**Understanding Alkaline Ionized Water**

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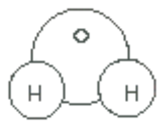
**http://heartspring.net/water_science.html**

The bodies of all living organisms are composed largely of water. About 70 to 90 percent of all organic matter is water.

The chemical reactions in all plants and animals that support life take place in a water medium. Water not only provides the medium to make these life sustaining reactions possible, but water Itself is often an important reactant or product of these reactions. In short, the chemistry of life is water chemistry.

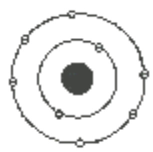
**Water, the universal solvent**

Water is a universal solvent due to the marked molecule and its tendency to form hydrogen bonds with other molecules. One water molecule, expressed with the chemical symbol H20, consists of 2 hydrogen atoms and 1 oxygen atom.



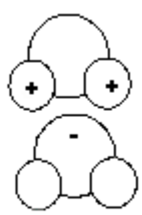

Water molecule

Standing alone, the hydrogen atom contains one positive proton at its core with one negative electron revolving around it in a three dimensional shell. Oxygen, on the other hand, contains 8 protons in its nucleus with 8 electrons revolving around it. This is often shown in chemical notation as the letter "0" surrounded by eight dots representing 4 sets of paired electrons.



Oxygen atom and its electrons

The single hydrogen electron and the 8 electrons of oxygen are the key to the chemistry of life because this is where hydrogen and oxygen atoms combine to form a water molecule, or split to form ions.




Polar attraction between water molecules

Hydrogen tends to ionize by losing its electron and form single H+ ions which are simply isolated protons since the hydrogen atom contains no neutrons. A hydrogen bond occurs when the electron of a single hydrogen atom is shared with another electronegative atom such as oxygen that lacks an electron.

In a water molecule, two hydrogen atoms are covalently bonded to the oxygen atom. But because the oxygen atom is larger than the hydrogen's, its attraction for the hydrogen's electrons is correspondingly greater so the electrons are drawn closer into the shell of the larger oxygen atom and away from the hydrogen shells. This means that although the water molecule as a whole Is stable, the greater mass of the oxygen nucleus tends to draw in all the electrons in the molecule including the shared hydrogen electrons giving the oxygen portions of the molecule a slight electronegative charge.

The shells of the hydrogen atoms, because their electrons are closer to the oxygen, take on a small electropositive charge. This means water molecules have a tendency to form weak bonds with other water molecules because the oxygen end of the molecule is negative and the hydrogen ends are positive.

A hydrogen atom, while remaining covalently bonded to the oxygen of its own molecule, can form a weak bond with the oxygen of another molecule. Similarly, the oxygen end of a molecule can form a weak attachment with the hydrogen ends of other molecules. Because water molecules have this polarity, water is a continuous chemical entity. These weak bonds play a crucial role in stabilizing the shape of many of the large molecules found in living matter. Because these bonds are weak, they are readily broken and reformed during normal physiological reactions. The disassembly and rearrangement of such weak bonds is in essence the chemistry of life.


To illustrate water's ability to break down other substances, consider the simple example of putting a small amount of salt in a glass of tap water. With dry salt (NaCI) the attraction between the electropositive sodium (Na+) and electronegative chlorine (Cl- ) atoms of salt is very strong until it is placed in water. After salt is placed in water, the attraction of the electronegative oxygen of the water molecule for the positively charged chloride Ions, and the similar attraction of the electropositive hydrogen ends of the water molecule for the negatively charged chloride ions, are greater than the mutual attraction between the outnumbered NA+ and CL ions. In water the ionic bonds of the sodium chloride molecule are broken easily because of the competitive action of the numerous water molecules.

As we can see from this simple example, even the delicate configuration of individual water molecules enables them to break relatively stronger bonds by conveying on them. This is why we call water the universal solvent. It is a natural solution that breaks down the bonds of larger, more complex molecules. This is the chemistry of life on earth in water and on land.

