Acid / Alkaline Water Ionizers
A Perspective from Custom Pure-the water store
Seattle, Washington

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Introduction

Anyone who has been approached by someone selling water ionizers wants more information. Could the claims being made possibly be true? Is this a scam? The internet is often the first place people turn to for research, but there one finds two extremes: people either trying to sell a particular brand of machine, or denouncing it as a fraud with no evidence of even having used a water ionizer. So what is one to believe? We decided it was time to investigate more deeply. Our primary motivation for this endeavor was to help us decide if we should add an ionizing machine to our product line. After all, our own customers were asking us about the technology.

We bought an ionizer and set out to test it for ourselves. We reviewed promotional DVDs; researched textbooks on water chemistry, biochemistry, and human physiology; and made use of professional consultations as well as information available on the internet. We found that much of the internet content was heavily biased, with minimal descriptions of the respective authors' backgrounds and frames of reference. With that in mind, we commence with sharing information about our background.

Our background and frame of reference

As of 2010, our combined experience in the water treatment field encompasses 49 years. Jim's background is in chemistry. He holds a Ph.D. in Polymer Chemistry and a Masters degree in Air and Water Resources. Jim started Custom Pure-the water store in 1981. He is our technical expert in all things water and how to treat it.

Pat's background includes a career in healthcare as an occupational therapist followed by more than 20 years of experience in water treatment. She holds a Masters degree in Business Administration and is our expert in marketing and sales. Both Pat and Jim have earned certifications as Certified Water Specialists through the Water Quality Association as well as certifications in four specialty areas (filtration, ion exchange, reverse osmosis, and ultra violet sterilization). We are proponents of alternative health methods and we believe in the importance of each person being responsible for their own health. We have an open mind to new ideas about maintaining one's health.

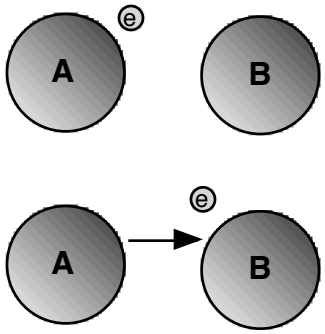
It is our intent here to provide our readers with an objective, balanced critique of water ionizing technology and the promoted claims. We present information about water chemistry, biochemistry, and human physiology that is often overlooked in the sales presentations. We also provide insight into the sales and marketing practices, and point out the misleading presentations used to sell water ionizers. But first we will clarify some essential terminology.

Terminology

The two measurements of water that are used to evaluate the effectiveness of these machines are pH and ORP.

What is pH? It is an acid–alkaline scale that ranges from 0 to 14. The neutral point is 7. Less than 7 is acidic and greater than 7 is alkaline. When we measure pH we are actually measuring the amount of hydrogen ions present in the water. Acid pH refers to the amount of hydrogen ions in the water, while alkaline pH refers to compounds that like to bond with the hydrogen and thereby remove it from its ionic state. The pH is an exponential function. A pH of 10 is ten times as alkaline as a pH of 9 and one hundred times as alkaline as a pH of 8, and so on. The EPA-established acceptable pH limits for public water supplies are between 6.5 and 8.5. These limits are primarily a means of corrosion control and are intended to limit contamination of the water by the plumbing.

What is ORP? This acronym stands for Oxidation Reduction Potential. When molecules come near each other some will have an extra electron they are willing to "give up" and others will be short an electron and try to take one from a neighboring molecule. Whenever there is oxidation there is also reduction, so there is an equation with oxidation on one side and reduction on the other. When a molecule gives up an electron that molecule is being oxidized. On the other side of the equation, when a molecule takes an electron it is being reduced. The measurement of ORP is actually measuring the millivolts of the water that are created by molecules looking to take electrons and by molecules looking to donate electrons. Positive ORP indicates the potential for more molecules eager to take an electron than molecules eager to give an electron. In traditional water treatment, the positive ORP measurement can indicate the oxidizing power of the chlorine in the water.



Molecule A becomes oxidized. It is a reducer or antioxidant because it gives an electron to molecule B.

Molecule B becomes reduced. It is an oxidizer because it takes an electron from molecule A.

A negative ORP reading indicates that there are more molecules eager to give up an electron and become oxidized than the other way around. These molecules are antioxidants because they are disarming the oxidizing molecule by giving them what they want, which is another electron. It is theorized that the health effect of antioxidant molecules is their ability to protect the body's tissues from being oxidized, sacrificing themselves by giving up the electron to the oxidizer.

