 1991;17:91–4.[Medline]

37. Piispanen R. Water hardness and cardiovascular mortality in Finland. *Environmental Geochemistry and Health* 1993;15:201–8.[CrossRef]

38. Punsar S, Karvonen MJ. Drinking water quality and sudden death: observations from West and East Finland. *Cardiology* 1979;64:24–34.[Medline]

39. Anderson TW, Neri LC, Schreiber GB, *et al.* Ischemic heart disease, water hardness and myocardial magnesium. [Letter]. *Can Med Assoc J* 1975;113:199–203.[Abstract]

40. Luoma H, Helminen SK, Ranta H, *et al.* Relationships between the fluoride and magnesium concentrations in drinking water and some components in serum related to cardiovascular diseases in men from four rural districts in Finland. *Scand J Clin Lab Invest* 1973;32:217–24.[Medline]

41. Luoma H, Aromaa A, Helminen S, *et al.* Risk of myocardial infarction in Finnish men in relation to fluoride, magnesium and calcium concentration in drinking water. *Acta Med Scand* 1983;213:171–6.[Medline]

42. Rubenowitz E, Molin I, Axelsson G, *et al.* Magnesium in drinking water in relation to morbidity and mortality from acute myocardial infarction. *Epidemiology* 2000;11:416–21.[CrossRef][Medline]

43. Rubenowitz E, Axelsson G, Rylander R. Magnesium and calcium in drinking water and death from acute myocardial infarction in women. *Epidemiology* 1999;10:31–6.[Medline]

44. Punsar S, Erämetsä O, Karvonen MJ, *et al.* Coronary heart disease and drinking water. *J Chron Dis* 1975;28:259–87.[CrossRef][Medline]

45. Huel G, Thomazeau R, Derriennic F, *et al.* Water hardness and cardiovascular mortality. A study of 947 Alsatian communities. *Rev Epidemiol Sante Publique* 1978;26:381–90.[Medline]

46. Smith WC, Crombie IK. Coronary heart disease and water hardness in Scotland—is there a relationship? *J Epidemiol Community Health* 1987;41:227–8.[Abstract]

47. Maheswaran R, Morris S, Falconer S, *et al.* Magnesium in drinking water supplies and mortality from acute myocardial infarction in north west England. *Heart* 1999;82:455–60.[Abstract/Free Full Text]

48. Reunanen A, Knekt P, Marniemi J, *et al.* Serum calcium, magnesium, copper and zinc and risk of cardiovascular death. *Eur J Clin Nutr* 1996;50:431–7.[Medline]

49. Saris NE, Mervaala E, Karppanen H, *et al.* Magnesium. An update on physiological, clinical and analytical aspects. *Clin Chim Acta* 2000;294:1–26.[CrossRef][Medline]

50. Durlach J. The importance of magnesium in water. In: *Magnesium in clinical practice.* London: John Libbey, 1988:221–2.

51. Salonen JT, Salonen R, Seppänen K, *et al.* Interactions of serum copper, selenium, and low density lipoprotein cholesterol in atherogenesis. *BMJ* 1991;302:756–60.

52. Salonen JT, Nyyssönen K, Korpela H, *et al.* High stored iron levels are associated with excess risk of myocardial infarction in eastern Finnish men. *Circulation* 1992;86:803–11.[Medline]

53. Rytkonen M, Ranta J, Tuomilehto J, *et al.* The SPAT Study Group. The Finnish Childhood Diabetes Registry Group. Bayesian analysis of geographical variation in the incidence of type I diabetes in Finland. *Diabetologia* 2001;44 (suppl 3) :B37–44.

54. Kousa A, Nikkarinen M. Geochemical environment in areas of low and high coronary heart disease mortality. In: Autio S, ed. *Special paper 23.* Espoo: Geological Survey of Finland, 1997:137–48.

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- **Masironi R**, Pisa Z, Clayton D. Myocardial infarction and water hardness in European towns. *Environ Pathol Toxicol* 1980;**4**:77–87.
- **Karppanen H**, Pennanen R, Passinen L. Minerals, coronary heart disease and sudden coronary death. *Adv Cardiol* 1978;**25**:9–24.[Medline]
- **Nerbrand CH**, Svärdsudd K, Ekland J, *et al.* Cardiovascular mortality and morbidity in seven counties in Sweden in relation to water hardness and geological settings. *Eur Heart J* 1992;**13**:721–7.[Abstract/Free Full Text]
- **Rylander R**, Bonevik H, Rubenowitz E. Magnesium and calcium in drinking water and cardiovascular mortality. *Scand J Work Environ Health* 1991;**17**:91–4.[Medline]
- **Piispanen R**. Water hardness and cardiovascular mortality in Finland. *Environmental Geochemistry and Health* 1993;**15**:201–8.[CrossRef]
- **Punsar S**, Karvonen MJ. Drinking water quality and sudden death: observations from West and East Finland. *Cardiology* 1979;**64**:24–34.[Medline]

