

ALL KANGEN MADE EASY BUNDLE

SCIENCE BEHIND KANGEN WATER

by Anick Martinez



Enagic[®]
INDEPENDENT
DISTRIBUTOR



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INTRODUCTION

KNOWLEDGE IS POWER

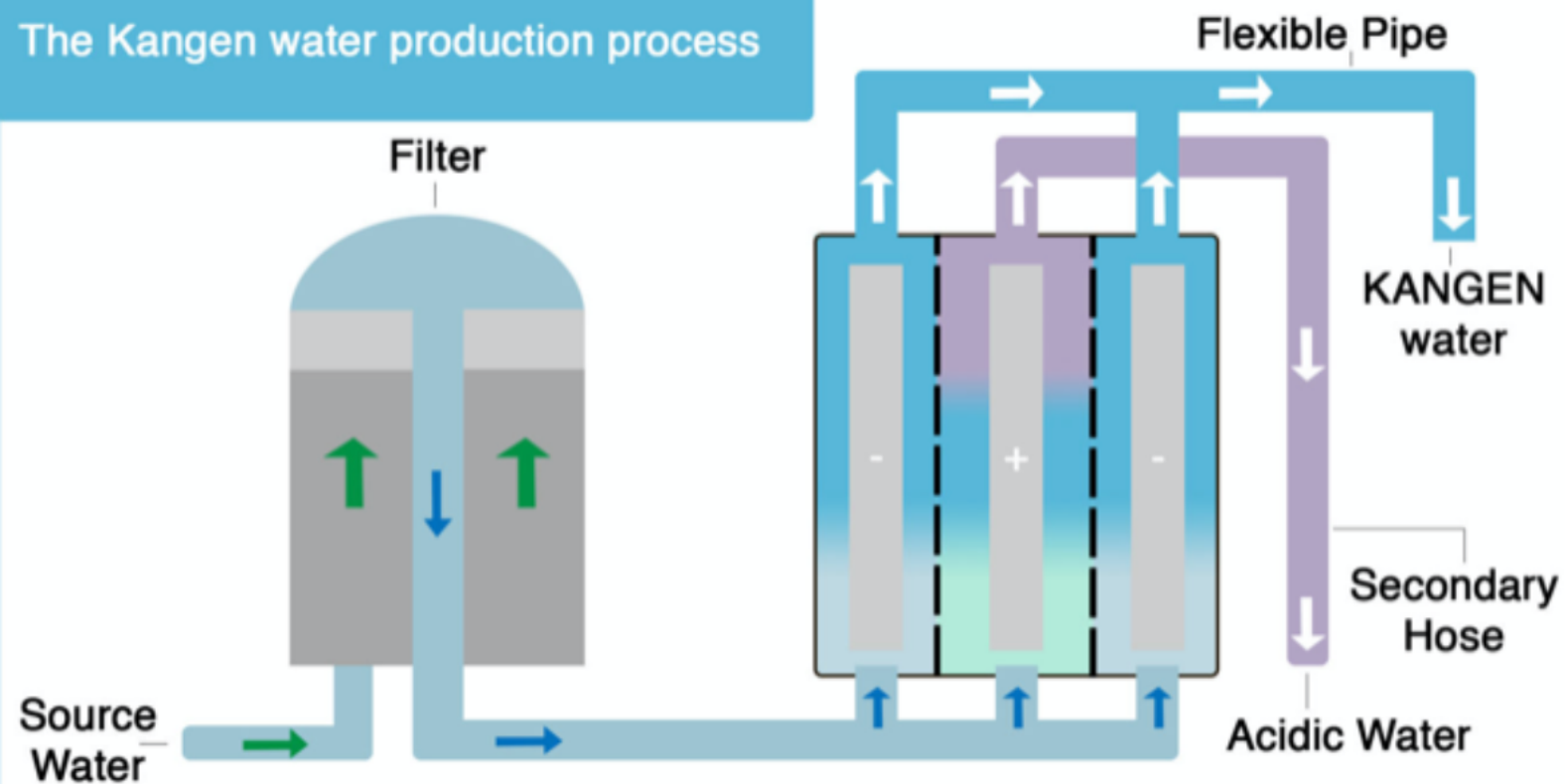
*Welcome to your Science
Behind Kangen Water e-book!*

The purpose of this e-book is to educate Enagic distributors on their product. It is essential to know our product well to serve our clientele best.

This e-book will dive deep into the science behind Electrolyzed Reduced Water (ERW), aka Kangen Water; from the filtration to the electrolysis process; the science behind Mild, Strong Acidic, and Strong Alkaline Water, and more!

It is crucial to understand the electrical and chemical mechanisms of the electrolysis process to understand the properties of the water entirely. Take your time while reading this e-book; some concepts may be new to you.

Enjoy your reading!



Water Ionization in Two Simple Steps:

Filtration and Electrolysis.

- First, tap water goes through the machine's inner filter, of which the main goal is to filter the chlorine and large floating particles in the water.
- Second, the clean water goes through titanium platinum-coated electrodes, which will dissociate (separate) the water molecules to create alkaline water and acidic water.

The more electrodes an ionizer has, the bigger the surface for electrolysis, resulting in a more significant number of molecular hydrogen (H₂).

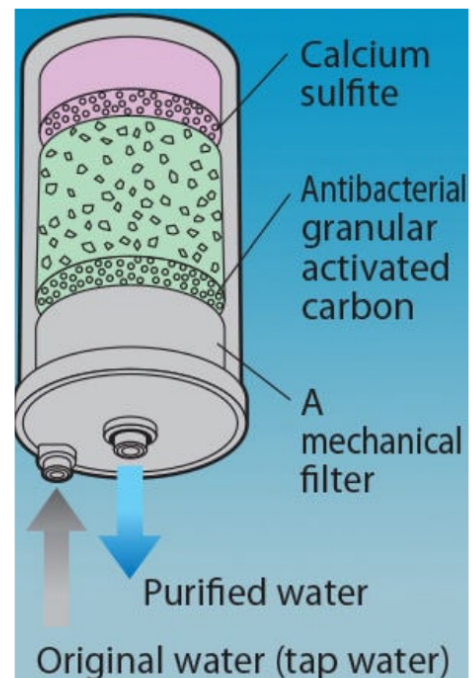
The internal filtration system.