What these machines do

For testing purposes we purchased a particular water ionizer made by Jupiter Science®, the Melody® model, and our observations of this technology are based on our experiences with this machine. Other machines vary somewhat, but the basic technology is the same for all of the water ionizers. It is beyond the scope of this paper to compare one water ionizer with another.

Water ionizers provide some minimal pre-filtration for chlorine removal. Jupiter Science's manual states that its pre-filter also contains a substance called tourmaline that is able to produce a negative ORP in the water even before it is treated electrically for the pH concentration. The manual for the LeveLuk model made by Enagic® (its alkaline water is called Kangen® water) states they use a liquid "electrolysis enhancer," although they don't specify what it contains. Enagic® also uses glycerophosphoric acid calcium in order to increase the pH concentration. Other manufactures may have slightly different means of pre-treating the water. However, none of the built-in filters are capable of removing all the contaminants in the water. Many of our customers are concerned about fluoride in the water and these machines are not capable of removing fluoride.

Once the water has passed through the built in pre-filter, it is exposed to electrically charged metal plates, the water is split into two streams and, in theory, the positively charged ions are drawn to the alkaline or high pH stream and the negatively charged ions are drawn to the acidic or low pH stream.

Water ionizers are also able to produce a negative ORP in the alkaline stream. There are more negatively charged ions than positively charged ions in the alkaline stream and this concentration leads to negative ORP reading.

Observations on using the ionizer

After the sales presentation (whether in person or online), it is easy for one to focus more on the water and less on what it is going to be like to actually use the machine. We wanted to find out

what variables influence the effectiveness of the machines and the water produced. We tested the machine on different sources of water, measured the influence of flow rate, measured the amount and pH of the wastewater, and retested water that had been stored over time. We limited our pH tests to the alkaline water because most people's interest in water ionizers is based on the anticipated effects of drinking the alkaline water.

Influence of feed water quality. Like any other water treatment equipment, a water ionizer will function differently on different water supplies. We tested the equipment using two water sources, with conductivity readings of 62 micromhos (low-mineral-content water from Seattle's surface water system) and 549 micromhos (high-mineral-content water from Cape George's community well system). We also tested the equipment using Seattle tap water that had been pretreated with our MB Series filter (to remove all contaminants) and then remineralized. We found that the more minerals present in the feed water, the higher the pH in the alkaline stream. We also found that a higher pH does not necessarily result in a lower negative ORP. We suspect that the lower negative ORP of the high-mineral-content water is due to the different types of minerals present in that feed water.

Source water	**Feed water conductivity**	**Alkaline stream**	
		pH	**ORP**
Seattle tap	62 micromhos	9.5	-206
Alkaline stream from Seattle tap w/ MB filtration & remineralization	86 micromhos	10.4	-175
Alkaline stream from Cape George tap	549 micromhos	10.4	-447

Influence of flow rate. These machines allow you to select the desired pH range. However, when used on water with a low mineral content, in order to get the higher pH one also needs to reduce the flow rate. With Seattle water we found it necessary to bring the flow rate down to about a half-quart per minute in order to get a pH of 10. Understandably, this could pose a problem for some users who might become a bit impatient waiting for their glass to fill so slowly. The temptation will be to either increase the flow rate (which will decrease the pH) or walk away while the machine is on, resulting in an overflow, wasted water, and possibly even floor damage.

Wastewater produced. Unless one captures all of the water produced by the alkaline and acid streams, these machines do produce wastewater. While producing the alkaline water, two-thirds of the water will come out of the metal alkaline dispensing tube, while at the same time one-third will come out of the acid hose (the secondary hose). The manufacturers do offer a number uses for the acid water, but how likely is it that a person would need the large amount of acid water produced? How many containers of acid water would someone be willing to store? Most people will let the acid “wastewater” go down the drain. The manufacturers have been clever in designing the acid (or waste) line to be a flexible plastic tube that is draped inconspicuously in the back corner of the sink. After a while one doesn't even notice the acid water going down the drain while the alkaline water is being produced. They may call it acid water, but for most people, this *is* wastewater. It is corrosive and over time will cause damage to the plumbing. Municipalities set the pH limits of substances that can legally be put into the sewer. In our city (Shoreline), substances released into the drain must have a pH between 5.5 and 11.5. Acid wastewater produced by water ionizers can

easily violate this rule, resulting in plumbing weakened by corrosion.