- **Anderson TW**, Neri LC, Schreiber GB, *et al.* Ischemic heart disease, water hardness and myocardial magnesium. [Letter]. *Can Med Assoc J* 1975;**113**:199–203.[Abstract]
- **Luoma H**, Helminen SK, Ranta H, *et al.* Relationships between the fluoride and magnesium concentrations in drinking water and some components in serum related to cardiovascular diseases in men from four rural districts in Finland. *Scand J Clin Lab Invest* 1973;**32**:217–24.[Medline]
- **Luoma H**, Aromaa A, Helminen S, *et al.* Risk of myocardial infarction in Finnish men in relation to fluoride, magnesium and calcium concentration in drinking water. *Acta Med Scand* 1983;**213**:171–6.[Medline]
- **Rubenowitz E**, Molin I, Axelsson G, *et al.* Magnesium in drinking water in relation to morbidity and mortality from acute myocardial infarction. *Epidemiology* 2000;**11**:416–21.[CrossRef][Medline]
- **Rubenowitz E**, Axelsson G, Rylander R. Magnesium and calcium in drinking water and death from acute myocardial infarction in women. *Epidemiology* 1999;**10**:31–6.[Medline]
- **Punsar S**, Erämetsä O, Karvonen MJ, *et al.* Coronary heart disease and drinking water. *J Chron Dis* 1975;**28**:259–87.[CrossRef][Medline]
- **Huel G**, Thomazeau R, Derriennic F, *et al.* Water hardness and cardiovascular mortality. A study of 947 Alsatian communities. *Rev Epidemiol Sante Publique* 1978;**26**:381–90.[Medline]
- **Smith WC**, Crombie IK. Coronary heart disease and water hardness in Scotland—is there a relationship? *J Epidemiol Community Health* 1987;**41**:227–8.[Abstract]
- **Maheswaran R**, Morris S, Falconer S, *et al.* Magnesium in drinking water supplies and mortality from acute myocardial infarction in north west England. *Heart* 1999;**82**:455–60.[Abstract/Free Full Text]
- **Reunanen A**, Knekt P, Marniemi J, *et al.* Serum calcium, magnesium, copper and zinc and risk of cardiovascular death. *Eur J Clin Nutr* 1996;**50**:431–7.[Medline]
- **Saris NE**, Mervaala E, Karppanen H, *et al.* Magnesium. An update on physiological, clinical and analytical aspects. *Clin Chim Acta* 2000;**294**:1–26.[CrossRef][Medline]
- **Durlach J**. The importance of magnesium in water. In: *Magnesium in clinical practice*. London: John Libbey, 1988:221–2.
- **Salonen JT**, Salonen R, Seppänen K, *et al.* Interactions of serum copper, selenium, and low density lipoprotein cholesterol in atherogenesis. *BMJ* 1991;**302**:756–60.
- **Salonen JT**, Nyyssönen K, Korpela H, *et al.* High stored iron levels are associated with excess risk of myocardial infarction in eastern Finnish men. *Circulation* 1992;**86**:803–11.[Medline]
- **Rytkonen M**, Ranta J, Tuomilehto J, *et al.* The SPAT Study Group. The Finnish Childhood Diabetes Registry Group. Bayesian analysis of geographical variation in the incidence of type I diabetes in Finland. *Diabetologia* 2001;**44** (suppl 3) :B37–44.

- **Kousa A**, Nikkarinen M. Geochemical environment in areas of low and high coronary heart disease mortality. In: Autio S, ed. *Special paper 23*. Espoo: Geological Survey of Finland, 1997:137–48.

Ray Kurzweil, Scientist,

Dispels Some Myths About Alkaline Water

Ray Kurzweil was inducted in 2002 into the National Inventors Hall of Fame, established by the U.S. Patent Office.

He received the $500,000 Lemelson-MIT Prize, the nation's largest award in invention and innovation.

He also received the 1999 National Medal of Technology, the nation's highest honor in technology, from President Clinton in a White House ceremony.