Enagic inner filters are antibacterial granulated activated charcoal, calcium sulfite, and mechanical filters; their **primary purpose is to remove chlorine by up to 95%**.

The internal filter (HG, HG-N, or F8) will also effectively remove lead, odor, rust, and unpleasant taste.

Granulated activated carbon filters can filter out contaminants down to 5 micrometers. This means that **some microplastics will be removed** as well.

This integrated filter **DOES NOT** remove fluoride, all bacteria, chloramines, iron, nitrates, heavy metals, or arsenic, which is why pre-filters are a huge plus (if not a must!).

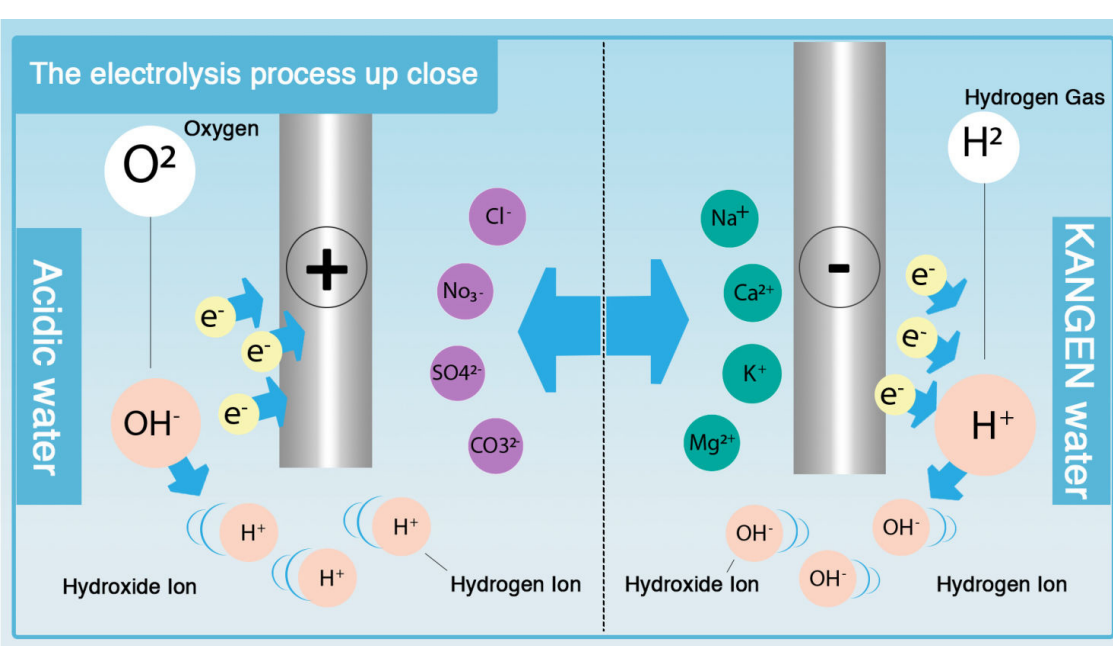


The electrolysis process.

Electro- stems from electricity, and *-lysis* means to divide or dissociate, so **the electrolysis of water uses electricity to split water molecules to create new compounds: hydrogen gas (H₂) and oxygen gas (O₂)**. This process takes place in the electrolytic cell of the water ionizer. In there, you will find the electrodes and a semi-permeable ion-exchange membrane.

The electrodes have two polarities: a positive electrode (anode) and a negative electrode (cathode). The anode will attract compounds that make up acidic water, and the cathode will attract compounds that make up alkaline water. The membrane prevents alkaline and acidic water compartments from mixing.

