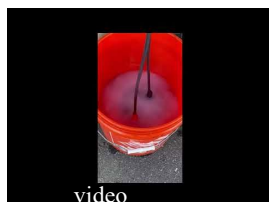
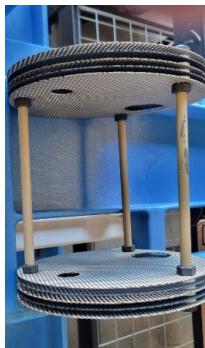


Manual for use of the Electro-Aeration technology

This part 1 in a series of manuals on the implementation of the water technological advance known as the nanobubble aeration generator. Possibly the simplest water purifier in the world, it can be adapted to any type of water and also act as a disinfectant to combat mosquitoes, bacteria and viruses in hospitals, camps, livestock farms. The aerator water can also be used as a substitute for pesticides in farms large and small naturally increasing yields and quality. A DC power source, such as solar, wind or AC to DC converters can be used to create the fauna & flora safe nanobubble water.

- (If you wish to bypass the summary, please go directly to instructions: [Ctrlclick:](#))

Summary: The aerator is the basic model of the patent pending revolutionary technology known as the Electro-Aeration Nano-Bubble generator. It is composed of 5 plates alternating between 3 cathode (-) and 2 anodes (+). One can add other sets and expand on these plates to attain processing levels of thousands of gallons of water a day. These 5 plates are the cornerstone. The basic plates have no motors, knobs, instruments and are plugged directly into a 12V DC supply in water. They will not electroshock or harm any life form. The Core utility is the 5-plate design:



To go directly to instructions: please [Ctrlclick](#):

Recommended video please watch the 7-minute PhD supervised study:



video

[link](#)

We can use this technology to accomplish a number of effects:

When placed in water and connected to a DC power source, The activated plates create a catalytic reaction known as electrolysis of water but in our case without pH modification such as KOH or any other addition.

Splitting of the water molecule into OH^- and H^+ or electrolysis at sub-microscopic level or nano-level negatively charges water as reflected by a -ORP reading. Negatively charged water corresponds to the electronegative charge of all life forms; plants and humans thrive on this form of water. Correspondingly bacteria are repelled by this type of water. This modified water creates a natural defense mechanism while enhancing photosynthetic processes.

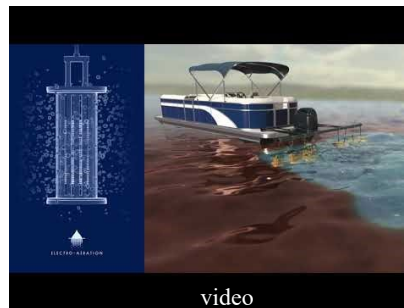
- Hydrogen Evolution Reaction (HER): At the negatively charged cathode, water molecules receive electrons (e^-) and undergo reduction to form hydrogen gas in a hydroxide form:

$$\text{H}_2\text{O} + 2\text{e}^- \longrightarrow \text{H}_2 + 2\text{OH}^-$$
- Oxygen Evolution Reaction (OER): At the positively charged anode, water molecules are oxidized, generating oxygen gas:

$$4\text{OH}^- \longrightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$$

1. Nano-bubbles are highly absorbable by cells and act as an adjuvant to nutrients and fertilizers lowering conventional dosages by 20-30%.
2. Oxygen species, such as ozone and hydrogen peroxide (2%) are naturally generated. Agriculture has long recognized the tremendous benefit of these natural disinfection agents in the reduction and potentially as a spray or foliar application, (with an added 5% vinegar solution), the elimination of pesticides.

