Hydrogen peroxide usage report
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Premise:
I use 7% hydrogen peroxide for my home water treatment system. Therefore, since I always have this material in the house, I wanted to explore other possible uses for it, including:

Disease control
Water sterilization
Bleaching of algae on surfaces
Indirect production of dissolved oxygen (for overstocked tanks, etc.)

Final conclusion:
After all of the tests were performed, the only additional use for this product that has merit was found to be "water sterilization". It is easier to control hydrogen peroxide in this use than is sodium hypochlorite (bleach). All other possible uses either didn't work well or had unwanted detrimental effects. Using peroxide as a dip to treat *Amyloodinium marinum* (velvet) has been reported in the literature. I had no cases of this disease to test, but will try it in the future if I run into that disease.

Overview:
With the chemical formula H2O2 this compound has some unexplored uses in aquariums. Hydrogen peroxide is available over the counter in pharmacies and supermarkets as a 3% solution. At this level, it is not reactive enough for most potential uses. Available through some home tap water treatment services, a 7% concentration solution of hydrogen peroxide is stronger and more useful. Do not use this product until you have read and fully understand the Safety Data Sheet (SDS) for it. Although even stronger concentration of H2O2 are available, they are very reactive and their use simply entails too much risk. In addition, these products have had stabilizers added to them which may not be suitable for use in and around aquariums. Perhaps the most immediate use for hydrogen peroxide is as a disinfectant / oxidizer. Filter elements and other aquarium items that have been fouled with organic materials can be soaked for 24 hours in a 7% solution of hydrogen peroxide. It is much easier to rinse off than bleach is, and does not leave a toxic residue like some other disinfectants might. Knowing the propensity for this compound to give off an oxygen atom in oxidizing reactions, some people have experimented with using it to raise the ORP level of aquariums, or to temporarily enhance the dissolved oxygen level in water. Remember, like ozone, too much hydrogen peroxide can pose a threat to the animals themselves. Some researchers have shown that protozoans can be killed by doses of hydrogen peroxide ranging from 12.5 to 25 ppm. Because this is in the range that some fish have shown sensitivity, more study is required. Testing for this compound can be done using a standard DPD chlorine test, at least in terms of presence or absence. There are now test strips available (see below) that can quantify peroxide concentrations from 0.05 ppm to 100 ppm. Additionally, an overdose of hydrogen peroxide can be neutralized with a standard aquarium dechlorinator. Fisheries biologists sometimes use hydrogen peroxide to treat bacterial gill diseases in freshwater fishes such as Columnaris, *Flavobacterium columnare* as a bath at a dose of 50 to 100 ppm for an hour each day for three days. It may also serve as a dip to treat marine fish for *Amyloodinium*. The typical dose for that is 20 ml of 3% hydrogen peroxide in one gallon

of aquarium water for 30 to 45 minutes. A static test of 5 ppm daily additions for five days eradicated cyanobacteria in a freshwater aquarium, but also damaged the nitrifying bacteria, causing a rise in ammonia levels.

Hydrogen peroxide dosing:
Because hydrogen peroxide is in a solution, and not a 100% active material, calculating doses is not very straightforward.

A 7% solution is 70,000 ppm and a 3% solution is 30,000 ppm

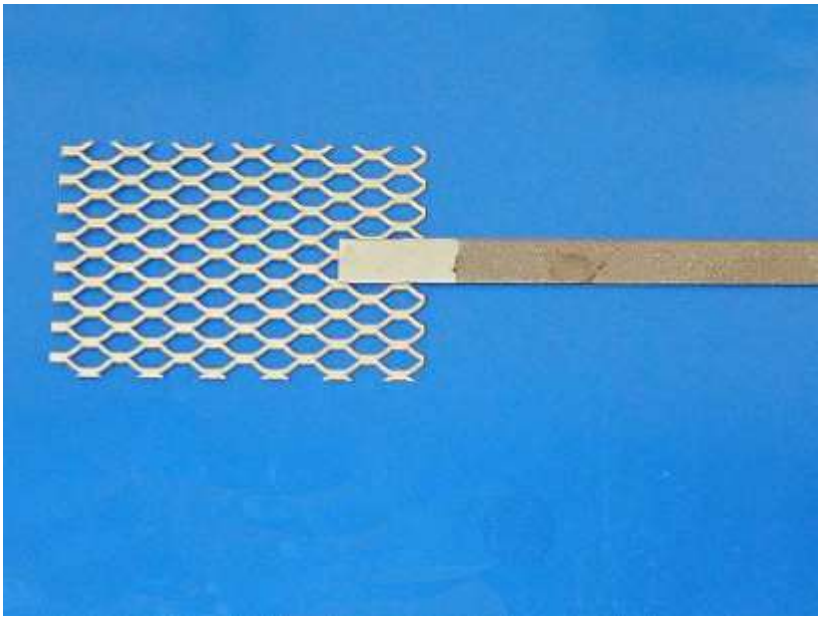
Using a 7% solution, the following doses can be calculated:
1 ml in 14 l = 5 ppm
.1 ml in .37 gallons = 5 ppm

