Chemical Filtration

Fundamental to the success of a healthy aquarium is the stable aquarium environment made possible by scheduled water changes and filtration. Water changes provide systematic removal of wastes not normally removed by filtration and restoration of a balanced ionic environment. No system exists, despite irresponsible or misinformed claims to the contrary, that can replace water changes.

Carbon. The most familiar chemical adsorbent is activated carbon. Despite the appearance of many new synthetic adsorbents on the market, carbon still remains an excellent filter material. Unfortunately, not all carbons are equal and an enormous amount of misinformation exists. Activated carbon for the aquarium should be a little larger than pin-head in size (granular). When washed and dry, it should be dull and not shiny. It should also tend to float at first. Good activated carbon should feel hard and not crumble, but will fracture under finger pressure. The best carbons are usually produced from bituminous coal and have a high porosity and low density. Look for high total surface area (450–550 m2/cc) combined with a high pore volume (0.45–0.60 mL/cc) or high molasses number (500–700), indicating a porosity suitable for water filtration. A high iodine number indicates microporosity suitable for gas filtration. Look for a carbon with low ash content, reflected by little or no effect on the pH of pure water. Seachem's MatrixCarbon™ is unique in that it incorporates these features into a spherical pellet, which has ideal hydrodynamic properties.

All activated carbons are produced from materials that were once living, be it coconut shell, wood, or coal, and all living materials are rich in phosphates for the simple reason that phosphates are essential to all earthly life forms. In fact, phosphates are the very backbone of DNA, the genetic material for life itself. The activation of carbons by heating to over 900 F in the absence of air does not destroy phosphates, but converts it to soluble orthophosphates. Consequently, all carbons leach phosphates into water. Some carbons (coconut) appear to leach less phosphates, but only because they are microporous. Such carbons function better as gas phase filtrants and are not suited for water filtration. Carbon cylindrical pellets are engineered for use in air filters and are not a good choice for water filtration.

Seachem's Renew™ is an excellent economical replacement for granular macroporous activated carbon. It has an equivalent capacity for organic removal as many carbons; it does not release phosphates; and, being white, it darkens with use, indicating exhaustion. It has a total surface area ranging from 500 to 600 m2/cc and a pore volume ranging from 0.5 to 0.6 mL/cc with an equivalent molasses number of 600 to 700. In addition to sharing some adsorbtive properties of carbon, it has ion-exchange properties that provide it with a capacity to remove ammonia from freshwater that exceeds that of zeolites. It has a limited, but demonstrated capacity to remove nitrites, nitrates, and phosphates.

Other types of chemical filtration include synthetic adsorbents, ion exchangers, insoluble oxides, and zeolite. Zeolites are white, dusty clays, usually sold for removing ammonia from freshwater. It has come in vogue to promote certain zeolites for the removal of nitrates in sea water by molecular filtration. Neither the kinetics of ion exchange nor that of molecular sieving by zeolites offer a practical means of removing nitrates from sea water to any useful extent. The only practical means of removing nitrate from sea water remains water changes or the biological approach of algae or anaerobic filtration. Seachem's denitrate™ and Matrix™ serve as both aerobic and anaerobic support materials.

Synthetic ion exchangers are useful in freshwater to help control ionic balance, remove ammonia, nitrite, and nitrate.

In marine water, some ion exchangers can remove limited nitrite and nitrate, but have no significant effect on ammonia. But, generally, the most useful function of ion exchangers, in both fresh and marine water, is organic removal, and in this they excel. Although not an ion exchange process, the ability of certain ion exchangers to remove organics can be phenomenal in both marine and fresh water alike. The ability of ion exchangers to remove organics is related to their hydrophilic and hydrophobic matrix structure and porosity, much the same as uncharged polymeric adsorbents. Synthetic adsorbents and ion exchangers with porosity suited for organic removal are macroporous and have low cross-linkage, giving them a lightly colored appearance. Darkly colored resins tend to be microporous and highly cross-linked and are not well suited for organic removal.

Insoluble oxides are either aluminum oxide or iron oxide and these materials are used for removing phosphate from water. They function best in seawater and at high pH. Spherical beads, rather than granules, of these materials are hydrodynamically superior and thus function best. Seachem's version of this product is PhosGuard™, a spherical porous bead of aluminum oxide that has a very high capacity for both phosphate and silicate.

SeaGel™ is formulated from MatrixCarbon™ and PhosGuard™, and is optimized specifically for aquaria where organic color body and acid removal is required without the introduction of phosphate. It is particularly effective in correcting algae problems in both marine and freshwater aquaria. It is not recommended for phosphate buffered freshwater aquaria.

Seachem's HyperSorb™ is a premium synthetic adsorbent with outstanding organic removal capacity and ionic management abilities. It is ideal for all types of water, including marine, brackish, and a broad spectrum of freshwater from acid to alkaline. It has all the advantages of carbon and none of the disadvantages. HyperSorb™ changes color progressively as it becomes exhausted, and then can be easily regenerated with ordinary household chemicals. Regeneration is near 100% effective and can be performed repeatedly. Purigen™ is a premium grade synthetic adsorbent that retains all of HyperSorb's™ qualities along with the added advantage of possessing a four fold greater capacity (than HyperSorb™) with virtually no impact on trace elements.

CupriSorb™ is a narrow spectrum, synthetic adsorbent based filter material for removing copper and heavy metals from either freshwater or marine water. It extracts all types of copper, including chelated copper, and remains effective until it turns a deep blue-black color. It may be regenerated repeatedly. If placed in continuous service, it will gradually extract even precipitated copper and make invertebrate culture possible in tanks previously heavily treated with copper. CupriSorb™ is a powerful copper specific chelating resin. Competing products are not chelating products, but merely cation exchange resins. Such resins can remove copper from freshwater but are ineffective in seawater.