**Oxidation - reduction reactions**

Basically, reduction means the addition of an electron (e-), and its converse, oxidation means the removal of an electron. The addition of an electron, reduction, stores energy in the reduced compound. The removal of an electron, oxidation, liberates energy form the oxidized compound. Whenever one substance is reduced, another is oxidized. To clarify these terms, consider any two molecules, A and 9, for example:

| | | | | | | |
|---|---|---|---|---|---|---|
| Ae- | | B | | A | | Be– |
| Electron | + | Electron | - | Oxidized Reduced | + | Reduced |
| Donor | | Receptor | | (lost an electron) | | (Gained an electron) |

When molecules A and B come into contact, here is what happens:

- B grabs an electron from molecule A.
- Molecule A has been oxidized because it has lost an electron.
- The net charge of 8 has been reduced because it has gained a negative electron (e-).

In biological systems, removal or addition of an electron constitutes the most frequent mechanism of oxidation-reduction reactions. These oxidation-reduction reactions are frequently called redox reactions.

**Acid and Bases**

An acid is a substance that increases the concentration of hydrogen ions(H+) in water. A base is a substance that decreases the concentration of hydrogen ions, in other words, increasing the concentration of hydroxide ions OH-

. The degree of acidity or alkalinity of a solution is measured in terms of a value known as pH, which is the negative logarithm of the concentration of hydrogen ions:

**pH=1/log[H+] =-Iog[H+]**

**What is pH?**

On the pH scale, which ranges from 0 on the acidic end to 14 on the alkaline end, a solution is neutral if its pH is 7. At pH 7, water donations equal concentrations of H+ and OH- ions. Substances with a pH less than 7 are acidic because they contain a higher concentration of H+ ions. Substances with a pH higher than 7 are alkaline because they contain a higher concentration of OH- that H+. The pH scale is a log scale so a change of one pH unit means a tenfold change in the concentration of hydrogen ions.

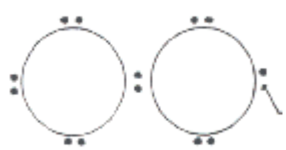
**Importance of balancing pH**

Living things are extremely sensitive to pH and function best (with certain exceptions, such as certain portions of the digestive tract) when solutions are nearly neutral. Most interior living matter (excluding the cell nucleus) has a pH of about 6.8. Blood plasma and other fluids that surround the cells in the body have a pH of 7.2 to 7.3. Numerous special mechanisms aid in stabilizing these fluids so that cells will not be subject to appreciable fluctuations in pH. Substances which serve as mechanisms to stabilize pH are called buffers. Buffers have the capacity to bond ions and remove them from solution whenever their concentration begins to rise. Conversely, buffers can release ions whenever their concentration begins to fall. Buffers thus help to minimize the fluctuations in pH. This is an important function because many biochemical reactions normally occurring in living organisms either release or use up ions.

## MICROWATER THEORY

**Why we get sick? - Oxygen: Too much of a good thing?**

Oxygen is essential to survival. It is relatively stable in the air, but when too much is absorbed into the body R can become active and unstable and has a tendency to attach itself to any biological molecule, includingmolecules of healthy cells. The chemical activity of these free radicals is due to one or more pairs of unpaired electrons. About 2% of oxygen we normally breathe becomes active oxygen, and this amount increases to approximately 20% with aerobic exercise.



**Superoxide an ion radical**

Such free radicals with unpaired electrons are unstable and have a high oxidation potential, which means they are capable of stealing electrons from other cells. This chemical mechanism is very useful in disinfectants such as hydrogen peroxide and ozone which can be used to sterilize wounds or medical instruments. Inside the body these free radicals are of great benefit due to their ability to attack and eliminate bacteria, virus and other waste products.

**Active oxygen in the body**

Problems arise, however, when too many of these free radicals are turned loose in the body where they can also damage normal tissue. Putrefaction sets in when microbes in the air invade the proteins,peptide, and amino acids of eggs, fish and meat. The result is an array of unpleasant substances such as:

- Hydrogen sulfide
- Ammonia
- Histamines
- Indoles
- Phenols
- Scatoles

These substances are also produced naturally in the digestive tract when we digest food, resulting in the unpleasant odor evidenced in feces. Putrefaction of spoiled food is caused by microbes in the air, this natural process is duplicated in the digestive tract by intestinal microbes. All these waste products of digestion are pathogenic, that is, they can cause disease in the body.

