Revisiting Reactors

So many have written about inexpensive CO2 reactors that Karen explains it all.

By Karen Randall

Q. I was reading in your January 1998 issue about a homemade CO2 system, but missed the magazine in which it was originally published. Is it at all possible for you to send me the details? Thanks for a great magazine!

A. I have received so many requests for information about low-cost carbon dioxide (CO2) supplementation that I've decided to cover it again. Why do we need supplemental CO2? Plants are 43 percent carbon by dry weight. In any but the most dimly lit, slow-growth systems, CO2 quickly becomes depleted. With just a little more light, however, carbon becomes the limiting factor for plant growth.

It is certainly possible to grow a beautiful tank full of plants without supplemental CO2, particularly if you have fairly soft, neutralish tap water. But even here plants may very well grow better with added CO2. At light levels above 2 watts per gallon, you will almost certainly get better growth with the addition of supplemental CO2.

For those struggling with harder water and a higher pH, added CO2 can mean the difference between success and failure, assuming proper attention to adequate light levels, proper trace element supplementation and suitable substrate. For those who'd like to experiment with supplemental CO2 without the expense of a pressurized tank system, a yeast reactor is an extremely economical solution and works very well for tanks up to about 30 gallons. Larger tanks will probably need to run more than one reactor.

There are many variations on the yeast reactor theme, so feel free to improvise. To get you started, here's one method that has worked well for many.

Use a plastic juice bottle of approximately 2 liters (the plastic for pop bottles has become so thin they tend to collapse if you try to pick them up with one hand — juice bottles are sturdier). Make a hole in the cap just large enough for a piece of air line tubing. A hole larger than necessary will probably leak later on. It can be made using either an electric drill or by holding a nail over a hot burner with a pair of pliers until it is hot enough to melt through the plastic cap. Cut a piece of air line tubing diagonally, so that it will go more easily through the hole in the cap. The tubing should not go far enough into the bottle that it will come in contact with the liquid below.

If you make the hole small enough that you have to force the tubing through, additional sealing may not be needed. If it is at all loose or if you just want added insurance, glue the tubing in place with a hot-glue gun.

Using a funnel, place 2 cups of sugar and 1 teaspoon of yeast in the bottle. Then fill the bottle with lukewarm (not hot) water to just about where the neck begins to narrow, and shake to mix. Screw the cap back on and insert the other end of the air line tubing into the intake of a power filter or canister filter, where the bubbles can mix and dissolve.

Until the liquid in the bottle has thoroughly cooled, keep the bottle higher than the tank to prevent a back siphon. Once it is cool, it is usually safe to put the bottle beside or beneath the tank. Some people like to use a CO2-resistant check valve to totally avoid the possibility of back siphoning.

Within 24 hours your yeast reactor should be producing enough CO2 to make a noticeable difference in a tank of between 20 and 30 gallons. If the tank is larger you may have to run more than one yeast reactor in series. If the tank is smaller you may need to reduce the amount of yeast and/or add a little baking soda to slow CO2 production. In all cases, but particularly with a very small tank or very soft water, check the pH frequently, until you are confident in the system, to make sure the pH isn't dangerously low.

Depending on tap water chemistry and the warmth of the house, you should find that the yeast reactor produces a fairly good amount of CO2 for about two to four weeks. At that point, you can revive the mixture by pouring out half and replacing it with another cup of sugar and refilling with water. If you let the reactor go for too long and the liquid has a strong alcohol smell when you open it up, or if it has completely ceased producing bubbles, you have probably produced high enough levels of alcohol to kill off the yeast. If this happens, simply empty the bottle, rinse and start again.

Occasionally someone who has followed the directions doesn't seem to be getting any CO2 production. If, after 24 to 48

hours, you shake the bottle and it fizzes like a soda bottle, it's producing CO2. If the CO2 isn't making it into your tank, there is a leak somewhere, most commonly where the tubing is inserted into the bottle. If the bottle does not fizz when shaken, the yeast is not active and you will have to start again with a fresh supply. Remember, yeast must be refrigerated once the container is opened.

Environmental Responsibility and Legislation
I recently opened up our small local newspaper and found the headline, "Plants Threaten Waterways." The article went on to paraphrase a new piece of legislation being proposed here in Massachusetts meant to try to track and limit the spread of non-native aquatic plants. This is a very serious problem even here in the cold Northeast, but is a much greater danger in the southeastern U.S.

Most threatened and endangered aquatic plants in Massachusetts are in danger due to the introduction of non-native plants. The three worst offenders here are Eurasian milfoil (Myriophyllum aquaticum), fanwort (Cabomba caroliniana) — a plant native to the U.S., but not the northeast, and water chestnut (Trapa natans). The southeastern states have major problems with a number of other species. Some of the worst are water hyacinth (Eichhornia crassipes), Hydrilla verticillata and Hygrophila polysperma.

The major factor in the spread of these weeds is boating. Plant material gets caught on boat propellers and trailers and is inadvertently transported from one body of water to another. But, except in the case of Cabomba, somebody originally introduced all of these species into the wild.

Most of these plants were introduced many years ago, when people were less concerned about the protection of our natural resources than we are now. Once these plants escape, they have the potential to spread very rapidly, crowding out native species.

Through home aquariums and garden ponds people learn more about the animals and plants that inhabit the waters of our planet and are more likely to be interested in preserving our natural resources. People do not protect what they do not care about.

Aquarists and gardeners (both terrestrial and aquatic) have a very big responsibility not to allow enjoyment of their hobby to endanger the natural environment. No responsible aquarist would ever dream of releasing an aquarium fish into the wild, although irresponsible people have done just that. Goldfish and koi are the prime examples in the north, whereas Florida is rampant with escaped exotic species.

Aquatic gardeners have to be just as careful. Never dump aquarium material anywhere near a natural body of water! That includes water and gravel, as well as plants. Never use a non-native plant to landscape beside a dock at your lakefront cottage. If you live near boggy or marshy ground, the same holds true. Many of our aquarium plants are amphibious and can grow quite happily in damp immersed conditions.

Pond owners have to be even more careful, such as making sure plant material can't overflow and escape into nearby wetlands. Although many pond plants cannot survive northern winters, some you might not expect to can.

Unfortunately, the response of some well-meaning, but uninformed, legislators is to introduce laws that could potentially hamper the hobby of aquatic gardening severely. New Hampshire has already passed such ill-conceived legislation that, while intended to stop the sale of Cabomba and milfoil, is written in such a way that it outlaws the possession, propagation, sale or transportation of "those species of vascular aquatic plants that were not part of New Hampshire's native aquatic flora before 1950."

We can work toward the goal of protecting our waterways without crippling a hobby that is not only enjoyed by many, but also serves as a means to educate people about the beauty of our natural world. Many states have developed lists of plants that are current or potential environmental dangers — good legislation we should support. This seems to be the direction Massachusetts is heading in.

If you live in Massachusetts, New Hampshire or another state, keep your eye on what's going on. If you hear of legislation banning aquatic plants, call and get a copy. Read it carefully and make sure it will not interfere with our hobby in unreasonable ways. And do your part to educate other aquarists.