Unstable ORP. We stored some high-alkaline/negative-ORP water in a glass bottle and periodically checked the pH and ORP. We found the pH to be relatively stable but the ORP drifted toward the positive numbers over time. In just one day the ORP changed from -210 to -167. In 13 days the ORP was already at +102. This indicates that the transfer of electrons from molecule to molecule, in order to seek equilibrium, happens on a continuous basis. Storing negative ORP water is ineffective.

Constituents of the acid and alkaline streams. We collected water samples from both the acid and alkaline streams and took them to a third-party laboratory to analyze the concentrations of calcium and fluoride. These elements were chosen to represent positively charged ions (calcium) and negatively charged ions (fluoride). We discovered that the positively charged ions were concentrated in the alkaline stream but also present in the acid stream. The negatively charged ions were concentrated in the acid stream but also present in the alkaline stream. Based on our analysis, the following table represents what one might expect to find in the alkaline and acid streams (assuming these contaminants are in the feed water).

Acid Stream	**Alkaline Stream**
Some Calcium	Concentrated Calcium
Some Magnesium	Concentrated Magnesium
Some Sodium	Concentrated Sodium
Some Lead	Concentrated Lead
Some Copper	Concentrated Copper
Concentrated Fluoride	Some Fluoride
Concentrated Carbonate	Some Carbonate
Concentrated Sulfate	Some Sulfate
Concentrated Chloride	Some Chloride
Concentrated Nitrate	Some Nitrate
Concentrated Arsenic	Some Arsenic

Recommendations. We recommend that people do not rely on a water ionizer alone to provide themselves with all the healthful minerals people need, nor should they rely on one of these machines to remove all the fluoride from their water. The type and concentration of minerals present in water varies widely. No single source will contain all the minerals one needs. The first and best source for minerals is fruits and vegetables. We recommend taking mineral supplements as well. We also recommend pre-treatment of water in order to remove fluoride and other undesirable contaminants before it passes through a water ionizer (note that this level of pre-treatment necessitates remineralizing the water before it can be ionized by the machine).

Marketing – the art of persuasion

Most of the "buzz" created about these machines comes from multilevel marketing (MLM) organizations. When the economy is in a major downward turn, activity in multilevel sales is on the rise. MLM was very strong in the early 1980s and has been strong again since the economic recession of 2008. People from all walks of life, finding themselves unemployed and seeking some means of income, can become seduced by the promise of very high profits and the prospect of being their own boss. But the only real information sales people are given is how to sell the

machine. Usually they have no background in water chemistry, biochemistry, or human physiology. We found their information about the machines and the impact of alkalized water on the body almost invariably comes from other people selling the machines, not from independent sources. This is how myths and misinformation are perpetuated and presented as truth.

The programs designed to sell these machines are colorful, impressive, and powerful. But they are also deceptive, and many of the claims they make are not backed by science. The product may have some benefits, but the sales methods used place them under a shadow of doubt. After seeing numerous presentations for water ionizers we researched the science from unbiased sources and have identified five major areas of deception.

pH color-drop test. A pH test using color drops is a visually impressive demonstration and inexpensive—only ten dollars for a small bottle. The reagent changes color when placed in water with yellow–orange indicating acid water, green representing a neutral pH, and purple indicating alkaline water. This method is easy to use and quickly brings people to the booth at a trade show. But it isn't an accurate way of measuring the pH of all types of water.

The most accurate method of testing the pH of water is electronically. This method provides a digital pH reading and should have an automatic temperature adjustment. A high-quality electronic meter that measures both pH and ORP costs about $1000 and requires proper calibration each time it is used. The electronic probe needs to be properly stored to prevent costly repair or replacement. It is understandable that the pH color-drop test is preferred when the more accurate method costs significantly more and is complicated to use.

We compared the accuracy of the color-drop method with the electronic method and found that when the water has minerals and carbonates present the two methods produce reasonably similar results. However, when compared using pure water that has no minerals or carbonates present the two methods produce very different results.

pH test data

Brand tested	**Conductivity**	**pH by meter**	**pH by drops**
Mineral water			
Arrowhead	455 um	7.58	7.5
Talking Rain	346 um	6.95	7.0
Low-to-no mineral water			
Aqua Fina	6 um	6.8	4.5
Custom Pure	0.8 um	7.4	4.0

Using a pure water sample the color-drop method produces an orange color, seeming to indicate a pH of 4. Yet the electronic meter will show a pH reading of 7.4. This is not a simple three-point discrepancy. Because the pH scale is a logarithmic scale the difference between a pH of 4 and 7 represents a 1000-fold disparity between the two testing methods.