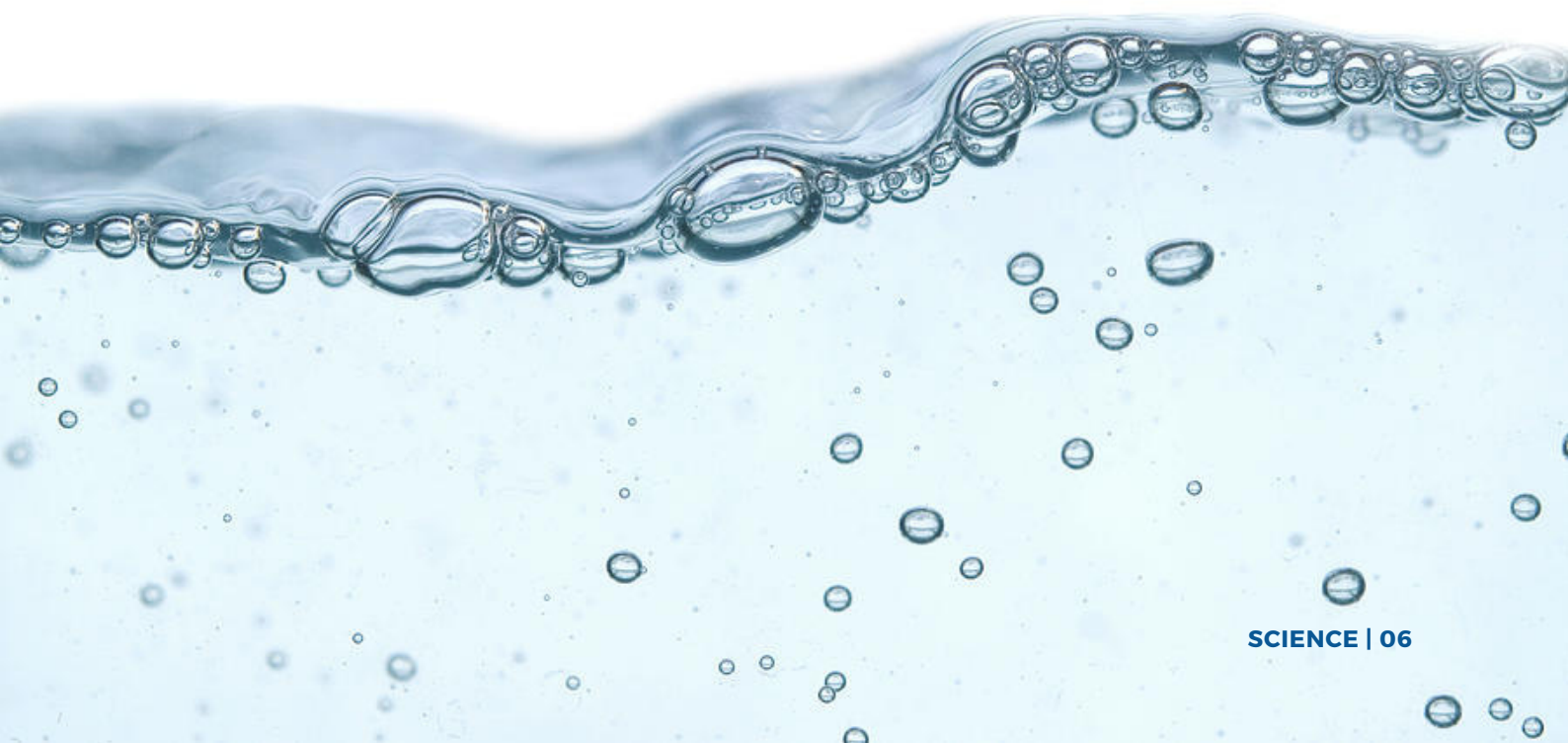
When the electric current passes through the water, the water molecule (H₂O) will be divided into HO and H⁺. These will then undergo a chemical change and turn into molecular hydrogen gas (H₂) and oxygen gas (O₂). We will dive into the chemical process later on.



The process in the electrolytic cell.

As pure water is not a good conductor of electricity, minerals are needed to propagate the electric current and dissociate the water molecules. **For water to be electrolyzed, there must be a mineral source in the water.**

- **If your water source is highly acidic, you may consider using an additive, calcium lactate**, to boost the electrolysis process and raise the pH levels (raise the alkalinity). Enagic has a solution; click [here](#) to get calcium lactate for your Kangen Water ionizer. *Refer to your Machine Maintenance e-book to know how to use calcium lactate.*
- Conversely, **in cases where the water has excess minerals**, the taste may be affected, or Kangen Water produced may be too high in pH level; **a good pre-filter is thus required**. *For more information, refer to your Choosing a Pre-Filter e-book.*



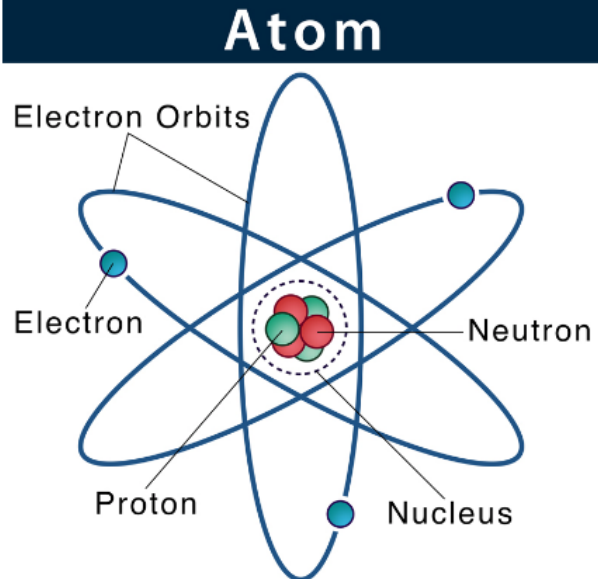
Chem 101: the Basics for a Deeper Understanding.

Body functions depend on cellular processes resulting from chemical changes; thus, understanding the underlying chemistry is essential.

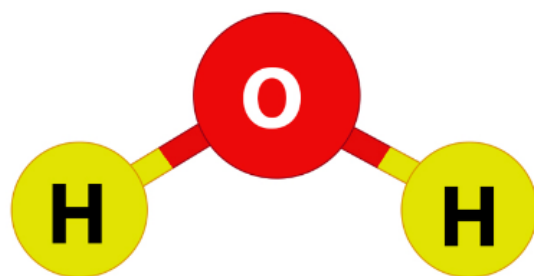
ATOMS & MOLECULES

Atoms are a minimal amount of matter. They are the components of molecules. Two or more atoms bonded together make up a molecule.

Atoms are made up of particles called protons, neutrons, and electrons, which are responsible for the mass and charge of atoms. Every atom has no overall charge (neutral).



Molecule



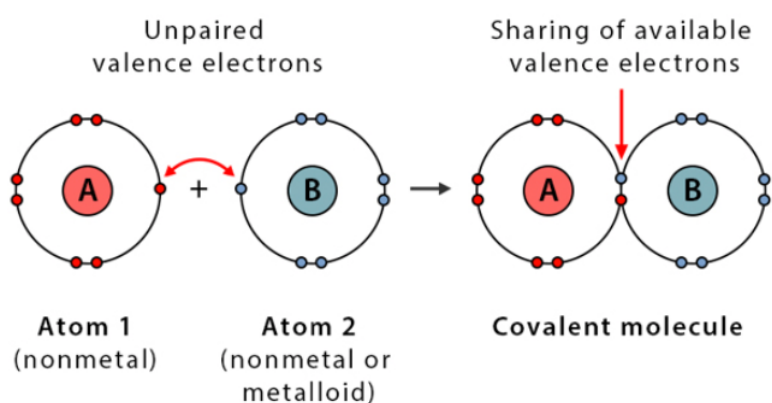
Water (H₂O)

 Hydrogen  Oxygen

This is because they contain equal numbers of positive protons and negative electrons. These opposite charges cancel each other out, making the atom neutral. Protons and neutrons make up the atom's nuclei, electrons orbit around the nuclei like the planets around the Sun.

