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AQUARIUM WATER PUZZLE

Rene Jez

Various hobby magizines publish quite a lot of articles about the maintenance of water conditions in aquarium tanks. Sometimes the opinions expressed by experienced hobbyists differ about how to maintain the quality of auarium water and what is a desirable rate of water changes. To bring some light into this problem, I would like to try to explain the basis of the process.

The actual process is not very complicated if we try to understand some of the basic points.

There are two distinctly different water conditions at the establishment of a new tank, the fresh (new) water or mature (old) water as we can call it. There are of course transition stages between these two extremes.

What is the basic differences in the water characteristics in our tanks? Firstly, let us leave out the influence of pH and hardness of the water, because this is not very significant in the early stage of the transformation of fresh water into mature water.

Good mature water is the ultimate aim of any aquarist, this task is particulary difficult for a novice in the hobby. Many beginners experienced/serious problems. Sometimes this has even resulted in them giving up the hobby.

What is fresh water? Tap or rain water is a typical case. Rain water is actully distilled water with traces of elements and dirt collected during the rain. Tap water is a mixture of treated water with added lime, chlorine and floride. Both of these so called fresh waters are basically bacteria free, clear and without colour.

Old aquarium water is clear too, but it has a tinge of yellowish colour, a sweet and pleasant smell and a lot of bacteria. The bacteria count is the characteristic sign of old water. A balanced amount of certain bacteria essential for fish waste processing is what we must try to achieve. This water does not give you those terrible disasters, such as the slimy surface films, filamentous algae, green dispersed algae and the most dangerous of all fast development of smelly, rotting water which will totally kill everything.

The water also develops a modified composition of elements as are necessary for the life cycle of some bacteria and algae.

Fish or plant waste products (as the essentual nutrients for the particular bacteria, algae or plants) are utilised or are transformed into less harmful products. The living bacteria is given by the availability of the particular nutrients (food) for them and they will readily multiply in the case of increased nutrient load. Even if the bacterial life cycle is only around 20 minutes, this response from a few thousand or a few million bacteria is a different matter and it is a precise balanced process with a possibility of reversing the process if something went wrong.

The fresh water has an extremely slow capacity to buffer a high load of fish waste, the slower the process of the simultanious development of all useful bacteria, the safer the results.

The time needed for the transformation of the fresh into the old mature water varies from approximately a week to a month, depending on the size and overall conditions in the tank. Of course, other factors such as the use of old gravel from a previously maintained tank, or the re-use of decorations or plants, shorten the natural development time by helping to introduce colonies of bacteria into the new environment. The process of water maturation cannot be substituted by any hi-tech mechanisation (filters, etc.). The only matter which counts is the amount of oxygen in the water. For this, a heavy aeration with the consequent movement of water is the cheapest solution.

Amongst many different bacteria, the most important are Nitrosomonas, changing ammonia into nitrites and Nitrobacter, processing nitrites into nitrates. Nitrates are low toxicity products originating from fish waste products and the organic decomposition of fish food or plants. The low level of nitrates can be maintained in two ways. A lush growth of plants (and algea) utilizing the nitrates for their growth or frequent changes of water in the case of unplanted tanks. Between these two alternatives, various different frequencies of water change activity can take place, according to the amount of fish and plants in the tank, for example, I have had to overhaul my tank only once in 3 years.

The only real water changes occured during the vacuuming of dirt from the gravel voids (representing a change of 15-20 litres of water in a one to two month time span). The 150 litre tank, containing 50-80 tetras fed with live foods (except tubifex worms) was in perfect shape without any filter at all, however there were always many plants to provide a buffering function to keep nitrate levels under control.

The water changes, particularly the large ones, can influence the whole function of the tank. Everyone should develop an approach to water changes based on necessity, not on what others advocate. The lean feeding of fish and thickly planted tanks slow down the development of nitrate levels. If all other factors are right (light, number of fish, etc.), changes of water will be less frequent as well as the need for scraping off the algae growth from the tank walls. Once the algae growth occurs on the plants, you know there is an extreme load of nutrients in the water and some water changes are necessary. Also, the tendency for fungus related fish diseases is often experienced.

A heavy overfeeding after a big water change can produce a disaster due to the

significant reduction in the number of bacteria available for explosive multiplication to neutralize toxic products.

Remember, the proper function of the bacteria requires sufficiant oxygen, fish gasping for air usually indicates a lack of oxygen and an increase in the rate of aeration is the first step needed to rectify the problem. Once the bacteria start to die, more and more oxygen is required for their organic disposal. Under these conditions a radical change of water often helps. When this step is undertaken, keep the fish hungry for a few days.

If someone is prepared to take a more scientific approach to mature the aquarium water, there is a way to establish the Nitrobacter colonies by adding sodium nitrate and following up with the addition of ammonia to develop Nitrosomonas baterias. This helps protect the Nitrobacter which are sensitive to levels of ammonia. Excess ammonia can kill the subsequent bacterial chain developement if the concentration reaches a dangerous level. This spells disaster for fish too.

The commercially sold water conditioners deal with this problem by offering feeding mixtures to the bacteria. A much cheaper solution is to use a bucket of water from an already established tanks, a few litres of farm pond water or a handful of live daphnia introduce into the freshly established tank. After this treatment, the first few fish can be introduced after 2-3 days, and in following days the number of fish may be gradually increased.

Until this point, we have left out pH and water hardness interference with the process of water maturation. In the beginning stage, all the above mentioned sources of water produce pH readings close to 7.0 to 7.5 (neutral pH being 7.0). The exception from this rule would be water from a well originating in limestone ground (with a pH of 7.5 to 8.5). Actually, a high reading of pH improves the conditions for bacteria multiplication, as does the higher hardness of water.

Once the biological process in the tank has increased the rapidity of the conversion of waste products into products such as nitrites, nitrates, carbon dioxide and others, some important developements tank place. One particular product are the hydrogen ions which decrease the pH reading towards a lower number, also, when carbon dioxide is not consumed by plants (where it is an important part of plant food) it forms carbonic acid and, with the above mentioned hydrogen ions, brings a very rapid drop of pH, producing those generally known problems with acidic water on the aquarium environment.

This is an explanation for the problems so often experienced by many aquarists. Even an ideal, healthy tank has a continuous tendency to drift to a lower pH reading because of the increased ratio of hydrogen ions. It is easy to buffer this tendency by a handful of shell grit or a few pieces of broken shells to arrest this process. The increased hardness is a negligible problem, as the calcium products are utilized by diatomacia and algaes or disposed of in occasional water changes.

Now that we know a little bit more about our tanks, we won't need to enter into the usual buying spree for test kits, water conditioners and acidity or alkalinity rectifiers. Let us realise the above mentioned facts and use them to make our maintenance problems more easy.

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