Static testing with freshwater fish:
A 12.5-gallon aquarium with a Betta and blue green slime algae was dosed with a hydrogen peroxide dose of 5 ppm daily. After three days, the algae growth was reduced. After eight days, the algae was eliminated, however the Ammonia tested at 0.31 ppm and the nitrite was at 0.027 ppm and still rising. This is borderline acceptable for Betta, so the peroxide additions were stopped. Seven days later, the algae began to return.

Static testing with marine aquarium:
Long term testing of my 16-gallon Bio cube at home showed that daily 25 ml additions of 3% hydrogen peroxide resulted in reduction of green hair algae and *Valonia* sp. However, bristle worms and shrimp were adversely affected. Despite copious water changes, when the peroxide additions were stopped, the GHA returned to its previous levels. *Valonia* was still present, but in fewer numbers. Additionally, heavy peroxide use (40 ml/day) eliminated the GHA, but it was replaced with a brighter green, turf species. Hand plucking and more water changes worked better.

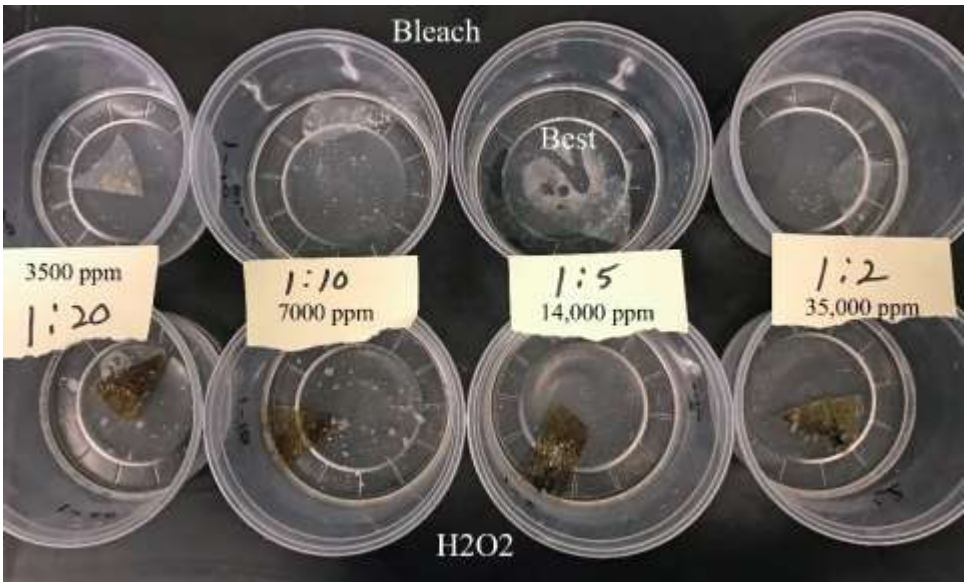
Hydrogen peroxide drop-down test:
It is reported in the aquarium hobby literature that hydrogen peroxide, added to seawater breaks down within minutes if the solution is aerated. This was found to be incorrect. A 25-ppm solution of hydrogen peroxide in strongly aerated seawater still measured > 20 ppm after 72 hours. A similar test using deionized water showed even more stability – a 25 ppm solution was measured after five days at 10-20 ppm.

Platinum catalyst test:
Reports are that platinum acts as a catalyst for hydrogen peroxide, releasing oxygen in a non-destructive manner. A platinum coated titanium anode was acquired. The anode was added to a solution of deionized water to which 25 ppm of peroxide was added. Bubbles soon began to adhere to the anode, showing proof of concept. However, the peroxide was exhausted after 24 hours, and 25 ppm is too high of a concentration to use with fish.



Platinum anode catalyst

Bleach / Hydrogen peroxide bleaching comparison:
Sections of plastic, overgrown with hydroids and brown algae were tested to see if hydrogen peroxide was an effective bleaching agent as compared to sodium hypochlorite (bleach).