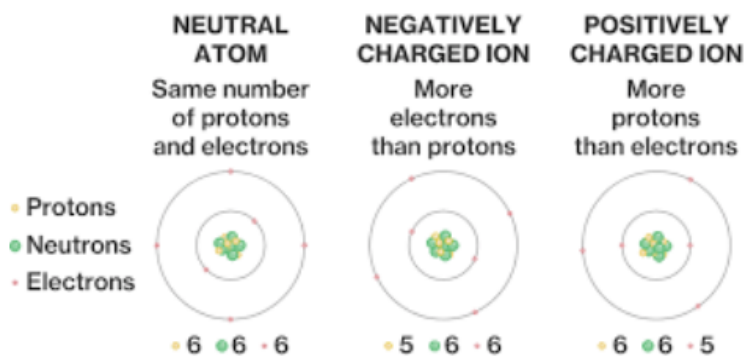
When two or more atoms bond together to form a molecule, they share their pair of electrons; this is called a covalent bond.

Covalent Bond



THE ION

If an atom gains or loses one or more electrons, it acquires a net electric charge and becomes an ion. Positively charged ions are called cations; negatively charged ions, anions. **Because of their charge, ions can conduct electricity when dissolved in water.**

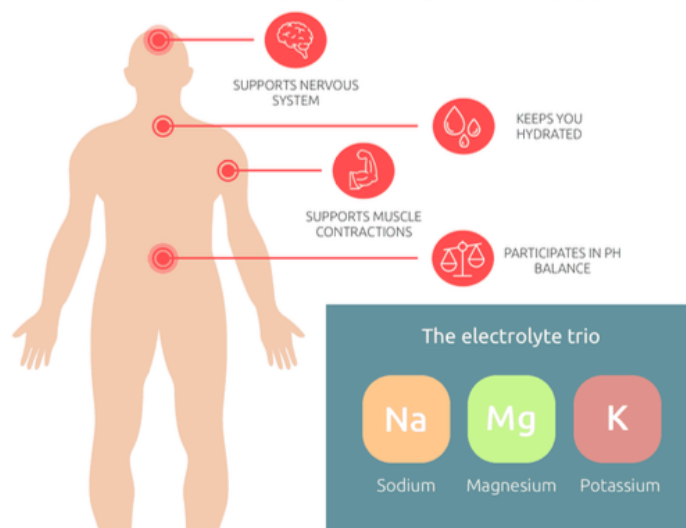


The ionic forms of minerals are referred to as electrolytes.

ELECTROLYTES

Electrolytes are minerals found naturally in the body, such as potassium, calcium, sodium, and magnesium. **Electrolytes are needed to keep the body's balance of fluids** at the proper level and maintain normal functions, such as heart rhythm, muscle contraction, and brain function.

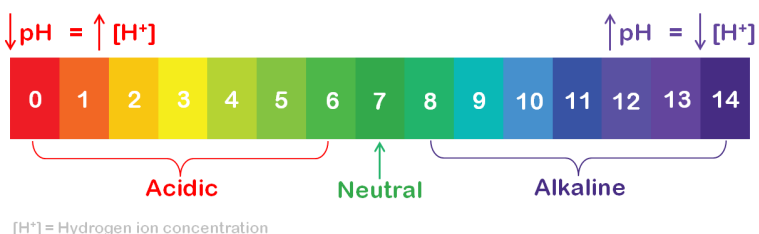
THE ROLE OF ELECTROLYTES IN THE BODY



POTENTIAL HYDROGEN, PH

pH measures the hydrogen ion $[H^+]$ concentration of a solution:

it expresses *acidity* or *basicity*. The more H^+ a solution contains, the more acidic it is. The pH scale ranges from 0 to 14.



BLOOD PH

Normal blood pH is 7.35 - 7.45

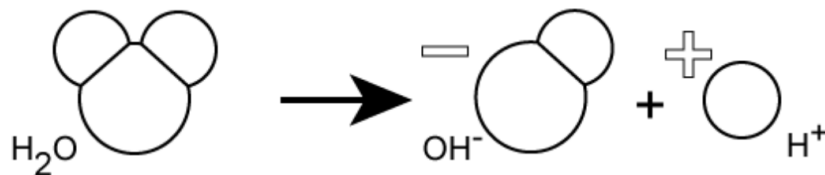
- Alkalosis occurs when blood pH rises to 7.5 - 7.8
- Acidosis occurs when blood pH drops to 7.0 - 7.3
- Homeostatic mechanisms in the body help regulate pH
- Buffers are chemicals that act to resist pH changes

Water Chemistry Behind Electrolysis.

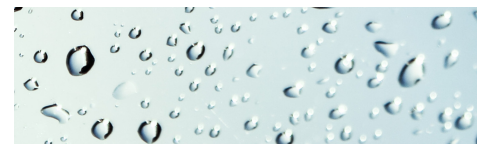
WATER DISSOCIATION

The production of ERW begins with a dissociation of water molecules (H_2O) to produce hydrogen ions (H^+) and hydroxide ions (OH^-).

An electric current can dissociate water molecules because it breaks the covalent bonds, which are binding energy, between the oxygen and hydrogen atoms.



Hydroxide ion Hydrogen ion



PRODUCTS OF ELECTROLYSIS

In chemistry, all the reactions that can happen will happen; you will just get different products in different quantities. In the case of water electrolysis, we have **two main products: molecular hydrogen gas (H_2) and oxygen gas (O_2)**. It's also essential to note that **ERW is cathodic water**.

