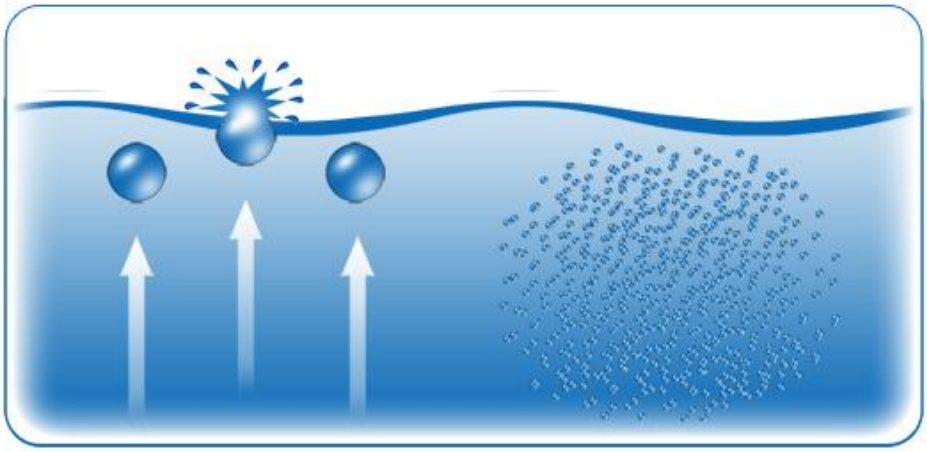
HYPOCHLOROUS ACID NANOTECHNOLOGY

What are Nanobubbles ?

Nanobubbles are nanoscopic gaseous (typically air) cavities - ten thousand times smaller than a human hair - in aqueous solutions that have the ability to change the normal characteristics of water. Ordinary bubbles have a diameter which range from 1 µm and larger. These quickly rise to the surface of a liquid and collapse. Nanobubbles which are <100 nm in diameter will randomly drift owing to what is termed, Brownian Motion and can remain in liquids for an extended period of time.



How is <u>electrochemically generated</u> Hypochlorous Acid different?

Water that is processed through the Aquaox generator creates a dispersion of paramagnetic chlorine-oxygen nanobubbles, the presence of which gives the water highly functional properties that are not found in “normal” water. It is these characteristics that give *electrochemically generated* Hypochlorous Acid its unique properties that make it extremely effective.

Bubble Stability & Longevity

Based on the Young–Laplace equation, bubbles grow or shrink by diffusion based on whether the surrounding solution is over or under-saturated with gas relative to the cavities pressure. Since the solubility of gas is proportional to the gas pressure and this pressure is exerted by the surface tension in inverse proportion to the diameter of the bubble, the normal tendency is for bubbles to shrink in size and dissolve in a few microseconds. However, nanobubbles are observed in water for days.
The stability of nanobubbles is not well understood but is thought to be a balance of the van der Waal’s force of attraction and the electric double-layer force of repulsion

between neighboring nanobubbles, with additional contributions from the virtual disappearance of buoyant force, bridging nanobubbles, entropic restriction, and fluid structuring.

The longevity factor of nanobubbles in water increases residence time of oxygen in the water and in doing so, directly impacts any type of aerobic or anaerobic interaction with viruses and bacteria.

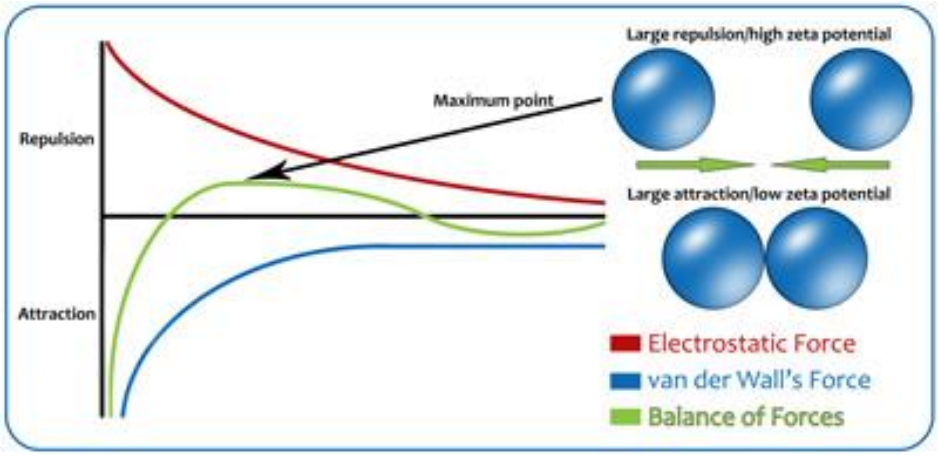


Diagram showing how the balance of energy forces affects the stability of Colloidal (nanoparticle) suspensions.