Further investigation showed that pH drops themselves contain three chemicals that selectively react to hydroxides, carbonates, and bicarbonates.[1] If these substances are in the water, the reagent will react to them, causing the water to change colors. Pure water does not contain these substances, leaving nothing for the reagent to react to. The orange color you see is the color of the reagent itself. The next time you see this demonstration, notice that the color of the reagent is orange.

When put into *pure water*, you are seeing the diluted color of the reagent itself, not a representation of pH.

Admittedly, it is difficult to accurately measure the pH of pure water because there are no buffers present in the water to stabilize the pH. When pure water is exposed to the air it quickly absorbs carbon dioxide which becomes carbonic acid. In the body, carbonic acid dissociates and becomes water and carbon dioxide. If needed, our body will use the carbon dioxide as a pH blood buffer; if not needed, it sends it to the lungs from where we exhale the carbon dioxide. The weak acid from pure water does not produce a problem with our metabolism because we exhale it so readily.

Micro-clustering. Promoters of water ionizers claim that through their machines the water is "micro-clustered" and this enables it to enter the body's cells more readily. They define micro-clustered water as having 5 to 6 molecules per cluster, whereas tap water has 10 to 13.[2] The promoters claim that due to its smaller clusters, the body "hydrates faster" with ionized alkaline water. That is a tough one to demonstrate at a trade show or on a video. So they use a tea bag and ask for a major leap of faith. One tea bag is placed into a clear glass of room-temperature, ionized alkaline water, and another into a clear glass of room-temperature tap water. The demonstrator points out that while the tap water remains clear, the ionized alkaline water quickly takes on the tea color. The unwary prospective buyer might be impressed, but this is a sales demonstration, not a test for micro-clustering of water molecules. We tried another test, again using two types of water: alkaline water from the ionizer and tap water filtered through our MB Series filtration system followed by a remineralizing filter. Both waters had a pH of 10 and both produced a room-temperature cup of tea at the same speed. The tea bag test is a demonstration that tea is more soluble in water with a high pH, not a demonstration of micro-clustering of water molecules.

A brief elaboration is necessary. H. Hayashi, M.D., Director of the Water Institute of Japan and a promotor of water ionizing technology, reports that nuclear magnetic resonance analysis does show that water coming from an ionizer has smaller clusters than tap water or well water.[3] But this claim brings up more questions; for example, what were the properties of the tap and well water being examined? A description of the chemical make-up of the waters tested would have been useful. Also, what were the pH and ORP of the waters tested? Did Hayashi also test water purified by reverse osmosis, distillation or ion exchange? In any case, this test does not demonstrate that this water *hydrates* a body any faster than any other type of water, and even if it did, how much "faster,"and to what effect?

Research into how our bodies become hydrated makes no mention of the size of water clusters. Water is allowed to move through membranes as a result of pressure variants. Sodium is the key component for getting water to pass between interstitial and intracellular spaces. A drop in sodium concentration results in a drop in interstitial fluid colloid osmotic pressure, and this is what allows water to pass through a membrane.[4] People who drink ample amounts of water will also have appropriate blood volume, which impacts the pressure variants and results in water getting through cellular membranes faster.[5]

Scare tactics. People who write advertising copy attempt to illicit an emotional response from the reader. Advertisers usually give very little technical information about a product and instead try to invoke a feeling. The technical information will be found on a "spec. sheet," not in the advertising found in the glossy brochure or on the web site.

In connection with the selling of anything it is important to look at the advertising as well as product demonstrations with a critical eye and ear and to pay attention to the words used. Regarding the selling of water ionizers, alarming words intended to be absorbed subconsciously are sometimes used to describe perfectly natural digestive processes in the body. For example, words like *toxic, poison, fight, dangerous, steal,* and *erode* are all words used to instill fear. One starts wondering if there is an acid-alkaline imbalance or, worse yet, a war going on inside. The marketers are counting on you to calm the fear (they created) by purchasing a water ionizer, just to be on the safe side.

Evidence of health benefits. There are three ways to describe the health benefits of any modality: through anecdotal accounts, case studies, and experiments. Specifically pertaining to ionized water (acid or alkaline), anecdotal accounts, and case studies describe one person's condition prior to and after using this water. There is no comparison to a control group. An anecdotal account tends to describe personal experiences, and a case study contains observations and interpretations by a clinician. Experiments, on the other hand, test multiple subjects (the larger the sampling pool the better) and use a control group in order to compare observations between the various groups being tested. The best experiments are designed to rule out variables that may also influence the outcome. Anecdotal accounts and case studies are limited by their small size. They examine only one person at a time, don't take the placebo effect into consideration, and also tend not to consider other influential variables such as diet or exercise changes the person makes in his or her life.