Hydrogen sulfide and ammonia are tissues toxins that can damage the liver. Histamines, contribute to allergic disorders such as a topic dermatitis, urticaria (hives) and asthma. Indoles and phenols are considered carcinogenic.

Because waste products such as hydrogen sulfide, ammonia,histamines, phenols and indoles are toxic, the body's defense mechanisms try to eliminate them by releasing neutrophils a (type ofleukocyte, or white corpuscle). These neutrophils produce active oxygen, oddball oxygen molecules that are capable of scavenging out and disintegrating tissues by gathering electrons from the molecules of toxic cells.

Problems arise, however, when too many of these active oxygen molecules, or free radicals, are produced in the body. They are extremely reactive and can also attach themselves to normal, healthy cells and damage them genetically. These active oxygen radicals steal electron from normal, health biological molecules. This electron theft by active oxygen oxidizes tissue and can cause disease.

| **Effects of Oxidation on Vital Organs** | |
|---|---|
| **Oxidized Tissue** | **Leads to:** |
| Liver | Hepatitis, cirrhosis, cancer |
| Pancreas | Pancreatitis, diabetes, cancer |
| Kidney | Nephritis, nephrosis, cancer |

Because active oxygen can damage normal tissue, it is essential to scavenge this active oxygen from the body before it can cause disintegration of healthy tissue. If we can find an effective method to block the oxidation of healthy tissue by active oxygen, then we can attempt to prevent disease.

| |
|---|
| Hydrogen sulfide, ammonia, histamines, indoles, phenols, and scatoles present in the digestive tract of the human body. |
| In order to protect the body from damage by hydrogen sulfide, ammonia, histamines, indoles, phenols and scatoles, neutrophils (leukocytes) produce active oxygen to oxidize these waste products. |
| Excess production of active oxygen occurs. |
| Excess active oxygen can damage normal, healthy biological cell molecules and alter their genetic codes. |

**Antioxidants block dangerous oxidation**

One way to protect healthy tissue from the ravages of oxidation caused by active oxygen is to provide free electrons to active oxygen radicals,thus neutralizing their high oxidation potential and preventing them from reacting with healthy tissue.

Research on the link between diet and cancer is far from complete, but some evidence indicates that what we eat may affect our susceptibility to cancer. Some foods seem to help defend against cancer, others appear to promote it.

Much of the damage caused by carcinogenic substances in food may come about because of an oxidation reaction in the cell. In this process,an oddball oxygen molecule may damage the cell's genetic code. Some researchers believe that substances that prevent oxidation - called ANTIOXIDANTS - can block the damage. This leads naturally to the theory that the intake of natural antioxidants could be an important aspect of the body's defense against cancer. Substances that some believe inhibit cancer include vitamin C, vitamin E, beta-caroteneselenium, and glutathione (an amino acid). These substances are reducing agents. They supply electrons to fee radicals and block the interaction of free radical with normal tissue.

**How we can avoid illness**

As we mentioned earlier, the presence of toxic waste products such as hydrogen sulfide. ammonia, histamines, indoles, phenols and scatoles impart an offensive odor to human feces. In the medical profession, it is well known that patients suffering from hepatitis and cirrhosis pass particularly odoriferous stools.

Excessively offensive stools caused by the presence of toxins are indicators of certain diseases, and the body responds to the presence of these toxins by producing neutrophil Ieukocytes to release active oxygen in an attempt to neutralize the damage to organs that can be caused by such waste products. But when an excess amount of such active oxygen is produced, it can damage healthy cells as well as neutralize toxins. This leads us to the conclusion that we can minimize the harmful effect of these active oxygen radicals by reducing them with an ample supply of electrons.

**Water - the natural solution**

There is no substitute for a healthy balanced diet, especially rich in antioxidant materials such as vitamin C, vitamin E, beta-carotene, and other foods that are good for us. However, these substances are not the best source of free electrons that can block the oxidation of healthy tissue by active oxygen.

