Beverly's Pet Center **FishTalk #1**

The First Four Weeks

This is the first in a series of short discussions on topics relating to freshwater and marine tropical fish. We will start from the beginning, or in other words, " What's going on in my tank? ". The processes described here apply to freshwater and marine systems.

There are three types of filtration that take place in a properly set-up tank system. *Mechanical* filtration is the process of physically trapping unwanted particles by running the water through floss, cotton, sponge, micron cartridges or other materials. *Chemical* filtration is achieved by using activated carbon or other resins to chemically remove certain compounds from the water. This discussion is going to cover the third type of filtration, *Biological*.

Fish, invertebrates and decaying matter form wastes in the tank water. These nitrogen based wastes begin mostly in the form of ammonia. This compound is very toxic to the tank's inmates. Fortunately, when you have well oxygenated water flowing over suitable media (gravel, DLS, Bio Balls, etc.), colonies of nitrifying bacteria begin to grow. The first type of these nitrifying bacteria are *Nitrosomonas*. They convert ammonia into nitrites. Nitrites are also toxic to our tank's inhabitants. Once nitrites are present a second type of nitrifying bacteria begin to grow. Billions of *Nitrobacter* and similar bacteria convert nitrites to nitrates. Nitrates are a thousand times less toxic than nitrites and can be tolerated in a tank to much higher levels.

Nitrates do not break down any further by the same type of bacterial action as in the ammonia and nitrites. The effects of nitrates are still not well known and there are different opinions as to how toxic they are. It does seem clear that invertebrates are more sensitive to nitrates than fish are, therefore making them more of concern in a reef-type tank.

The normal method of removing nitrates is partial water changes. Draining out some tank water and replacing it with new, nitrate free, water reduces these levels. A ten percent a week change is optimal, but for many of us, too much maintenance. A twenty percent change once a month is not too much to ask and what I would consider the minimum "required" maintenance.

A second method for nitrate removal exists, but at this time has not yet gained wide acceptance or use. This method uses a denitrifying filter. There are denitrifying bacteria that break down nitrates. These anaerobic (without oxygen) bacteria do not occur naturally in a tank in sufficient numbers to control nitrate buildup. Denitrifying filters are set-ups designed to provide the conditions for the growth of these bacteria, thus preventing a nitrate buildup in the tank.

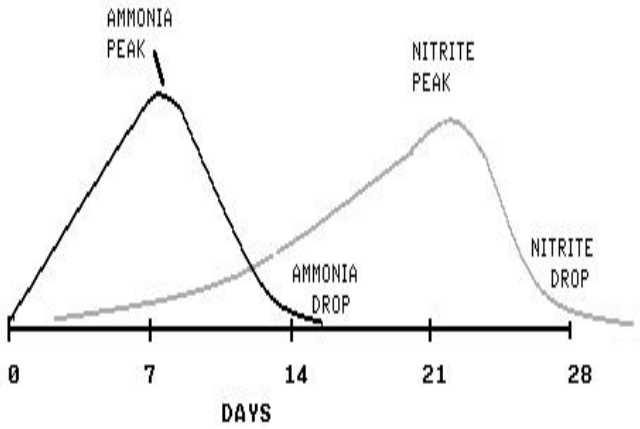
Now that we have an idea of the processes, lets look at the new tank from day 1 and see how it works. You bring home your new tank and fill it. Of course we dechlorinate the tap water and adjust the temperature, salinity and pH, while we float the first new inhabitants-to-be in the tank. Preferably these fish are of the hardy variety (damsels). We will note at this point that there is a way to start the new tank and run it through its *cycle* without using fish. Ammonium chloride can be used to provide the food to begin our bacterial bloom, but it doesn't provide nearly the same beauty and movement in the tank!

Soon the damsels are merrily swimming around the tank. A little food is offered that they greedily accept. Most of the food is eaten and a little escapes to the bottom. The food that was eaten will soon be excreted into the water from the opposite end of the fish that it went in. A large part of this waste is *nitrogenous waste* in the form of ammonia. Any morsels that escaped the damsels begin to decay and form the same types of waste. This begins the rise in ammonia levels that occur in new tanks.

Now our friends the Nitrosomonas bacteria smell food and begin to multiply accordingly, on the surfaces we have so graciously provided. These surfaces may be a gravel bed with an undergravel filter or the media in a wet/dry filter. The water flows over these surfaces bringing the Nitrosomonas the two things they need to grow, oxygen and food (ammonia). In return for the nice accommodations the Nitrosomonas break down the ammonia into nitrites. The actual time required for the bacteria to "catch up" or break down the ammonia at the same rate it is being produced varies according to conditions and load. Generally you will find ammonia levels rising for about one week and dropping off by the end of the second week.

Once nitrites begin to show up in the tank, Nitrobacter and crew will follow. There is some inhibition of Nitrobacter growth in the presence of high ammonia levels. As ammonia levels begin to drop the Nitrobacter colony's growth speeds up. This inhibition accounts for prolonged periods of high nitrite levels sometimes encountered while cycling a tank. Nitrites begin to show up within the first few days and will climb to a peak in approximately 3 weeks. By the end of week 4 the level will usually drop, sometimes suddenly. This is the day we have waited for!

When ammonia and nitrite levels drop to zero, the tank is cycled. This bed of nitrifying bacteria is the tank's *biological filter*. A well established biological filter can expand and decline in size to handle normal variations in load. The "load" is the amount of waste produced in the tank, which will vary according to feeding and the addition or removal of fish. Once a tank cycles the load can be gradually increased without any significant rise in waste levels. There are load limits for any given system and these limits can be figured with some accuracy.



TIME SCALE OF NITRIFICATION

The process of cycling a tank can be speeded up by *seeding*. This entails the addition of nitrifying bacteria to the tank. Gravel or other media from an already established tank is one source of this seed. Commercially available products also supply a source for a seed. Products such as Fritz-Zyme or Bacter Plus are nitrifying bacteria cultures and will speed up the cycling process. The process can be speeded up but there is no such thing as an instant seed. A tank still requires time to form a well established, mature biological filter that can handle the waste breakdown required to maintain water quality at a level needed to keep more sensitive fish.