Promoters of water ionizers mostly use anecdotal evidence to describe the health benefits of their product. These personal stories add a friendly, inspiring touch. Of course it is important to realize that we are not told the personal stories about when the machine was of no help. We have learned from some of our customers that their purchase and use of an ionizer had no impact on the ailment that prompted them to buy it in the first place. Pat Fox (co-author) drank ionized-alkaline water for two months, being careful to drink the same amount she was accustomed to drinking before the test period (to rule out the variable of water volume consumed). She did experience some negative health effects during the test period but is not willing to blame them on the water. Her conclusion is that she did not notice any health improvements or changes in well-being.

When asked for better evidence, the promoters often claim the clinical studies conducted in Japan and Korea contain the proof we are looking for. Most of the research on the health benefits of the acid or alkaline water from ionizers is being done in these two countries because most of the machines are manufactured there. Clearly, not all of the studies have been translated into English, but there are a few websites promoting water ionizers that do publish some translated studies.[6] We also looked for clinical studies from an unbiased source (pubmed.org) and found some abstracts of studies carried out in many countries—curiously, none of them in the U.S.

We found a common pattern in the clinical studies on alkaline/negative-ORP water. All of them described the control groups' water as “tap” or “clean.” There was never an adequate description of this water that would have helped rule out any other variables. For instance, was the control water chlorinated? If it was, then perhaps the control group drank less water because of poor taste. Did the control water and test water differ in other ways? The most glaring omission in all of the test reports we read was the failure to acknowledge the importance of the volume of water consumed. None of the studies described how much water the test subjects drank before or during the particular test, or whether there was a difference in consumption between the control groups and the test groups.

All of the clinical studies we read ignore the basic value of water itself. Their entire focus is on the characteristics of the test water. Many of the health claims made for drinking alkaline water are

identical to the claims made for simply drinking more water. Batmanghledje theorizes that many common ailments are basically owing to chronic dehydration. In his seminal book, *Your Bodies Many Cries for Water,* he describes the physiology of ailments such as ulcers, asthma, headaches, high cholesterol and pain, explaining how, in the early stages, these are actually symptoms of regional dehydration.[7] He recommends drinking one-half ounce of water for every pound of body weight daily as a minimum for optimal health.[8] For many people, this amounts to between two and three quarts per day. He also doesn't specify any particular type of water. He is not selling a machine, a filter, or water; he just recommends drinking *more* water for better health.[9] Patton and Thibodeau also report on the symptoms of inadequate hydration. They write, "Fluid volume deficits cause low blood pressure, low cardiac output, electrolyte disturbances, or acid base abnormalities."[10] Clearly the volume of water the test subjects consume is of vital importance, yet none of the studies mention the amount of water consumed before or during the test period. So the question remains, what caused the difference between the control group and the test group? Was it the pH, the negative ORP, the minerals, the volume of water consumed, some combination of these, or something else?

Facts of biochemistry and human physiology. The presentations that are used to sell these machines lead the viewer to believe that if one drinks alkaline water it will neutralize the acid in our bodies. This ignores well-known facts concerning pH buffers and how water gets moved around the body. The presentations we saw also misuse medical terminology and inaccurately describe the cause of an acid imbalance in and around cells. Let's review some essential facts about the human body.

1. The body's buffering system keeps the blood pH within a very narrow range. The body has a very powerful buffering system that keeps blood pH between 7.35 and 7.45. As Patton and Thibodeau point out, "A buffer is a substance that prevents marked changes in the pH of a solution when an acid or base is added to it. They don't prevent changes in pH but they do minimize them."[11] The pH of the blood is dependent on the ratio of carbon dioxide to bicarbonates. If the pH drifts below 7.4 (slightly more acidic), the body produces bicarbonates (more alkalinity) and/or expels carbon dioxide (less acid) through the lungs in order to restore the pH balance. Conversely, if the pH drifts to the alkaline side, above 7.4, the body produces carbon dioxide (more acid) or removes bicarbonates (less alkalinity) via the kidneys and restores the pH balance.

2. Water gets to the cells and interstitial fluid via the blood stream. We give our bodies water through what we eat and drink, and the water is moved around the body via the blood stream.[12] The pH of the water is adjusted by the body's buffering system in order to keep the blood pH within its narrow healthy range. The pH of the water one drinks will not be the same pH as the water within the cells and surrounding fluid. The pH of water is changed in the stomach, again in the small intestine, again when it is in the blood stream, and once again when it is in the cells and surrounding fluid. The pH of the water one drinks has no effect on the pH of the water once it is inside the body and passing through membranes because the buffering system alters it.