Water treated by electrolysis to increase its reduction potential is the best solution to the problem of providing a safe source of free electrons to block the oxidation of normal tissue by free oxygen radicals. We believe that reduced water, water with an excess of free electrons to donate to active oxygen, is the best solution because:

- The reduction potential of water can be dramatically increased over other antioxidants in food or vitamin supplements.

- The molecule weight of reduced water is low, making it fast acting and able to reach all tissues of the body in a very short time.

Microwater is the product of mild electrolysis which takes place in the Microwater unit. The production of Microwater, its properties, and how it works in the human body are described in the next section. Microwater is treated tap water that has not only been filtered, but has also been reformed in that it provides reduced water with a large mass of electrons that can be donated to active oxygen in the body to block the oxidation of normal cells.

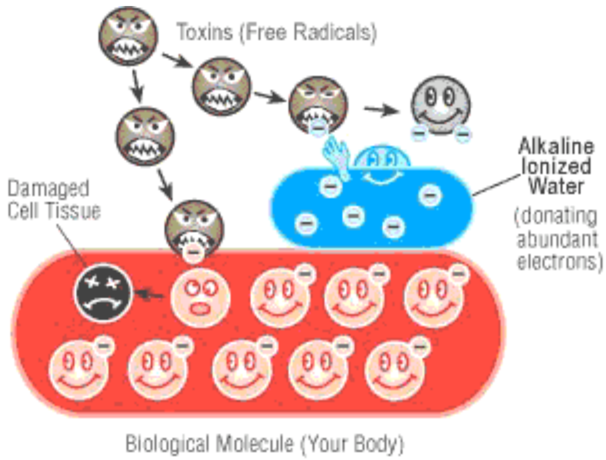
**Redox potential, not pH, is the crucial factor**

Traditionally we have judged the properties of water from the standpoint of pH, in other words whether water is acidic or alkaline. According to Dr.Yoshiaki Matsuo Ph.D., the inventor of the Microwater unit, "in my opinion, redox potential is more important than pH. The importance of pH is over emphasized. For example, the average pH of blood is 7.4 and acidosis or alkalosis are defined according to deviation within the range of 7.4 + -0.05. But nothing has been discussed about ORP, or oxidation-reduction potential."

The pH of tap water is about pH 7 or neutral. When tap water is electrolyzed into microwater, its reduced water has a pH of about 9 and the oxidized water a pH of about 4. Even if you make alkaline water of pH 9 by adding sodium hydroxide or make acidic water of pH 3 by adding hydrogen chloride, you will find very little change in the ORP values of the two waters. On the other hand, when you divide tap water with electrolysis you can see the ORP fluctuate by as much as + -1,000mV. By electrolysis we can obtain reduced water with negative potential that is good for the body.

**USING MICROWATER - What Microwater Does**

The microwater unit produces two kinds of water with different redox potentials, one with a high reduction potential and the other with a high oxidation potential.




**Reduced water**

When taken internally, the reduced microwater with its redox potential of-250 to -350 mV readily donates its electrons to oddball oxygen radicals and blocks the interaction of the active oxygen with normal molecules.

A biological molecule (BM) remains intact and undamaged.

**BM-e || MW-e + AO —> MW + AO-e**

Undamaged biological molecules are less susceptible to infection and disease. The microwater gives up an extra electron and reduces the active oxygen (AO), thus rendering it harmless. The AO is reduced without damaging surrounding biological molecules. Substances which have the ability to counteract active oxygen by supplying electrons are called scavengers. Reduced water, therefore, can be called scavenging water.

When taken internally, the effects of reduced water are immediate. Microwater inhibits excessive fermentation in the digestive tract by reducing indirectly metabolites such as hydrogen sulfide, ammonia,histamines, indoles, phenols and scatoles, resulting in a cleaner stool within days after reduced water is taken on a regular basis. In 1965 the Ministry of Welfare of Japan announced that reduced water obtained from electrolysis can prevent abnormal fermentation of intestinal microbes.