What is Zeta Potential?

Zeta Potential is a measure of the electrical force that exists between atoms, molecules, particles, and cells in a fluid. Zeta potential's strength determines the amount of material (nutrients, wastes) that fluids such as your blood and lymph can carry. In this way, more nutrients can be carried throughout your body and accumulated deposits of waste can be removed.

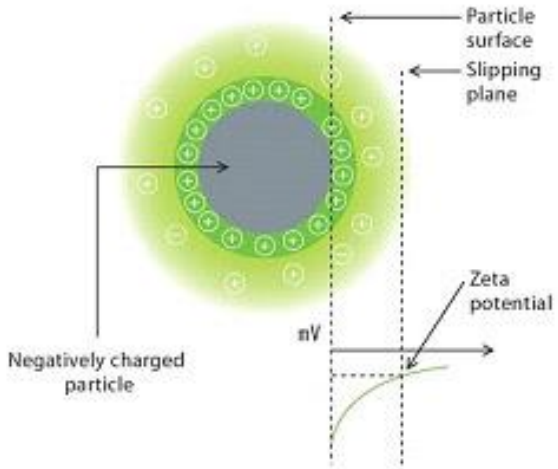


Diagram showing the ionic concentration and potential difference as a function of distance from the charged surface of a particle suspended in a dispersion medium.

What is a Colloidal Dispersion?

A colloid is any particle, droplet or bubble having a diameter between 1 and 1000 nanometers. A colloidal dispersion is a system in which colloidal species are dispersed in a continuous phase of different composition or state.

Aquaox Hypochlorous Acid solution contains a high concentration – 50,000,000> per 1 ml (1 cubic centimeter) - of nano size bubbles of chlorine-oxygen in the treated water. These "colloidal particles" exhibits all the characteristic of a colloidal dispersion and will influence the nature and extent of any interfacial behavior of that bulk water.

The Surface Chemistry of Suspensions

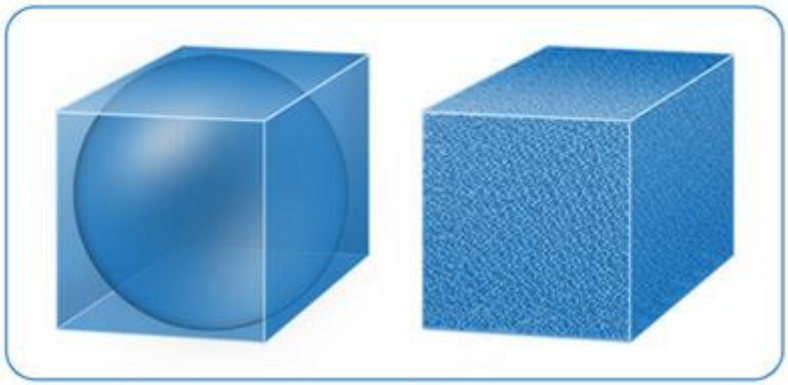
All particles have a "surface charge" in water. Just like "surface area", it is a fundamental parameter that directly impacts the performance characteristics of any suspension such as surface chemical activity. Surface charge effects are normally negligible for massive solids but they become dominant in the description of colloidal (nanoparticle) behavior.

Air bubbles in water are negatively charged. The high concentration of negatively charged paramagnetic chlorine-oxygen nanobubbles has two effects on particles suspended in water. First, it alters the ionic equilibria of any dissolved ionic species in a solution and second, it changes the net charge on a particle surface, both of which directly impact the stability (and ultimate processability) of the particle suspension.

What is Bubble Surface Area?

Surface area is a fundamental parameter that directly impacts the performance characteristics of any suspensions. The smaller the material, the greater the surface area and surface-to-volume ratio per given mass of material. It is one of the reasons why catalysts perform as they do.

Surface area is a very important concept in water treatment and water use. With air bubbles, it strongly influences the rate at which chlorine-oxygen diffuses from air into water; the greater the surface area, the faster chlorine-oxygen can move through the surface.



Aquaox Hypochlorous Acid solution contains an exponentially increased surface area-to-volume ratio per mass as compared to containing normal bubbles – more than 50,000,000 nanobubbles per 1 ml (1 cubic centimeter) of water.

As the particle size is reduced, the surface area-to-volume ratio per given mass increases – an essential characteristic to all colloidal (nanoparticulate) dispersions.

This substantial increase in the interface provides a much greater contact area and more effective transport system of vitamins and minerals throughout the intestinal tract. It impacts the efficiency of chemical reaction with any dissolved or suspended components in the water and enhances aerobic bacterial activity.