3. Acidosis is not caused by eating and drinking common foods, even if unhealthful. In medical terms, the condition of acidosis occurs when the blood pH is slightly below 7.35. This happens when the body's buffering system is overwhelmed with a strong acid such as antifreeze or a large dose of aspirin. Acidosis can also be caused by poorly controlled type 1 diabetes. Respiratory acidosis is present when the lungs are not able to expel the CO_2. This condition is often caused by emphysema, severe pneumonia, or slowed breathing due to over sedation. Death can occur when blood pH drops below 6.8.[13] Drinking alkaline water would have no effect on this life-threatening condition. Generally, the promoters of water ionizers incorrectly use "acidosis" to

describe the build up of acid waste products in and around cells.

4. Alkalosis is not caused by drinking too much alkaline water. Just as acidosis cannot be corrected by drinking alkaline water, alkalosis cannot be produced by drinking alkaline water. This condition of the blood pH being greater than 7.45 can be caused by prolonged vomiting (loss of acid), excessive loss of sodium or potassium due to overactive adrenal glands, or use of diuretics. Death can occur when blood pH exceeds 7.8.[14] One cannot produce this condition by drinking alkaline water or correct it by drinking acidic water.

5. The pH levels inside cells and in the interstitial fluid is a product of metabolism. According to Patton and Thibodeau, "Extremely high protein diets that produce a predominantly acid mineral residue when metabolized may tax the body's ability to remain in acid-base balance if consumed over prolonged periods."[15] Fluid volume deficits can also cause acid-base abnormalities.[16] The wide range of biochemical processes that occur in and around cells produces different pH values in different types of cells, not the pH of the water we drink.

Summary

Now that we have personally used a water ionizer, created our own experiments, and researched alternative sources for unbiased facts, let us examine some of the claims being made and see how they measure up.

"Alkaline water is the most healthful water to drink." Probably not. None of the studies we reviewed considered the value of the volume of water consumed. We all know that drinking plenty of water is "good for us." It has not been proven that drinking alkaline water makes people healthier. (Refer to the section titled "Evidence of health benefits" beginning on page 8; also see #1 under "Facts of biochemistry and human physiology" on page 9).

"Acid water is good for skin care, dental care, and sanitizing hard surfaces." Yes. Acidic water with a positive ORP will have oxidizers present which can be effective in controlling bacteria. There are a number of valid scientific studies supporting this claim.[17]

"*Negative-ORP alkaline water is a good source for antioxidants."* Possibly. Our tests have shown that the water ionizers do indeed produce a negative ORP. It seems reasonable that if a positive number reflects the potential for oxidation, then a negative number would represent the potential for antioxidants. However, in an article by Fusco et al. concerning the effects of antioxidant supplementation on the aging process, the authors concluded that "major limitations in literature still need to be addressed to better evaluate the potential benefits from antioxidant supplementation"[18]. Much is not yet understood about antioxidants and how they are best assimilated. The authors remind us that "it may be that only particular antioxidants (possibly in combination with others) might exert protective effects on clinical or biological conditions or that only specific populations might benefit from antioxidant supplementation (i.e. only subjects with low antioxidant and/or high oxidative stress levels)."[19]

"*Oxygenates the water."* No. This process does not add oxygen to the water. This term may be getting confused with oxidation. Originally, oxidation meant the addition of oxygen to a compound. Now the term refers to the removal of an electron from a molecule, resulting in either the increase of a positive valence or a decrease of a negative valence.[20] Oxygen is not adde to the water.

"*Washes acid wastes from the body.*" Any water will do the same. Helping the body eliminate waste is a function of the water itself, not its pH, ORP, or size of the water molecule (see #2 under "Facts of biochemistry and human physiology,"on page 9).

"*Micro-clustered water hydrates one faster.*" Not true. There is simply no credible evidence for the claim that micro-clustered water hydrates one faster (see "Micro-clustering" on page 7, which comes under the heading "Marketing – the art of persuasion").

"*Helps with acid alkaline imbalance.*" It has not been proven that the unique characteristics of this water improve the acid-alkaline imbalance (see "Facts of biochemistry and human physiology" beginning on page 9). However, a greater volume of water (of any kind) does help remove acid waste from cells.[21]

Conclusion

The single unique feature we can acknowledge about the water ionizer is they do produce what appears to be water with antioxidants, as evidenced by the negative ORP readings on the alkaline water. We have not, however, seen any clinical studies that specifically demonstrate the effectiveness of antioxidants in water. Of course, there are numerous reports concerning the importance of antioxidants in one's diet, but these generally refer to the antioxidants present in our food.