**Oxidized water**

Oxidized water with its redox potential of + 700 to + 800 mV is an oxidizing agent that can withdraw electrons from bacteria and kill them. The oxidized water from the Microwater unit can be used to clean hands,kitchen utensils, fresh vegetables and fruits, and to sterilize cutting boards and minor wounds. Tests have shown that oxidized water can be used effectively to treat athlete's foot, minor burns, insect bites,scratches, and so on.

Dr. Yoshiaki Matsuo, Vice Director of the Water Institute of Japan, has developed another apparatus capable of producing hyper-oxidized water with a redox potential of +1,050 mV or more and of pH lower than 2.7. Tests have shown that this hyper-oxidized water can quickly destroy MRSA (Methecillin Resistant Staphylococcus Aureus).

Although hyper-oxidized water is a powerful sterilizing agent, it won't harm the skin. In fact, it can be used to heal. Hyper-oxidized water has proven effective in Japanese hospitals in the treatment of bedsores and operative wounds with complicated infections.

But perhaps the most exciting future application of hyper-oxidized water is in the field of agriculture where it is has been used effectively on plants to kill fungi and other plant diseases. Hyper-oxidized water is non-toxic, so agricultural workers can apply it without wearing special protective equipment because there is no danger of skin or respiratory damage. An added benefit of using hyper-oxidized water to spray plants is that there is no danger to the environment caused by the accumulation of toxic chemicals in the ground.

**Microwater superior to antioxidant diet**

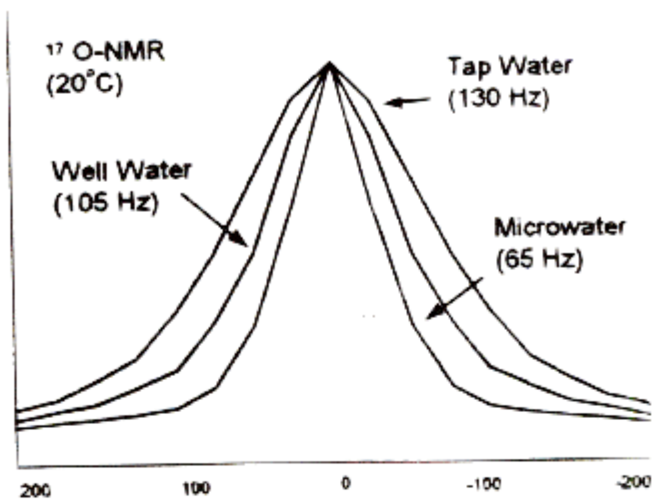
Today we read much about correct dieting principles and paying attention to what we eat in order to stay healthy. This is a sensible practice, but it is surprising that many of us don't realize that the bulk of what we eat is composed of water. Vegetables and fruits are 90% water; fish and meat are about 70% water as well.

Even advocates of the importance of vitamin C in diet staples have to admit that its potency, namely, the redox potential of this important vitamin, rapidly diminishes with age and preparation for the dining table. Carbohydrates, the main consistent of vegetables and fruit, has molecular weight of 180 whereas water has a much lower molecular weight of 18.

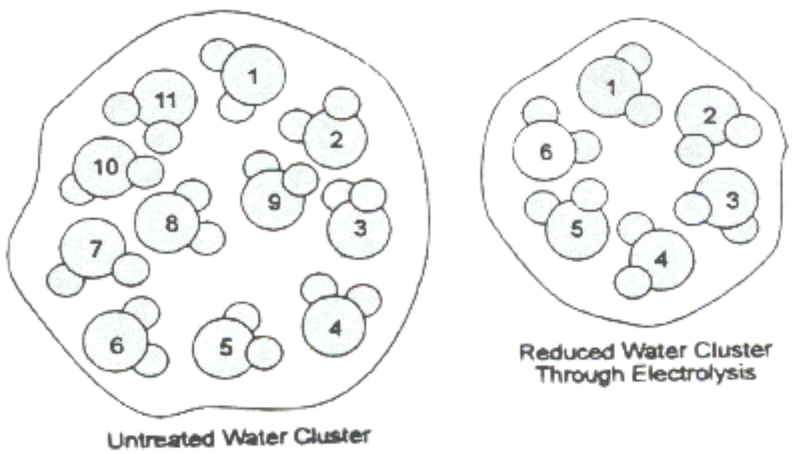
| **Molecular Weight Compared** | |
|---|---|
| **Substances** | **Molecular Weight** |
| Microwater | 18 |
| Beta-carotene | 150 |
| Vitamin E | 153 |
| Vitamin C | 176 |

Microwater, with its low molecular weight and high reduction potential,makes it a superior scavenging agent of active oxygen. But electrolysis inside the Microwater unit not only charges the reduced water with electrons, it also reduces the size of reduced water molecule clusters.