- **At the negative electrode (cathode)** (equation 1), water is reduced to molecular hydrogen and hydroxide ions (OH^-). The OH^- ions cause an increase in the resulting water's pH, making it more alkaline.
- **At the positive electrode (anode)** (equation 2), water is oxidized to oxygen gas (O_2) and protons (H^+). The increased hydrogen ion (H^+) concentration makes the water acidic.

Equation 1, cathode reaction: $4\text{H}_2\text{O} (\text{l}) + 4\text{e}^- \rightarrow 2\text{H}_2 (\text{g}) + 4\text{OH}^- (\text{aq})$

Equation 2, anode reaction: $6\text{H}_2\text{O} (\text{l}) + 4\text{e}^- \rightarrow + \text{O}_2 (\text{g}) + 4\text{H}_3\text{O}^+ (\text{aq})$

e are the electrons

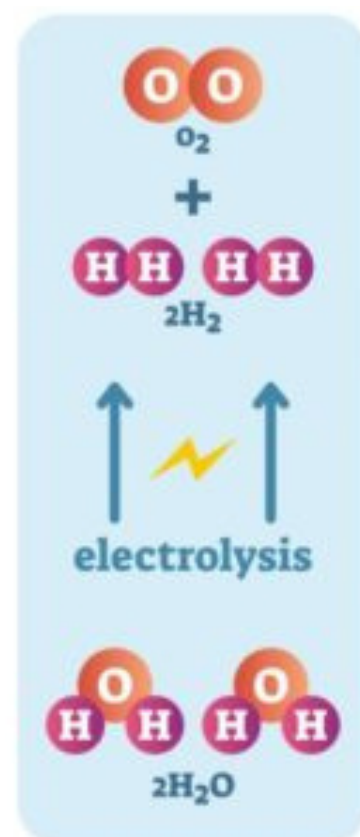
Overall reaction: $2\text{H}_2\text{O} (\text{l}) \rightarrow 2\text{H}_2 (\text{g}) + \text{O}_2 (\text{g})$

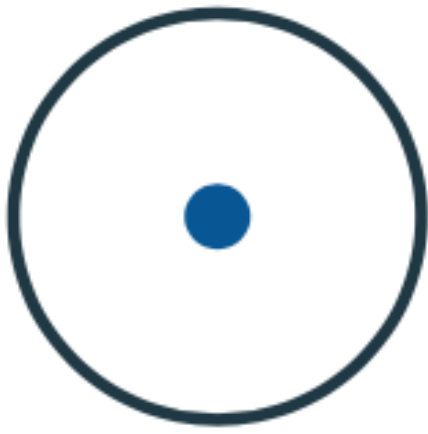
The amount of molecular hydrogen produced is twice the amount of oxygen gas.

- Cathodic alkaline water (ERW) is thus abundant in molecular hydrogen gas, the antioxidant agent of Kangen Water.
- In contrast, anodic acidic water is abundant in dissolved oxygen gas, the oxidizing agent of acidic water.

IN SUMMARY...

- When the electric current passes through the water, the water molecules (H_2O) are dissociated into OH^- (hydroxide ion) and H^+ (hydrogen ion).
- At the negative electrode (cathode), the H^+ , being an unstable compound, will immediately react with another H^+ to form H_2 (molecular hydrogen).
- And at the positive electrode (anode), the OH^- will react with other OH^- to create O_2 (oxygen gas).

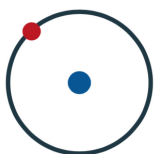




HYDROGEN ION

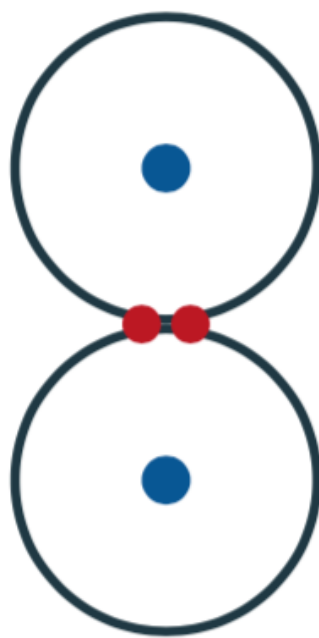
A positively charged hydrogen ion (H^+ cation) is also known as **just a proton**. Because a hydrogen atom only has one electron and one proton, if the atom loses its electron, it's only a proton.

A higher concentration of H^+ in a solution means a higher degree of acidity.



HYDROGEN ATOM

A hydrogen atom ($H\cdot$) has an unpaired electron (represented by the dot). It is, therefore, a **reactive free radical**. Atomic hydrogen is very rare in nature.

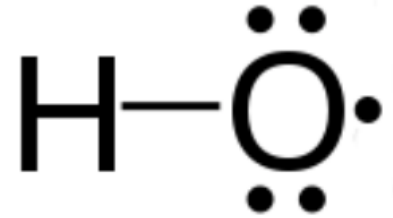
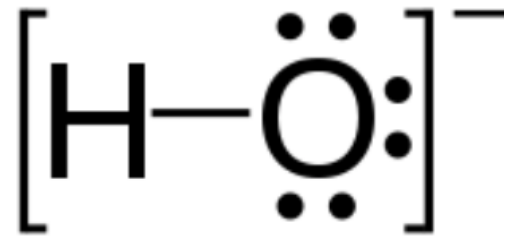


MOLECULAR HYDROGEN

Molecular hydrogen gas (H_2) is the **primary form of hydrogen found in nature**. It's when two hydrogen atoms (H) are covalently bonded $H-H$. It is also called diatomic hydrogen or dihydrogen.

This form of hydrogen is highly researched by the scientific community, mainly due to its **potent antioxidant effects**.

Being the smallest molecule in the universe, its size and high lipid solubility allow it to **quickly diffuse into the cellular and subcellular compartments of the mitochondria and cell nuclei**.



