Building an Anoxic Filtration System - Part 2

The anoxic filtration system is inexpensive to build and is adaptable. It will fit anywhere because it can be built to fit whatever space is available. The only constraint is that there should be about one basket per adult fish but, even in this, there is flexibility. If ever it is found that more baskets are needed for an increased stocking level, and space is limited, an extra layer can be stacked on top of the bottom layer as long as they are spaced so that the bottom of one basket doesn't rest directly on top of the one below. This will ensure that water can still flow past all surfaces of all baskets.

A basket where water is able to flow past all six surfaces, (the four sides plus the top and bottom), will be able to remove ammonia more efficiently than a basket where water can't flow past one or more of the surfaces. The gap doesn't have to be great. Since typical baskets taper toward their bottoms, even if the tops are touching, there will still be adequate spaces between them for water to freely circulate around all sides. If small spacers (such as PVC pipe pieces) are placed underneath the baskets, they will allow water to circulate underneath them too.

Stacked baskets can reduce the anoxic pond footprint

Anoxic filtration systems can be of any shape or size to suit available space and the depth of 600 mm (24 inches) is a suggestion that will suit a wide range of common aquatic plants. The depth isn't important to how efficiently the baskets will function; they will work at any depth that is convenient to the hobbyist from being just covered by water to a depth of one meter or more.

Deep anoxic systems will allow the baskets in it to be stacked in order to get the maximum number of baskets into any given surface footprint. However, if a deep anoxic pond is considered, thought should also be given to the ease of future maintenance.

As a guide, there should be about one basket per adult fish for the system to provide stand-alone anoxic filtration. Just putting one or two biocenosis baskets somewhere in the pond may not have any significant effect. The optimum size of the biocenosis basket is 30 cm x 30 cm x 20 cm (12"x12"x8"). It's possible to use smaller baskets but they will have less room inside them for anoxic conditions to develop so they won't be as effective as the optimum size.

Larger baskets would allow for a larger anoxic zone to develop but will become very heavy once they have been submerged. A point that should be remembered is that each basket may have to be lifted out to allow for occasional maintenance of the basket itself or cleaning any leaves that may blow into the anoxic pond or sediment that may accumulate in it. A leaf net over the anoxic pond will reduce maintenance.

Any other convenient shape would be just as suitable as long as all the baskets are completely submerged and that water can flow gently through the pond without disturbing the contents of the baskets.

Avoiding settlement in the anoxic pond

Whichever filtration method is used, conventional aerobic or anoxic filtration, a turnover rate of once per hour or greater is recommended. The faster ammonia is removed from

where the koi are excreting it and presented to the biofilter the better because the overall effect will be to reduce background levels of ammonia in the main pond.

Since nitrifying bugs rapidly colonize any wet surface (including the media in a conventional aerobic filter) where there is also a source of ammonia, every surface in a koi pond will provide a home for the ammonia bug (nitrosomonas). Their waste product, nitrite, will then provide a nutrient source for the nitrite bug (nitrobacter) which will also colonize every wet surface in the pond. The result is that there will always be a degree of the nitrogen cycle conversion of ammonia to nitrate in koi ponds.

Where anoxic filtration is employed, the ammonia is removed from the system without leaving nitrate as the end product. Therefore a quicker rate of removal of ammonia from the main pond and the consequential reduction of background ammonia in it is not only of benefit to the koi but it also reduces, as far as is possible, the nitrogen cycle taking place in the main pond. This allows the majority of ammonia to be removed and dealt with in the anoxic pond without nitrate being produced as an end product.

Accordingly, the recommended flow rate through an anoxic pond is as fast as is possible without disturbing the contents of the biocenosis baskets. Even with a relatively high pond turnover rate, the rate at which water flows through the anoxic system will be far slower than the rate at which it passed through the pipework leading to it. The slower rate of flow through the anoxic system inevitably will lead to some settlement of suspended silt so there will be some settlement of the suspended particles that the water had been carrying. Provided any settled silt isn't allowed to build to a depth of more than a few millimeters and it doesn't contain any organic debris such as fallen leaves, it will become inert and will not lead to a subsequent deterioration in water parameters.

One recommended addition to an anoxic system is a pre filter. Installing a good pre filter before the anoxic pond will remove most of the suspended particles. This in turn will substantially reduce the amount of silt that will subsequently accumulate in the anoxic system although, even with a pre filter, there still will be some settlement. Any good pre filter, including brushes, bead filter, sieve filter, settlement chamber, can be used before the anoxic system.

Occasionally the silt accumulated on the bottom of the anoxic system will have to be removed. With an adequate pre filter, this will only need to be done a few times a year. If the anoxic system has a sloped bottom with a drain at the lower end, this cleaning can be as simple as opening a valve to flush the sediment away. It may be necessary to use a hose to further reduce the accumulated sediment. A pond vacuum may also be used. In any case be careful not to disturb the basket media.

Gravity Flow or Pump Fed

The anoxic system can be built either by a direct gravity flow from the pond and then pumped back to the pond or by pumping from the pond, flowing thru the anoxic system and then gravity flow back to the pond. In either case a good pre filter before the anoxic system is crucial. The water entering the anoxic system should be passed thru a diffuser of some sort to distribute the flow and not disturb the contents of the basket. A perforated pipe, set vertically works well for a diffuser.

Filling the Baskets

For a 12”x12”x8” mesh basket, you will need “Special Kitty” Cat Litter available at Wal-Mart for about $4 for a 25lb bag and “Ironite 1-0-1” by Pennington available at most garden centers for about $19 for a 15lb bag plus some fine mesh fabric (like a nylon stocking) to hold the Ironite.

Fill two of the baskets half full of kitty litter then rinse well to remove dust. Place 9oz of Ironite in the fine mesh and secure the ends. Place the mesh bag in the center of the basket then put the contents of the other basket on top. That is all there is to it!

If you are not using plants in your baskets, the Ironite should last many years. If you are using plants in your baskets, the Ironite will need to be replaced every several years. You will not need any other federalizer if you are using plants.

You can use other brands of cat litter but it must be clay, non-clumping, and preferably without odor control. A 25lb bag will fill about 1 ½ of the 12” baskets. Also, there are a few other products that can be substituted for cat litter. Laterite, if you can find it, can be used instead of Ironite but you will need to use twice as much Laterite.

How it Works (highly simplified)

Do to the different polarization of the Ironite and the ammonia, the ammonia is drawn to the Ironite. Simply, the Ironite acts somewhat like a magnet. This does not require that water is drawn to the center of the basket.

There are certain types of bacteria, here collectively called facultative bacteria, which can function in either an aerobic or in an anaerobic environment. Since the center of the basic is anoxic there is not enough oxygen for nitrification to take place. So the bacteria converts ammonia directly to nitrogen gas. Also this same group of bacteria will obtain oxygen from any nitrite, nitrate or phosphate that may be present thereby reducing those levels with the resulting by-product being harmless gases.

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John's Notes:

This is a very highly condensation of Syd Mitchell's article on his web site, www.mankysanke.co.uk. Pictures, science panels and illustrations have been omitted. I have tried to reduce the 22 printed pages from his web site to just a few so that it would fit in our newsletter. I have also added some of my own comments in the above. I hope I have grasped the essence of the Anoxic Filtration System in this condensation and in the condensation that appeared in our October newsletter. If you are interested in more information and further links, visit Syd's website. Or if you wish you may contact me for further information and/or see my Anoxic Filtration System.