After a six-hour exposure, brown coloration means less bleached.

Bleaching of aquarium components is useful when completely renovating an aquarium. This of course cannot be done with animals present, but it is helpful when cleaning jellyfish exhibits. Bleach, however, is difficult to rinse off afterwards. Hydrogen peroxide is much easier to remove. However, this bench test showed that peroxide, even at a 1:2 dilution, did not have

sufficient bleaching effect. The lowest concentration that achieved 100% bleaching was a 1:5 solution of bleach after six hours.

Hydrogen peroxide test on deionized water:
Chemical effects of hydrogen peroxide on deionized water were examined to see if there were any profound changes. A one-liter sample of deionized water had 50 ppm of hydrogen peroxide added, and then measurements were taken over time:

Prior to addition:
Dissolved oxygen = 8.29 mg/l @ 95% saturation
pH = 3.67
Total dissolved solids = 3
Oxidation reduction potential= 433.7

After 30 minutes:
DO = 8.09 mg/l @ 93% saturation
pH = 3.65
TDS = 41
ORP= 473

After 45 minutes:
DO = 7.88 mg/l @ 90.3% saturation
pH = 3.64
TDS = 41
ORP= 472

After two hours:
DO = 7.28 mg/l @ 83.7% saturation
pH = 4.21
TDS = 42
ORP= 477.2

After three hours:
DO = 7.25 mg/l @ 83.3% saturation
pH = 3.73
TDS = 43
ORP= 476

Overall, there was a slight rise in ORP and a temporary rise in dissolved oxygen, but not many other changes following the 50-ppm addition.

A second challenge was made at 100 ppm hydrogen peroxide, but 5 grams of algae was added to serve as a biocatalyst:

Prior to algae addition:
DO = 7.22 mg/l @ 82.8% saturation

pH = 3.65
TDS = 43
ORP= 474.4

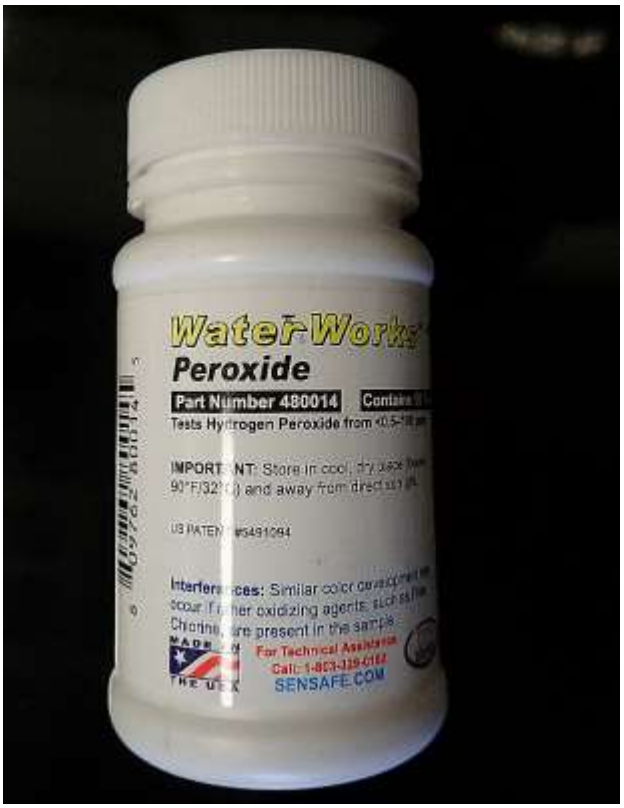
One hour after algae addition:
DO = 9.01 mg/l @ 103% saturation
pH = 4.16
TDS = 37
ORP= 477

Three hours after algae addition:
DO = 11.62 mg/l @ 136% saturation
pH = 4.45
TDS = 32
ORP= 476

Four hours after algae addition:
DO = 12.7 mg/l @ 147% saturation
pH = 4.61
TDS = 31
ORP= 475.3

Sixteen hours after algae addition:
DO = 13.5 mg/l @ 153% saturation
pH = 4.65
TDS = 29
ORP= 482.7

The conclusion is that hydrogen peroxide breaks down faster in the presence of organic material, and this releases oxygen. This is likely due to the presence of peroxidase in the algae cells.



High range peroxide test strips – 0.5 to 100 ppm

Low range peroxide test strips – 0.05 to 4 ppm