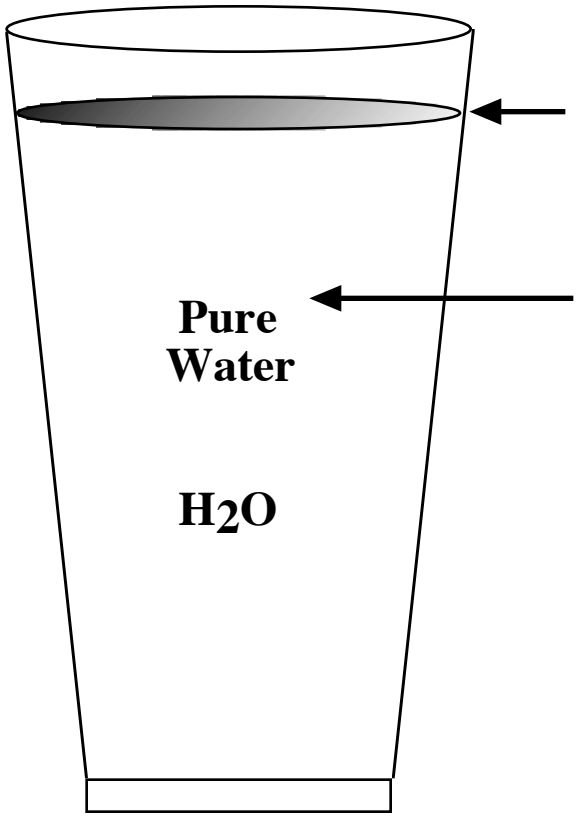
Some foods that naturally contain lots of antioxidants are beans (black, kidney, pinto, red), berries (blueberry, cranberry, blackberry, strawberry, rasberry), as well as apples, cherries, plums , artichokes, potatoes, pecans, and prunes. On the other hand, there is some research showing that even though a particular food may have lots of antioxidants they may not be easily absorbed.[22] More research is needed to better understand how well antioxidants from food are absorbed once the food has gone through the digestion process. The same holds true for antioxidants purported to be in water.

The importance of the pH of the water has been overemphasized in the sales presentations for these machines. Since the clinical studies we consulted have not taken into account the value of the volume of water consumed, we have seen no proof that drinking ionized alkaline water is any better for one's health than drinking neutral or slightly acidic water. Studies of physiology clearly point out that the body's buffering system is well equipped to adjust the pH of substances we ingest in order to keep our blood pH within its proper range.

One's diet is the cause for any acid-alkaline imbalance that may exist. Some foods produce acid waste when metabolized, while others produce alkaline waste when metabolized. The typical Western diet seems to be the main culprit in acid production. If one eats a lot of meat and dairy products, which produce acid waste in the body, it is also important to eat lots of green leafy vegetables, which tend to produce alkaline waste. If we eat both, the waste products in our cells will tend to be better balanced. Acid or alkaline, cellular waste products are removed by water.

Our bodies consist of 60-85 percent water. This incredible substance has a myriad of functions in the body. A glass of water contains *mostly* water; the impurities are dispersed throughout. The diagram on the next page illustrates the proportion of water compared to the "stuff in the water." Another way to look at the proportion of water to the "stuff in it" is the measure of total dissolved solids (TDS). If water with a TDS of 60 ppm (parts per million) is represented by one million buckets of water, only 60 buckets would contain "stuff" (things other than water). The remaining

999,940 buckets would be pure water. The water itself, regardless of its pH, ORP, or what is dissolved in it, plays a huge role in ones health and the maintenance of life itself. The body can make use of nutrients, oxygen, minerals, and carbonates because of *water*.



Stuff in the water
Shaded area represents disinfectants, minerals, carbonates and sediment

Functions of pure water
(area not shaded)
Delivers nutrients and oxygen to the cells
Removes waste products from cells
Provides proper environment for cells
Facilitates chemical reactions
Regulates body temperature
Lubricates joints
Dissolves minerals and nutrients to aide in assimilation
Helps prevent constipation
Protects body organs and tissues
Moistens tissues (mouth, eyes and nose) [23,24]

Regardless of the specific health improvements one may be seeking, we continue to stand by common sense health habits, namely: (1) eat a healthy, well balanced diet full of fruits and vegetables (for the vitamins, minerals, and antioxidants your body can most easily assimilate); (2) take mineral supplements to insure one is getting all the minerals needed and in the right concentrations; supplements can provide some peace of mind since our diets are not always well balanced and water is a poor source for all the minerals one needs; (3) get plenty of exercise; and (4) drink plenty of water (perhaps as much as two to three quarts a day) in order to prevent chronic dehydration, and if one's water contains unwanted impurities or tastes bad, consider getting a filter so the amount one drinks won't be limited by the quality of the water.