He has also received scores of other national and international awards, including the 1994 Dickson Prize (Carnegie Mellon University's top science prize), Engineer of the Year from Design News, Inventor of the Year from MIT, and the Grace Murray Hopper Award from the Association for Computing Machinery. He has received twelve honorary Doctorates and honors from three U.S. presidents.

He has received seven national and international film awards. Ray's books include The Age of Intelligent Machines, The Age of Spiritual Machines, and Fantastic Voyage: Live Long Enough to Live Forever. Four of Ray's books have been national best sellers and The Age of Spiritual Machines has been translated into 9 languages and was the #1 best selling book on Amazon in science

[Ed. Note: Please view Mr. Kurtzweil's 20+ page VERY impressive resume here -
I promise your review of his credentials will give total credibility to his words below.]
http://www.phwaterforhealth.com/kurzweil.htm

Note: This report in no way reflects the opinions of any team or distibutor, the author of this Manual, or Enagic, Inc.

The reports are not displayed for the purpose of suggesting therapeutic result from use of alkaline water. They are displayed purely for the purpose of education.

We do NOT publish them with the intention of trying to prove a curative or therapeutic recommendation. Consult your doctor for specialized medical advice.

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Question: I have read on the Internet that it is not possible to create alkaline or acid water from pure water and that water that is pure enough to drink can't be split into alkaline and acid components. Is this true?

Answer: As responsible scientists, we had the same skepticism when we first heard about alkaline water.

Therefore, the first thing we did was to purchase a water alkalizer as well as an accurate electronic pH meter. We ran tap water with pH 7.1 from our home faucet into the device and found that the water coming out of the alkaline outlet had a pH of 9.5 (indicating very alkaline), while the water from the acid outlet measured pH 4.5 (indicating very acidic).

We repeated this experiment with a variety of tap waters obtaining alkaline outputs with a pH ranging from 9.5 to 9.9. It is true that "pure" or distilled water can not be ionized. If you were to try to "split" distilled water, it would not work. Tap or spring water, however, has dissolved minerals in it. It's the minerals in the water; primarily calcium, potassium and magnesium that allow water to be "split" by an electric current into alkaline, "electron-rich" (i.e., containing negatively charged ions that can engage in chemical reactions to provide electrons to positively charged free radicals) and acid, "electron-deficient" components.

Individuals who say it is not possible to split tap or spring water are misinformed.

Question: One site on the Internet states *"Ionized water is nothing more than sales fiction; the term is meaningless to chemists. Most water that is fit for drinking is too unconductive to undergo significant electrolysis."*

The above statement is easily shown to be incorrect with a simple pH meter and an electrolysis machine. Most tap waters run through the machine produce highly alkaline water as measured by a pH meter.

Question: Since you advocate drinking alkaline water, why not simply mix something like sodium bicarbonate (baking soda) with water and drink that? There are, in fact, alkaline waters sold that are made by mixing water with bicarbonate. Wouldn't that work as well and be much less expensive than a water alkalize?

Answer: There are more benefits to "alkaline water" than simply the alkalinity or pH. **The most important feature of alkaline water produced by a water alkalize is its oxidation reduction potential (ORP).** Water with a high negative ORP is of particular value in its ability to neutralize oxygen free radicals.
ORP can also be directly tested using an ORP sensor and meter. We have conducted these experiments as well. We found that water coming directly from the tap had an ORP of +290mV, while the water coming out of the water alkalizer had a negative ORP. The more negative the ORP of a substance (that is, the higher its negative ORP), the more likely it is to engage in chemical reactions that donate electrons. These electrons are immediately available to engage in reactions that neutralize positively charged free radicals. This is the key benefit of water produced by a water alkalize that is not available by simply drinking water than has had some bicarb or other compounds dissolved in it to make it alkaline.

Although water mixed with bicarbonate is indeed alkaline, it does not have a negative ORP; rather it has a positive ORP, meaning that it is unable to neutralize dangerous oxygen free radicals. Alkaline water produced by running tap water through an electrolysis machine does have a high negative ORP, meaning that it does have the ability to neutralize oxygen free radicals. We have confirmed these ORP measurements through our direct tests.

Question: OK, why is it important to drink alkaline water with a high negative ORP?

Answer: All chemical reactions occur with the transfer of electrons. Negatively charged entities are said to be reducing agents, meaning they are relatively electron rich and are able to donate electrons, reducing the charge of the entity with which they react.