HYDROXIDE ION VS. HYDROXYL RADICAL

There is an essential difference between the hydroxide ion (OH^-) and hydroxyl radical ($OH\cdot$).

The dot on the symbol $OH\cdot$ is indicative of an unpaired electron, which means it is a free radical.

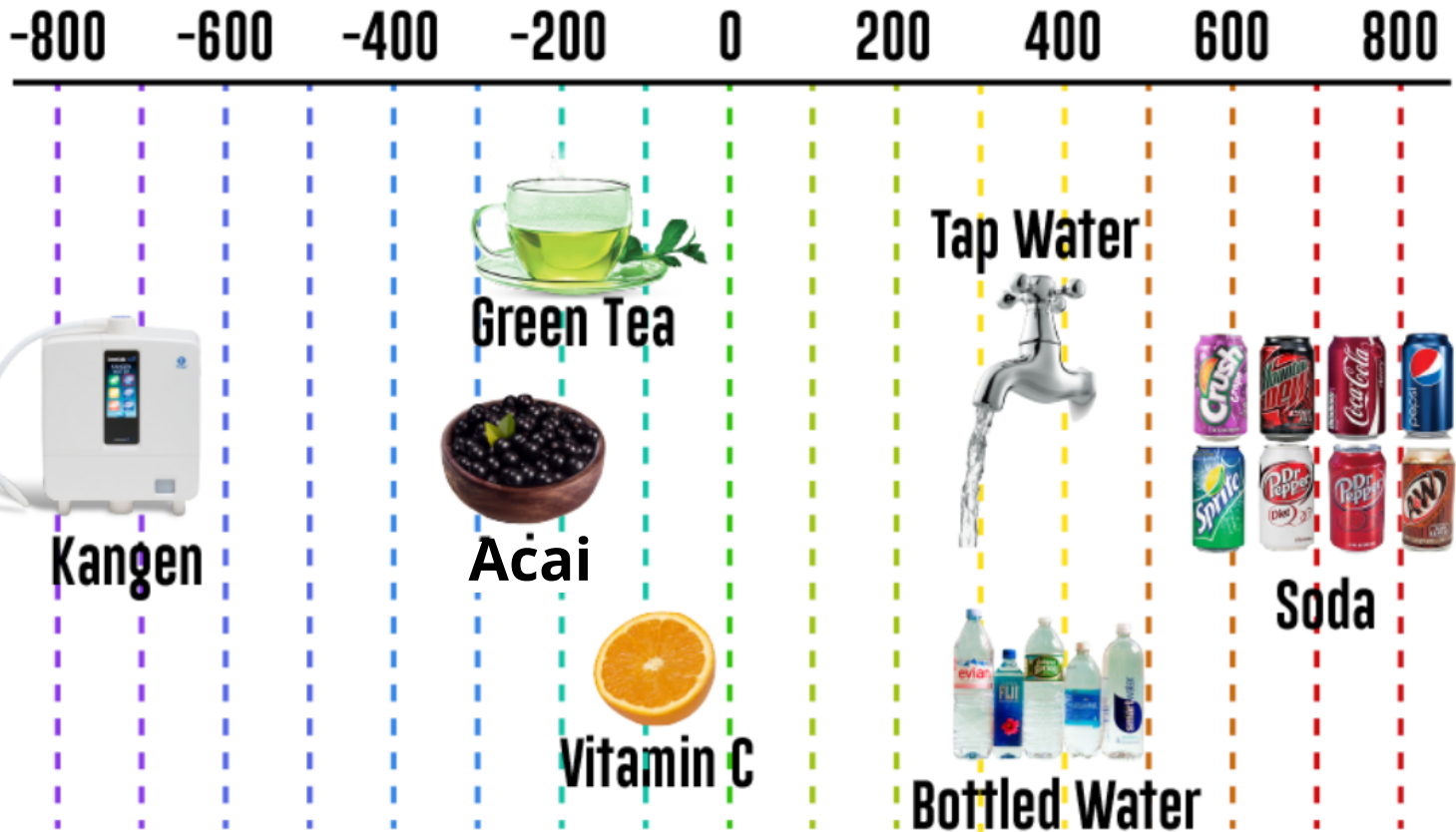
The hydroxyl radical has the highest oxidizing capacity among all chemicals.

The hydroxide ion OH^- contains a stable pair of electrons; it is a base in acid-base chemistry.

Hydroxide ion content is higher in alkaline water according to the definition of pH, but it is **not a biological antioxidant**.

- ORP (mv)

+ ORP (mv)

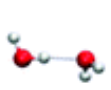


Oxidation-Reduction Potential.

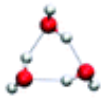
One of the main characteristics of molecular hydrogen-rich water is its negative Oxidation-Reduction Potential (ORP).

The ORP measures the capacity of a solution to either release (-) or to accept (+) electrons from chemical reactions. In other words, **the ORP measures the ability of a solution to be an antioxidant (negative ORP) or an oxidant (positive ORP).**

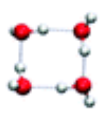
The ORP of fresh Kangen Water from a K8 is -850. Nevertheless, molecular hydrogen diffuses rather quickly, so it is always recommended to drink fresh Kangen Water to get the maximum molecular hydrogen and antioxidant property.