If one is still intent on purchasing a water ionizer after reading this report, we recommend asking the sales person two questions: (1) How long have you been selling these machines? and (2) What was your occupation before you started selling these? Then the question becomes "Does this person have enough technical background and experience to give me factual, unbiased information to help me make my decision?" Promoters may be well-meaning but if all of their information is coming from the selling organization, prospective buyers are probably not getting all the facts.

Notes

1. F. Joseph Harrison and Wes McGowan, *WQA Glossary of Terms* (Lisle, Illinois: Water Quality Association, 1993), p. 4.

2. Hidemitsu Hayashi, "Benefits of Alkaline, Ionized Water," www.ionizers.org/water/html (accessed May 18, 2010).

3. Ibid.

4. Kevin T. Patton and Gary A. Thibodeau, *Anatomy & Physiology,* 7th Edition (St. Louis: Mosby, 2010), p. 993.

5. F. Batmanghledje, *Your Body's Many Cries for Water: You're not sick; you're thirsty; don't treat thirst with medication* (Falls Church, Virginia: Global Health Solutions, Inc., 2008), p. 77.

6. See "Clinical Studies of Alkaline Water," www.waterforlifeusa.com/resources/clinical-studies-of-alkaline-water (accessed Sept.19, 2009).

7. Batmanghledje, p.4.

8. Ibid, p. 135.

9. Ibid, p. 138.

10. Patton and Thibodeau (as per note 4), p. 995.

11. Ibid, p. 1004.

12. Ibid, p. 985.

13. James L. Lewis III, "Acidosis," *Merck Manuals Online Medical Library,* revised July 2008, http://www.merck.com/mmhe/sec12/ch159/ch159b.html (accessed April 5, 2010).

14. Ibid., http://www.merck.com/mmhe/sec12/ch159/ch159c.html (accessed April 5, 2010).

15. Patton and Thibodeau (as per note 4), p. 1003.

16. Ibid., p. 995.

17. See K. A. Fabrizio et al., "Comparison of Electrolyzed Oxidizing Water with Various Antimicrobial Interventions to Reduce Salmonella Species on Poultry," *Poultry Science* 81(10) (Oct. 2002): 1598–605; "Treatment of Escherichia coli (0157:H7) inoculated alfalfa seeds and sprouts with electrolyzed oxidizing water," Department of Agricultural and Biological Engineering, Pennsylvania State University, University Park, Pennsylvania, *International Journal of Food Microbiology* 86(3) (Sept. 15, 2003): 231–7; K. S. Venkitanarayanan et al., "Inactivation of Escherichia coli (0157:H7) and Listeria monocytogenes on plastic kitchen cutting boards by electrolyzed oxidizing water," Department of Animal Science, University of Connecticut at Storrs; N. V. Vorobjeva et al., "The bactericidal effects of electrolyzed oxidizing water on bacterial strains involved in hospital infections," *Artificial Organs* 28(6) (June 2004): 590–2; and H. Xin et al., "Effect of electrolyzed oxidizing water and hydrocolloid occlussive dressings on excised burn-wounds in rats." *Chinese Journal of Traumatology* 6(4) (Aug. 1, 2003): 234–7.

18. Domenico Fusco et al., "Effects of Antioxidant Supplementation on the Aging Process," www.ncbi.nlm.nih.gov/pmc/articles/PMC2685276 (*Clinical Interventions on Aging* 2[3] [September 2007]).

19. Ibid.

20. F. Joseph Harrison, *Water Treatment Fundamentals* (Lisle, Illinois: Water Quality Association, 2004). p. 44.

21. Batmanghelidj (as per note 5), p. 22.

22. Jennifer Warner, "Antioxidant Riches Found in Unexpected Foods," http://www.webmd.com/food-recipes/news/20040617/antioxidants-found-unexpected-foods?page=2 (accessed May 10, 2010).

23. Mayo Clinic Medical Information and Tools for Healthy Living, "Dehydration" (Mayo Foundation for Medical Education and Research, 2010), http://www.mayoclinic.com/health/medical/IM02564 (accessed April 28, 2010)

24. Batmanghelidj, p.16.

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