Relatively electron-poor entities are referred to as oxidizing agents, meaning they tend to pull electrons away. Thus, each substance in our body may act as either an oxidizing or reducing agent.
However, not just any negatively charged ion will be able to engage in the specific chemical reactions needed to neutralize oxygen free radicals. The HCO_3^- (bicarbonate) ions in alkaline bicarb water do not have this potential, whereas the OH^- and mineral-rich water coming from an electrolysis machine (from tap water) does have this potential. That is implied in the negative value of the "oxidation reduction potential."

Free radicals are among the most damaging molecules in the body and are highly unstable molecules that are oxidizing agents and are electron deficient. They are a principal cause of damage and disease in the body. Oxygen free radicals contribute significantly to a broad variety of harmful conditions in the body ranging from life-threatening conditions such as heart disease, stroke and cancer, to less severe conditions such as sunburns, arthritis, cataracts, and many others. Free radicals MUST get electrons from somewhere and will steal them from whatever molecules are around, including normal, healthy tissues.

Damage to tissues results when free radicals strip these electrons from healthy cells.

If the damage goes on unchecked, this will lead to disease. For example, the oxidation of LDL cholesterol particles in arterial walls by free radicals triggers an immune system response that results in atherosclerosis, the principal cause of heart disease. The negative ions in alkaline water from an electrolysis machine are a rich source of electrons that can be donated to these free radicals in the body, neutralizing them and stopping them from damaging healthy tissues. Specifically, these ions have the potential to engage in the chemical reactions necessary to neutralize oxygen free radicals.

Vitamin C and E, grape seed extract and alpha lipoic acid, for example, are all powerful electron donors. The vegetable-rich diet we recommend is alkaline and helps donate electrons to the body. **Alkaline, electron-rich water falls in the same category**. **It can help with your body's need for electrons to counteract free radicals.**

Interestingly, we also tested vegetable juice with the ORP meter and found that it also has a high negative ORP, meaning that it is able to neutralize oxygen free radicals. So at least one of the important benefits of eating vegetables can be obtained from drinking the high negative ORP alkaline water from an electrolysis machine.

Another benefit of drinking alkaline water is that it assists in the absorption of minerals. We know that if the body is not absorbing enough minerals, it will rob minerals from the body's mineral reserves, chiefly calcium from the bones.

It is well known that many chronic diseases result in excess acidity of the body (metabolic acidosis). We also know that the body tends to become more acidic due to modern dietary habits and lifestyles and the aging process itself. By drinking high negative ORP alkaline water, you combat metabolic acidosis and improve absorption of nutrients.

The blood is carefully buffered to keep it in a narrow range between pH 7.35 to 7.45. The body keeps blood pH stable by utilizing alkaline buffers, chiefly bicarbonate, to neutralize acidic liquids (such as colas, which have a pH as low as 2.5) and other acidic products and byproducts. But as the blood stream receives these acidic substances, the alkaline buffers get used up.

Drinking alkaline water helps reduce the burden on the limited alkaline buffers which are needed for the body's natural detoxification processes.

Question: Is there research that actually shows the benefits of drinking alkaline water?

Answer: A number of studies are summarized below. One study described below suggests that alkaline water encourages "friendly" anaerobic microflora in the human intestinal tract, and discourages "unfriendly" aerobic organisms. The researcher (see Vorobjeva NV below) writes: "Many diseases of the intestine are due to a disturbance in the balance of the microorganisms inhabiting the gut. The treatment of such diseases involves the restoration of the quantity and/or balance of residential microflora in the intestinal tract. It is known that aerobes and anaerobes grow at different oxidation-reduction potentials (ORP). The former require positive E(h) values up to +400 mV. Anaerobes do not grow unless the E(h) value is negative between -300 and -400 mV.

In this work, it is suggested that prerequisite for the recovery and maintenance of obligatory anaerobic microflora in the intestinal tract is a negative ORP value of the intestinal milieu. Electrolyzed reducing water with E(h) values between 0 and -300 mV produced in electrolysis devices possesses this property. Drinking such water favors the growth of residential microflora in the gut. A sufficient array of data confirms this idea."

Dr. Grossman has also had many of his patients report of health benefits they have experienced from drinking alkaline electron-rich water.

Question: How can alkaline water with a pH of 9 or 10 be expected to affect the body when the pH of the stomach can be as low as 2 - or less?

Answer: It is important to remember that large amounts of hydrochloric acid are present in the stomach primarily when food is there. **There is only a small amount of acid in stomach when it is empty, and this can be easily overcome when alkaline electron-rich water is consumed.** Therefore, in order to gain **maximum benefit, we recommend drinking alkaline water in between meals.** Water consumed between meals will very quickly pass through the stomach and the GI tract.