NMR (nuclear magnetic resonance) analysis reveals that tap water and well water consists of clusters of 10 to 13 H20 molecules. Electrolysis of water in the Microwater unit reduces these clusters to about half their normal size - 5 to 6 water molecules per cluster.




As the graph shows, the NMR signal that measures cluster size by line width at half-amplitude shows 65 Hz for reduced water and 133 Hz for tap water, revealing that the reduced water clusters are approximately half the size of tap water clusters.




This is why microwater is more readily absorbed by the body than untreated tap water. Microwater quickly permeates the body and blocks the oxidation of biological molecules by donating its abundant electrons to active oxygen, enabling biological molecules to replace themselves naturally without damage caused by oxidation that can cause diseases.

**Summary and Conclusions**

**Upstream and downstream theory - Prevent disease at the source**

According to Dr. Hidemitsu Hayashi, Director of the water Institute of Japan, "To eliminate the pollutants in a large stream that is contaminated as its source, we must work on the problem upstream at the headwaters - the source of the pollution - not downstream where we can only try to treat the evidence of damage caused by the pollution. Microwater's contribution to preventative medicine is essentially upstream treatment."

We consider the digestive tract upstream where we intake water and food. Although many people today in developed countries are growing more skeptical about what they eat, they tend to concentrate more on what the food contains rather than the metabolized products of foods in the digestive tract.

**Upstream**

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| Reduced water Indirectly reduces hydrogen sulfide, ammonia, histamines, indoles,phenols, and scatoles and changes them into harmless substances. |
| Defecation of cleaner stools. |

For example, consider the typical balanced diet of meat and vegetables. Meat protein is metabolized into amines while nitrates form fertilizers used to grow vegetables metabolize into nitrites in the digestive tract. These amines and nitrites combine to form nitrosamine, a recognized carcinogen.

Vegetables Meat

Nitrates Protein

Nitrites Amines

Nitrosamine (carcinogen)

We've already discussed that odoriferous feces are evidence of excessive fermentation in the digestive tract, so reduced water performs a very important function upstream in the digestive tract by reducing this excessive fermentation as evidence by cleaner stools within days of starting a steady regimen of reduced water.

**Downstream**

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|---|
| Reduced water supplies electrons to excess, active oxygen free radicals produced as a result of aerobic metabolism and reduces them,rendering them harmless. |
| The oxidation of normal, healthy cell molecules by active oxygen is blocked. The biological molecules remain intact. |
| Diseases linked to excessive oxidation of normal biological molecules are prevented. |

Downstream from the digestive tract, starting at the liver, reduced water quickly enters the liver and other organs due to, first, its lower molecular weight, and, secondly, the size of its clusters. At tissue sites throughout the body, reduced water with its safe, yet potent reduction potential readily donates its passenger electrons freely to active oxygen and neutralizes them so they cannot damage the molecules of healthy cells. Normal cells are protected from the electron thievery of active oxygen and allowed to grow, mature, function and regenerate without interference from rogue, oddball oxygen radicals which tend to steal the electrons from he molecules of normal, healthy biological molecules.

**The water boom**

We are now in the midst of a water boom. In Japan and other countries consumers are buying various kinds of bottled and canned water even though water is one of our most abundant vital resources. Research data reveals that mineral waters have an CRP of +200 mV, slightly lower than the +400 mV measured for ordinary tap water. We can say that at least mineral water is marginally better than tap water from the viewpoint of ORP. Compared to any processed water for sale, however, microwater with its reduction potential of -250 to -300 mV is beyond comparison due to its ability to scavenge active oxygen radicals.