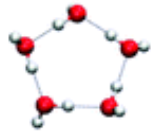
2-Linear (1)



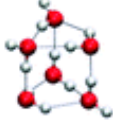
3-Cyclic (3)



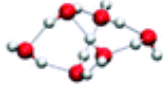
4-Cyclic (4)



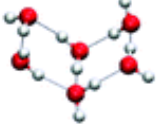
5-Cyclic (5)



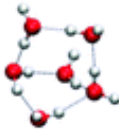
6-Prism (9)



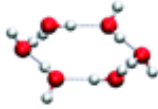
6-Cage (8)



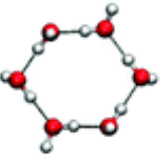
6-Book (7)



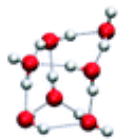
6-Bag (7)



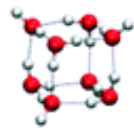
6-Cyclic (6)



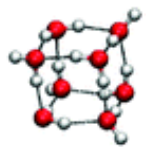
6-Cyclic' (6)



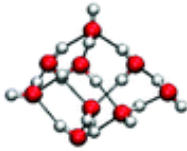
7-Prism (10)



8-D2d (12)



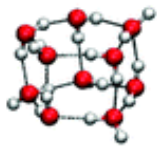
8-S4 (12)



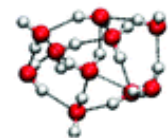
9-D2dDD (13)



10-Prism (15)



10-Prism' (15)



10-Butterfly (15)

Restructured Water.

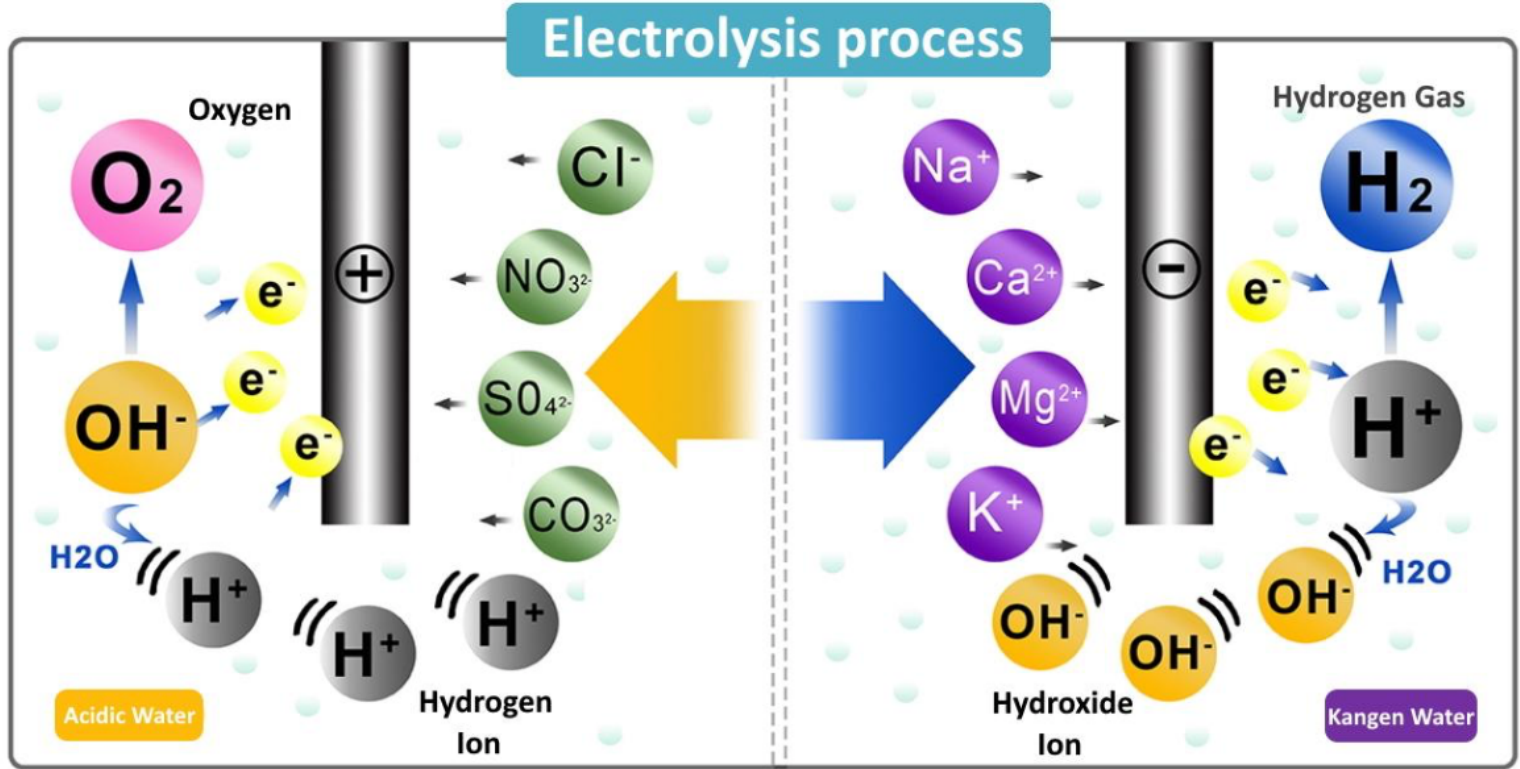
Physical chemists are well aware of water's mysterious nature and the **many different forms of water clusters** due to hydrogen bonding. **A water cluster is a hydrogen-bonded assembly or cluster of water molecules**, in chemistry.

Theoretical models have predicted many such clusters. Some have been detected experimentally in various contexts such as ice, bulk liquid water (water not at the surface or edges of another material), gas phase, and others.

Water clusters have been proposed to explain some mysterious properties of water. Water clusters are also implicated in stabilizing specific supramolecular structures, like DNA. They are also expected to play a role in hydrating molecules and ions dissolved in water.

As far as science tells us, **these clusters are unstable, fleeting arrangements**, meaning they may last fractions of seconds. There are numerous studies on the properties of water, and recent advances in science have allowed us to analyze the structure of liquid water in great detail but still have not provided definitive answers to an increasing number of questions.

Enagic ensures that Kangen Water is restructured water.



Minerals in Kangen Water.

Tap water contains various naturally present minerals and mineral compounds like sodium, calcium, magnesium, potassium, chloride, nitrate, sulfate, and carbon dioxide.

The chemical action of minerals is determined by the charge of the ions that form their crystal structure. So when passing an electric current through the water, these will migrate to the place (electrode) that has their opposite charge.