A sample of studies on the health benefits of alkaline electron-rich water:

Huang KC, Yang CC, Lee KT, Chien CT. Reduced hemodialysis-induced oxidative stress in end-stage renal disease patients by electrolyzed reduced water. Kidney Int. 2003 Aug;64(2):704-14.
BACKGROUND : Increased oxidative stress in end-stage renal disease (ESRD) patients may oxidize macromolecules and consequently lead to cardiovascular events during chronic hemodialysis. Electrolyzed reduced water (ERW) with reactive oxygen species (ROS) scavenging ability may have a potential effect on reduction of hemodialysis-induced oxidative stress in ESRD patients.
METHODS: We developed a chemiluminescence emission spectrum and high-performance liquid chromatography analysis to assess the effect of ERW replacement on plasma ROS (H_2O_2 and HOCl) scavenging activity and oxidized lipid or protein production in ESRD patients undergoing hemodialysis.

Oxidized markers, dityrosine, methylguanidine, and phosphatidylcholine hydroperoxide, and inflammatory markers, interleukin 6 (IL-6), and C-reactive protein (CRP) were determined.

RESULTS: Although hemodialysis efficiently removes dityrosine and creatinine, hemodialysis increased oxidative stress, including phosphatidylcholine hydroperoxide, and methylguanidine. Hemodialysis reduced the plasma ROS scavenging activity, as shown by the augmented reference H2O2 and HOCl counts (Rh202 and Rhocl, respectively) and decreased antioxidative activity (expressed as total antioxidant status in this study). ERW administration diminished hemodialysis-enhanced Rh202 and Rhocl, minimized oxidized and inflammatory markers (CRP and IL-6), and partly restored total antioxidant status during 1-month treatment.

CONCLUSION: This study demonstrates that hemodialysis with ERW administration may efficiently increase the H2O2- and HOCl-dependent antioxidant defense and reduce H2O2- and HOCl-induced oxidative stress.

Shirahata S, Kabayama S, Nakano M, Miura T, Kusumoto K, Gotoh M, Hayashi H, Otsubo K, Morisawa S, Katakura Y. Electrolyzed-reduced water scavenges active oxygen species and protects DNA from oxidative damage. Biochem Biophys Res Commun. 1997 May 8;234(1):269-74.

Active oxygen species or free radicals are considered to cause extensive oxidative damage to biological macromolecules, which brings about a variety of diseases as well as aging. The ideal scavenger for active oxygen should be 'active hydrogen'. 'Active hydrogen' can be produced in reduced water near the cathode during electrolysis of water. Reduced water exhibits high pH, low dissolved oxygen (DO), extremely high dissolved molecular hydrogen (DH), and extremely negative redox potential (RP) values.

Strongly electrolyzed-reduced water, as well as ascorbic acid, (+)-catechin and tannic acid, completely scavenged O.-2 produced by the hypoxanthine-xanthine oxidase (HX-XOD) system in sodium phosphate buffer (pH 7.0). The superoxide dismutase (SOD)-like activity of reduced water is stable at 4 degrees C for over a month and was not lost even after neutralization, repeated freezing and melting, deflation with sonication, vigorous mixing, boiling, repeated filtration, or closed autoclaving, but was lost by opened autoclaving or by closed autoclaving in the presence of tungsten trioxide which efficiently adsorbs active atomic hydrogen.

Water bubbled with hydrogen gas exhibited low DO, extremely high DH and extremely low RP values, as does reduced water, but it has no SOD-like activity.

These results suggest that the SOD-like activity of reduced water is not due to the dissolved molecular hydrogen but due to the dissolved atomic hydrogen (active hydrogen).

Although SOD accumulated H2O2 when added to the HX-XOD system, reduced water decreased the amount of H2O2 produced by XOD. Reduced water, as well as catalase and ascorbic acid, could directly scavenge H2O2. Reduced water suppresses single-strand breakage of DNA b active oxygen species produced by the Cu(II)-catalyzed oxidation of ascorbic acid in a dose-dependent manner, suggesting that reduced water can scavenge not only O2.- and H2O2, but also 1O2 and .OH.

Vorobjeva NV. Selective stimulation of the growth of anaerobic microflora in the human intestinal tract by electrolyzed reducing water. Med Hypotheses. 2005;64(3):543-6.