3. This form of water increases root strength and size, lowering the amount of water flowing through the plant into soil.
4. In conventional soil, Nano-bubble water permeates or penetrates soil deeper than conventional water, reducing watering demand.
5. In regenerative agriculture, nanobubble water increases dissolved oxygen for aerobic beneficial bacteria propagation.
6. As we provide a blend of OH^+ and O_2 , we do not suffer the same issues with oxygen injection as we are not just an oxidizer, but also a reducer. In chlorination, this redox effect lowers the amount of disinfection by-products.
7. One can use the technology with salt and lowered pH in fisheries as the HOCL will not harm fish under 60 PPM. Additionally, the HOCL will alter the harmful NH_4 to ionized and safer NH_3 . Systems can be designed for elimination of TKN and denitrification.
8. Removal of noxious algae and odor at lake, pond or river surface level.



9. In drinking water, we found a better taste and feel to the water. This is subjective, but many have commented and enjoy this water. (ice cubes)

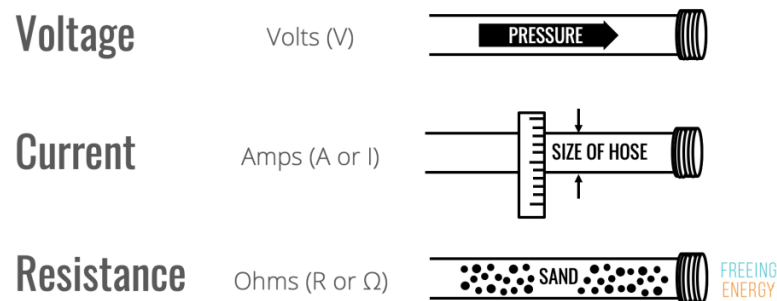
Caveats:

This is very simple technology and has few restrictions on its use. As we generate O_2 and H^+ gases at the surface of the vessel, it is important to not be near an open flame/cigarette DURING the process. It is also recommended to do the process in a well-ventilated environment or outdoors. One can simply put a lid on the vat or container during the process. The gases will return to the water naturally. Other than being mindful of the gaseous evolution during the process, there are no real safety issues.

Part 2 working Instruction:

1. The EA unit at a minimum operates within a range of roughly 9 Volt and 35 Amperes. or 9×35 equals 315 Watts in *fresh unsalted water*. We do not require a perfect 12-volt feeding into an inverter to ensure purity of voltage. We just require current. Thus, we can use "old or used panels" which do not produce the requisite 12 volt, but as we increase the panels, we increase the amperage and that is the optimum condition.
2. We are not Voltage driven but Current driven. The actual innovation/patent is lowering the Ohms (Ω) through the geometry of EA. We have so little resistance that we can increase the Amperage without increasing Voltage. Fluctuation in either V or Amp do not harm the unit or alter the outcome.

Electricity is like a water hose



3. Conversely, in salt water, we will draw in water 12-13 volts and 30- 65 amperes, or 800- 1000 Watts. BUT the EA will just draw a maximum of that a single panel or 2 or 5 panels. We look for what we want to achieve and adjust V and Amp correspondingly by panels. The reactions with salt water are better as the current (Amps) drawn from the panel is higher. That's why we always recommend adding salt, and a little salt goes a long way. For example: Sea water is 30,000 PPM TDS (total dissolved solids), Brackish water is 5000 ppm, tap water in cities is usually 200-300 ppm. Our technology really kicks in at 1000- 2000 ppm TDS. Thus 2 grams of salt per liter. Or 2000g (2 Kg) of salt per 1000 liter. Time and quality of water determines the chlorination aspect. So again: this depends on the quality of the initial water: its pollution load. As you increase time, you increase **Total**

chlorine, and the Cl required for that pollution load. Now you need to balance that with **residual or free** chlorine for taste and discharge regulations. So that's the balancing act.

