denitrate

denitrate™ is an economical, natural porous material with a pore distribution and geometry that promotes both aerobic nitrification within the first few millimeters of depth and anaerobic denitrification at the core. The material has a high surface area and supports a high density of bacteria. Although denitrate™ has capacity to trap nitrate, this, as with other nitrate retaining materials, such as certain zeolites and synthetic resins, is quite limited and the primary mechanism of nitrate removal is anaerobic denitrification.

The chemistries of nitrates and marine water are such that the removal of nitrate from sea water by either physical or chemical processes is very ineffective. Water changes and biological removal of nitrate by anaerobic denitrification or the harvesting of vegetative growth (algae scrubbers) remain the most effective means of controlling nitrate.

To control nitrate in the aquarium, it is important 1) to limit the introduction of nitrogen sources and the formation of nitrate; and 2) to remove nitrate at a rate greater than or equivalent to the rate of formation.

The formation of nitrate can be controlled by limiting the biological load, the avoidance of excessive feeding, and the use of products, such as chemical filtration, protein skimming, ozone, and UV, that remove nitrogenous waste. It is also helpful to use a well vented wet-dry or ammonia tower to vent ammonia directly to the air before it can be converted to nitrate.

The removal of nitrate can be attained by water changes, the harvesting of algae, and bacterial denitrification. “Live” rocks or reef rocks remove nitrate by anaerobic denitrification. denitrate™ removes nitrate by the same process. Efficiency is magnified several folds by forcing the water to filter through the porous denitrate™. As with reef rock, anaerobic conditions are achieved by the porosity and the depletion of oxygen by the aerobic process at the surface. Excessive flow rates should, therefore, be avoided, as they may impede development of an adequate anaerobic environment to support denitrifying bacteria. Adequate food sources are present in the water already and supplementary feeding is both not needed and unadvisable. Since denitrate™ works by a biological process, it requires about one to two weeks before the process is effective. Likewise, the useful life of the product is not determined by active sites, but by water clarity and the product’s capacity to become occluded by particulates.

If the nitrate concentration is high before using denitrate™, it should be brought to less than 20 mg/L nitrate by water changes. Water changes remain the most economical method of lowering high nitrate concentrations to manageable levels. Once an acceptable concentration is attained, it can be maintained by using a sufficient quantity of denitrate™ to remove nitrate at a rate at least equivalent to the rate of nitrate formation so that nitrates will either remain constant or decline. If after two weeks in service, nitrate continues to rise, an inadequate quantity of denitrate™ is in use. A general guide is to use one liter of denitrate™ for every 50 gallons. Increased use of chemical filtration, protein skimming, ozone, UV, live rock, macroalgae, even microalgae, wet-dry surface, all decrease the required amount of denitrate™. Conversely, a decrease of these parameters as well as an increased biological load, call for a greater quantity of denitrate™ to compensate. No single denitrifying product should be viewed as a cure-all for nitrate problems or as an excuse for lax management practices.

Nitrate does not rise and fall precipitously. Believe your animals before you believe your test kit. Always confirm suspicious kit results with another kit from a different manufacturer.

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The hobbyist should consider his objectives carefully before investing heavily in nitrate removing products, particularly some of the more costly products or some of the more dangerous denitrifying filters (require feeding with methanol). Hobbyists and public aquaria have been keeping fish in high nitrate waters (over 100 mg/L nitrate) for years with no perceptible ill effects on fish and many invertebrates. Low nitrate concentrations become important only when the objective is the maintenance and growth of delicate corals in reef systems. Low nitrate concentrations also help control the proliferation of hair algae.

denitrate™ is also an excellent media for aerobic nitrification and it makes an ideal biological filter in drip trays, canister filters, sumps, or even box filters. Depending on where it is used, it may or may not require a filter bag. At high flow rates (greater than 100 gallons per hour), it will function solely as an aerobic filter. At slow flow rates (less than 50 gallons per hour), it will function as both an aerobic filter and an anaerobic denitrifying filter. It may also be used as a tank substrate in place of gravel or sand. Used on the bottom, it will function as both an aerobic substrate and an anaerobic denitrifying media. For use as a bottom substrate, it should be soaked for several days prior to use to allow it to become water-logged and sink. For use in seawater, soak in seawater of slightly higher specific gravity than the aquarium water. Pre-soaking is essential, because denitrate™ is highly porous and, while still filled with air, will float. In a reef tank, bottom use not only increases the denitrifying capacity of the tank, but also enhances the appearance of the tank as it supports prolific coraline algae growth on its exterior surface, when used in conjunction with Reef Calcium™.