96-99% of the "friendly" or residential microflora of intestinal tract of humans consists of strict anaerobes and only 1-4% of aerobes. Many diseases of the intestine are due to a disturbance in the balance of the microorganisms inhabiting the gut. The treatment of such diseases involves the restoration of the quantity and/or balance of residential microflora in the intestinal tract. It is known that aerobes and anaerobes grow at different oxidation-reduction potentials (ORP). The former require positive E(h) values up to +400 mV. Anaerobes do not grow unless the E(h) value is negative between -300 and -400 mV.

In this work, it is suggested that prerequisite for the recovery and maintenance of obligatory anaerobic microflora in the intestinal tract is a negative ORP value of the intestinal milieu. Electrolyzed reducing water with E(h) values between 0 and -300 mV produced in electrolysis devices possesses this property.

Drinking such water favours the growth of residential microflora in the gut. A sufficient array of data confirms this idea. However, most researchers explain the mechanism of its action by an antioxidant properties destined to detox the oxidants in the gut and other host tissues. Evidence is presented in favour of the hypothesis that the primary target for electrolyzed reducing water is the residential microflora in the gut.

Chen H, Kimura M, Zhu Z, Itokawa Y, Evaluation on ionized calcium as a nutrient. The 11th symposium on Trace Nutrients Research, Japan Trace Nutrients Research Society, p131-138, 1994.

Summary: To clarify effect of ionized calcium water for drinking water in rats, 36 Male Wister rats weighing about 50g were randomly divided into 6 groups, and given following diet and drinking water : (1) Ca-sufficient diet, tap-water; (2) Ca-

sufficient diet, tap-water;(3) Ca-sufficient diet, calcium lactate added-ionized calcium-water : (4) Ca-deficient diet, calcium lactate added-water ; (5) Ca deficient diet, calcium lactate added-water :(6) Ca-deficient diet, calcium lactate added ionized calcium-water.

The diets were given by paired-feeding method 4 weeks and drinking water was ad libitum. The significant change of calcium concentration in the rats were was follows; Ca concentration of plasma, spleen, of plasma, spleen, kidney, testis and tibia in Ca deficient groups (4), (5), (6) were significantly low compared with

these in Ca sufficient groups (1),(2),(3) Ca concentration in brain of groups (4),(5),(6) was low compared to these in groups (2), Ca concentration in heart and muscle of group (4) was low compared to Ca deficient groups (1),(2),(3), but these in group (5) drank Ca added-water was recovered and these in group (6) drank ionized-Ca-water was higher than these in any other groups. Ca concentration of liver in groups (4) were significantly lower than that in group (1),(3) and Ca concentration of liver in Ca deficient rats (groups (5),(6)) drank Ca-added-water were high compared to these in group (4). In 24 hours urine discharge of group (2) was high compared with groups (4), (5), (6).

These results suggest that ionized Ca in drinking water may be active for intestinal absorption.

Vormann J, Worlitschek M, Goedecke T, Silver B, Supplementation with alkaline minerals reduces symptoms of patients with chronic low back pain, J Trace Elem. Med. Biol. Vol. 15, pp. 179-183, 2001

Abstract: The cause of low back pain is heterogeneous, it has been hypothesized that a latent chronic acidosis might contribute to these symptoms. It was tested whether a supplementation with alkaline minerals would influence symptoms in patients with low back pain symptoms. In an open prospective study 82 patients with chronic low back pain received daily 30 g of a lactose based alkaline multimineral supplement (Basica) over a period of 4 weeks in addition to their usual medication. Pain symptoms were quantified with the "Arhus low back pain rating scale" (ARS). Mean ARS dropped highly significant by 49% from 41 to 21 points after 4 weeks supplementation. In 76 out of 82 patients a reduction in ARS was achieved by the supplementation. Total blood buffering capacity was significantly increased from 77.69 ± 6.79 to 80.16 ± 5.24 mmol/L (mean ± SEM, n=82, $p < 0.001$) and also blood pH rose from 7.456 ± 0.007 to 7.470 ± 0.007 (mean ± SEM, n=75, $p < 0.05$).

Only intracellular magnesium increased by 11% while other intracellular minerals were not significantly changed in sublingual tissue as measured with the EXA-test.

Plasma concentrations of potassium, calcium, iron, copper, and zinc were within the normal range and not significantly influenced by the supplementation. Plasma magnesium was slightly reduced after the supplementation (-3%, $p < 0.05$).

The results show that a disturbed acid-base balance may contribute to the symptoms of low back pain. The simple and safe addition of an alkaline multimineral preparate was able to reduce the pain symptoms in these patients with chronic low back pain.