- Sodium, calcium, magnesium, and potassium are positively charged minerals; they will migrate to the negative electrode (cathode) and thus be present in our drinking water. These are electrolytes.
- Chloride, nitrate, sulfate, and carbon dioxide are negatively charged substances; they will migrate to the positive electrode (anode), thus not present in our drinking water. Plants thrive with these compounds, so Mild Acidic Water is suitable for plants.

As a result, Kangen water contains positively charged essential minerals; electrolytes that naturally fuel the body.



Duration of Kangen Water Properties.

Molecular hydrogen, antioxidant properties: maximum effects during the first 30 to 60 minutes, then decreases over the hours. Molecular hydrogen lasts around 6 to 8 hours in the water.

Alkalinity: 1-2 weeks.

Restructuring: unknown.

The duration of these properties **depends on how and where you store your Kangen Water.**

The amount of molecular hydrogen and level of alkalinity also depends on the flow rate, water temperature, and mineral content of your source water. For maximum properties, make sure to **run cold (not freezing) water as slow as possible**, and make sure your source water has an optimal level of minerals (check the pH regularly).



Conclusion on Kangen Drinking Water.

- The inner filter of the Kangen Water ionizer filters 95% of the chlorine, large sediments, some micro-plastics, and unpleasant odors and tastes. The acquisition of pre-filters is highly recommended for higher water quality.
- Once filtered, the water undergoes the electrolysis process, where it will be split into H^+ and OH^- ions. These will then experience other chemical reactions to give rise to the two essential products: molecular oxygen (O_2) in acidic water and molecular hydrogen (H_2) in alkaline Kangen Water.
- Molecular hydrogen is the antioxidant agent of electrolyzed reduced water. The high pH (alkalinity) is a byproduct of the electrolysis process but not the primary goal. ERW contains electrolytes that fuel the body. This water also exhibits a negative ORP of -850, showing its high antioxidant power.
- Enagic ensures that Kangen Water is restructured water.
- The molecular hydrogen (main property) of Kangen Water will dissipate rather quickly, which is why it is always recommended to consume fresh Kangen Water.

Acidic Waters.

Strong Acidic, Mild Acidic, and Beauty Water are produced at the positive electrode of the electrolysis chamber.

STRONG ACIDIC WATER PH 2.5

Strong Acidic Water, also known as **electrolyzed oxidizing water (EOW)**, is produced with the help of the electrolysis enhancer **NaCl** (table salt).

Minerals are necessary for the electrolysis of water. When we want to increase its power to get extreme pH levels, we must add an additional mineral source to the water - to strengthen the electrolysis process.

The production of Strong Acidic Water takes place at the anode. The sodium (Na) and chlorine (Cl) from the enhancer dissociate, the Na goes to the cathode, and the Cl goes to the anode and forms hypochlorous acid (HOCl).



The resultant product is a hypochlorous acid (HOCl) solution with a pH of 2.5 and a positive ORP of around +1000 mV to +1600 mV.

- EOW is used for cleaning, sterilization, disinfection, and sanitization.
- EOW is effective in removing pesticides in food.
- EOW doesn't appear to exert the same irritation as HOCl to skin and other mucous membranes.

MILD ACIDIC WATER PH 4 - 6

Mild Acidic Water has many different uses: washing your skin, watering plants, cleaning, and more! The pH of this water is very versatile, and you should not let it go to waste.



BEAUTY WATER PH 6

The pH of Beauty Water is similar to the skin's pH, which is around 5.5, thus helping it maintain a healthy pH for the skin flora or microbiome. Maintaining a healthy skin pH and skin flora is key to beautiful, healthy skin.

The Japanese Ministry of Health, Labor, and Welfare (JMHLW) approved this water in 1965 as an **astringent for beauty purposes.**





Strong Alkaline Water.

Strong Alkaline Water is produced via electrolysis of a NaCl solution at the cathode side, the same way Strong Acidic Water is made but on the other side of the electrolysis chamber.

The resultant product is a solution of sodium hydroxide (NaOH) with a pH of 11.5 and a negative ORP of around -950 mV to -1500 mV.

- This cathodic water is considered **functional water**, used for cleaning, rinsing, lipid extraction, removing stains, and more.
- It can readily saponify oils, making it a beneficial washing agent for greasy or oily areas. This also gives it the ability to reduce the pesticides in your food by soaking your produce in this water for 10-20 minutes.
- Good thermal conductor.
- **The ability of this water to saponify oils increases when stored for a day.** A possible explanation for this is that calcium salts form and drop out of the solution as the water sits. This is important because calcium blocks micelle formation, which is important for the final saponification/emulsification of the oil.

Storing these Waters.

- To store, place the water in a **lightproof container**, fill it to the very top to avoid unnecessary contact with air, and **store it in a cool, dark place** (the refrigerator is ideal). Best if you keep it in a glass container.
- **Keep Strong Acidic and Strong Alkaline Water in the refrigerator for no more than 4-5 days and replace the water in your take-out bottle every day.**
- For water used **for domestic purposes**, including Mild Acidic Water, Strong Acidic Water, and Strong Alkaline Water, less care is required, but we recommend **changing your supply once a week.**



	pH Before	ORP Before	pH After	ORP After	Temp
Microwave	10.7	-764	10.4	-755	108
Boil	10.7	-735	9.9	103	212
Fridge	10.6	-755	10.5	-385	45
Freeze	10.4	-755	10	-460	32
Cup of ice water	11	-785	11	-770	32

The Effect of Temperature.

- **Boiling** ionized water does significantly decrease its health value. It will take the negative ORP (antioxidant value) out of the water and even reduce the pH.
- **Freezing** ionized water does not, by itself, reduce its health value very much. As long as you take precautions not to expose the ionized water to air, your frozen ionized water should be good.
- **Warming** your ionized water does not seem to reduce the health value much (unless you bring it to a high temperature).
- **Adding ice** (especially if the ice was made of ionized water) doesn't decrease its health value.

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