4. Example: a very polluted water, contains high biological elements: urine, some food waste, arsenic, pesticides, phosphates, sulfur compounds. Basically, crummy water with very low dissolved oxygen. (No blackwater)
 - In the first step, we need to filter that water through a sand filter of some sort, get rid of as much of the solids as possible. Sand is good, you can also use what are called separators, such as lamella, presses and other contraptions. NO MUD! Decant the water and mud if you have to.
 - We run that water into a big tank, any tank of which we know the quantity i.e.: 1000 liters, 500l whatever. This gives us the metric for salt addition.
 - Now here we can proceed with the technology and create drinking water: no acid required: just the salt and the filtration. This will create hypochlorite which is a good disinfectant. However, adding the acid and creating hypochlorous acid is preferable, especially if there are known virus in the water.

Using the unit for chlorination:

The chlorination aspect involves creating hypochlorous acid (HOCl) is a natural, nontoxic, and potent antibacterial agent: Antimicrobial properties. HOCl is effective against a wide range of microorganisms, including bacteria, viruses, and fungi. It's also been shown to be more effective than many conventional antibiotics. It will not harm fish up to 60 PPM, great for growing fish, spraying on plants for pesticide increasing/yield. Mosquito abatement, spray in hospitals, refugee camps. many uses!

- We add a weak acid such as vinegar or citric acid, even formic acid. How much? Basically, until you know the equivalence point, when base will go acidic there is trial and error. I have found over the years; the volume of acid will be 1-2 liters or so per 1000. This brings the pH down to roughly 5-6 pH. So, a little test strip would be a good add to the kit.

- Now you are ready to use the technology: this is literally putting the plates in the vessel and attaching it to a source of energy; wind, solar, car battery, or AC current that has been transformed to DC voltage. *(You will need a DC power supply that has at least 55 amperes draw, or it will short out due to internal protection (fuses) These DC supplies are typically used for battery storage devices)*
5. The EA works by creating a catalytic reaction that goes from a very low conductivity to higher conductivity. The higher the conductivity the higher the amperage draws. To simplify, if you add salt to the water the EA unit will draw more amperage, IF conductivity or less dissolved solids: then less amperage. We cannot precisely state the electrical qualities without knowing the particular electrical value of THAT water. Thus, the broad-shoot on one or 2 or 3 100-Watt panels.
 6. When is the process done? For drinking water, you will need a Chlorine test strip available for the pool industry: these are very inexpensive and include the pH test too.



When the free chlorine strip reads 1-5 PPM. you are done with disinfection and after being run through the CAG filter, you have produced basic potable water that is pathogen free and lower as converted to less reactive forms many elements, such as phosphate, arsenic, manganese, sulfur and perhaps boron.

7. The salt is dissociated into Na and Cl. This chlorination would not be normally possible without a LOT more voltage and amperage, thus our innovation.
8. The process is automatic with the application of power. There are no switches, knobs or other instrumentation. It is designed to work for a long time, years, without interruption subject to passivation or when the plates get a coating. At this point the plates are not



producing the creamy look (nano-bubbles) in water, and they need to be popped out for an acid wash. One just dunks the plates into a bucket full of the strongest acid you can find and let it sit there for a few minutes, rinse it off with water, brush the plates with any kind of brush and replace it in tank.

Carbon Filtration

The carbon filter serves 2 purposes: It captures organic material, some metals and reduces the smell of chlorine.

9. The carbon source can be coffee grains, rice hulls, coconut shell that is carbonized: Thus, the word Granular Activated Carbon. *"Granular activated carbon (CAG) has two functions in a water treatment train: (a) Adsorb the organic compounds that are present in all natural water bodies (well, lake, river); and (b) Removing residual free chlorine that was applied as a biocide in a previous step".*
10. Carbon is usually activated by heat and there are many folks doing that process. CAG can also be derived from cow dung. *"As the morphology of cow dung is closer to sawdust than to coal or nutshell-like materials, it is more suitable for chemical activation. Potassium hydroxide and phosphoric acid have been used as activators to transform cattle manure into activated carbons."*
11. Carbon filtration is well established, we look forward to any other method that satisfies the primary rule:

Low cost, small footprint, long life and an effective global water solution!

Nick Eckelberry
& Talbott Howard
For Electro-Aeration Inc.