Biofiltration Technology

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While most aquarists have a general understanding of the benefits of biological filtration in their home aquarium, few are knowledgeable on the significant complexities that make it so effective, yet so simple, to establish and maintain. An ideal biological filtration system is one that closely mimics nature, and by doing so, will result in a healthy aquatic environment requiring little maintenance. With proper materials and techniques, biofiltration can be exceptionally effective in the removal of typical contaminates in a pond or aquarium (ammonia, nitrite, dissolved organic solids, as well as nitrate), thus promoting a more natural aquatic environment. The following provides a brief overview of biofiltration, how it works, and what one should look for when selecting the appropriate materials to establish a biological filtration system in an aquatic environment.

What is biological filtration?

Biological filtration involves the growth and containment of specific microorganisms working as a consortium to maintain a natural and balanced aquatic environment. These organisms consume unwanted contaminants, such as ammonia, nitrite, nitrate and dissolved organics as their food source, breaking them down into water, CO_2 and nitrogen gas.

How does biological filtration work?

Designing a biofiltration system requires careful attention in ensuring that the right types of aerobic and anaerobic bacteria - those that promote ammonia and nitrite removal and denitrification - can colonize and flourish in a balanced way. It also entails the incorporation of beneficial physical capabilities (i.e. biologically unaided) to add oxygen, maintain water flow and also remove excess CO_2, nitrogen and other dissolved gasses, as well as suspended solids, from the aquatic environment. In designing a biofiltration system, it becomes particularly important to provide enough exposed space, or surface area, on which these beneficial bacteria can grow, while also ensuring sufficient water flow for bringing necessary nutrients to the bacteria.

There are many types of microorganisms that can be cultivated to work harmoniously in establishing and maintaining a healthy aquatic environment. Each variety or subset of these beneficial microorganisms provides a unique

ReefresH20

ReefresH2O, a clean technology product from NanoDynamics, Inc., is an advanced biological filtration media for the aquaculture market. It is based on the Cell-Pore inorganic ceramic foam technology that provides a highly interconnected porous structure ideal for extensive aerobic and anaerobic colonization - resulting in a cleaner, healthier environment for aquatic life.

The vast porosity of ReefresH2O allows wastewater to flow freely through the media with minimal backpressure, thus assuring maximum exposure. With more

"job function", with heterotrophic bacteria that consume carbonaceous material, nitrifying bacteria that consume ammonia and nitrite, and de-nitrifying bacteria that reduce nitrate into nitrogen gas. In general, de-nitrifying bacteria are very slow growing, and nitrifying bacteria, while faster than the latter, are still relatively slow growing compared to heterotrophic bacteria. Due to these different growth rates, it becomes imperative that the media sustaining these organisms has enough surface area for all their continued proliferation.

What should I look for in a biological filtration system?

While biofiltration can be facilitated via use of various media, both natural and man-made, the key to an efficient system lies in balancing its capacity for beneficial bacterial growth. A system's bacterial population is in direct proportion to the speed at which existing bacteria can grow and thrive on the available nutrients (dissolved organic and nitrogen contaminates). A higher population density provides a greater number of bacteria, thus facilitating these natural reactions at a faster rate. The challenge, therefore, is in selecting a high surface area biofiltration media that is both efficient enough to fit within the footprint of an aquarist's system and effective enough to handle the biological burden of that system. Biological filtration systems can be fashioned from either natural materials (such as rock or wood) or synthetic media (i.e. ceramic, plastic, or other composite materials), with the latter providing the ability to adjust and enhance overall system attributes, such as increased surface area. When evaluating the different types of biofiltration systems available, the following criterion can provide a helpful guide in determining a reliable choice. Overall, the biofiltration system should:

1. Be comprised of inert media (i.e. corrosion and chemically resistant) that also in no way presents potential harm to aquatic life.
2. Provide reliable, proven capabilities in ammonia/ nitrite removal and denitrification (nitrate reduction).
3. Require as small a footprint as possible.
4. Be available at a low overall capital cost.
5. Operate with low energy consumption.
6. Require little maintenance.
7. Offer ease of portability.
8. Deliver scalable performance (i.e. performance per unit volume should be constant regardless of the system's size).
9. Exhibit good mechanical strength and turndown ratio (i.e. ability to work under a wide range of water flow rates and nutrient loading levels).
10. Offer ease of monitoring to ensure the system is functioning properly.

surface area than other biomedia products on the market, ReefresH2O is an ideal solution for hobbyists and professionals who are serious about optimizing the performance of their freshwater, saltwater, reef and pond installations.

The use of ReefresH2O biofiltration media in a contained aquaculture system enables the acceleration of the natural nitrogen management process, significantly streamlining the effort to achieve and maintain optimum conditions. The current ReefresH2O biofiltration line includes spheres, cartridges, plates, blocks, and the patented BioRocker wet-dry system.

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