Carbon Confusion

While browsing the shelves of most fish stores, you find a multitude of products to condition water. One of the most useful products is *activated carbon*. There are many brands of activated carbon that vary in appearance and price. What are the differences? How is it used? What function does it perform? These are the questions we will answer.

First we'll start with a little background information on what carbon is. Following the background we'll cover some guidelines on the use of carbon. We'll finish with the effects of carbon filtration.

There are many types and grades of carbon. Activated carbon is made from coal, wood, nuts and even animal bone. A process of heating the material at high temperatures and then repeating this in the presence of steam, air or carbon dioxide. Variations in the processing method yield activated carbons with different characteristics and pore sizes. These will determine what types of compounds the activated carbon will filter out. Many characteristics affecting the choice of a carbon cannot be readily distinguished by the user. We must find a good brand, where the manufacturer has done its homework, that has properties aimed at the needs of the aquarium. Some companies will buy whatever is cheapest, regardless of its qualities. These are the ones to avoid. Often companies rate their carbons with names like "hobbyist", "professional" and "research" grades or "activated" and "super activated". The better rated carbons cost more and usually perform better.

There are several observable traits that can be used to compare carbons. Some carbons have greater volume for a given mass (in other words, they are lighter or the same amount by weight will fill a larger container) than others. This indicates more or larger pores and greater internal surface area. Greater surface area is desirable because it increases the capacity of the carbon.

The proper carbon for aquarium filtration should have a dull look and be firm, but crushable. The inside of the grains should contain a lot of space. You can test this by throwing some activated carbon into water. The carbon should float for a second and make a hissing noise before sinking.

Large pore size will trap large molecules more effectively (organic waste - proteins). Small pore sizes trap small molecules better. In aquarium filtration we need to remove both large and small molecules, so an activated carbon with a mixture of pore sizes is best.

The quantity of carbon that should be used and how often to change it is not an easy question to answer. The amount and types of filtration being used are one factor in this equation. Biological load (amount of fish, feeding, decaying matter, etc.) is also a major factor for determining the correct amount of activated carbon. Since actual measurement and calculation to try and figure

out the answer would be quite technical, involved and require expensive equipment, we will take another route.

There is a large variance in recommendations for the amount of activated carbon to use and how long to use it. My recommendation is to use about 10 ounces of activated carbon for each 50 gallons of water and change it every 30-60 days. The activated carbon should be placed in the filter system so water cannot flow around it, but must pass through the carbon. This is just a starting point and should be used along with the information that follows and a little experimentation to find the optimum usage for your system.

One definite indicator that the carbon needs to be changed is the yellow tint that aquarium water will take on over time. This color change may be difficult to detect in the tank until it is severe. A simple way to check is to take a little tank water and put it in a clear glass. Hold the water sample in front of a pure white piece of paper. This will easily reveal any color.

There are two main factors causing activated carbon to become inactive carbon Over time the pores in the carbon become filled with the types of compounds they attract. Once the pores fill, the carbon can no longer hold any more.

The second factor causing a decline in the effectiveness of carbon is coating. A slime type coating occurs on the outside of the carbon grain blocking the pores. Washing can remove some of this and bring a little more life to the carbon
At last we come to the final and most important question "What does filtration with activated carbon do?". Activated carbon removes many metals from the water. It also removes dyes and antibiotics. This is why most medications require the removal of carbon from your filter to be most effective. Good carbon filtration makes the water crystal clear. This is one of our aims in using carbon but we must not let it fool us. Don't stop doing partial water changes just because the water looks great!

A very important function of activated carbon is the removal of *dissolved organic carbons* or DOC. This term lumps together most organic carbon compounds that are dissolved in water including carbohydrates, proteins,and fatty acids.

Buildup of DOC reduces the natural buffering ability of water. The explanation of this occurence is very technical and beyond the scope of this discussion. (If you are interestedin the details, check out the books referenced at the end of this article.) The bottom line is pH begins to drop and becomes difficult to stabilize.
Removal of DOC helps the water maintain higher alkalinity, thus making it easier to keep pH in the proper range.

It is good news that activated carbon removes all this bad stuff, but unfortunately there are good nutrients that also are removed. Many trace elements, which are especially vital to invertebrates, are filtered out of the water by activated carbon. Some suggest intermittent use of activated carbon in reef tanks. Discontinue use immediately after water changes or the addition of trace elements. This allows the inhabitants of the tank to get what they need. The final determination of what is right for your tank must come from observation. Watch the condition of the water and it's occupants to find out what works best for your system. Every tank is a unique environment and I think this is what makes the hobby so fascinating.

References

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