



## Salt Water Reef Chemistry and Essential Supplements

When maintaining a successful saltwater reef tank it is essential to understand, monitor, and maintain pristine water quality. There are two chemical equilibria that one must take into consideration to have a full understanding of what is occurring in the system. The first being nitrogen and organic cycling the other being carbonate chemistry.

### Organic Waste:

When fish food is feed to the system, the fish consume it, process it, and expel it. The major component of this waste is ammonia. This is then broken down in several stages into Nitrite, then to Nitrate. Ammonia and nitrite at miniscule levels are toxic to fish and corals. Nitrate in excess is toxic to fish and even more toxic to corals.

Nitrogenous compounds are not the only players in the organic cycling game. Phosphate is another organic compound that is of concern to the reef aquarist, as phosphate will act as a direct INHIBITOR of calcification, i.e. corals will not grow at all if phosphate is in excess.

Nitrate, Phosphorus, and other organics can be removed from the aquarium by several means:

- Dilution via water changes
- Biological breakdown by anoxic bacteria.
- Absorption / assimilation via plants, bacteria, and chemical media.
- Well functioning and efficient system filtration.

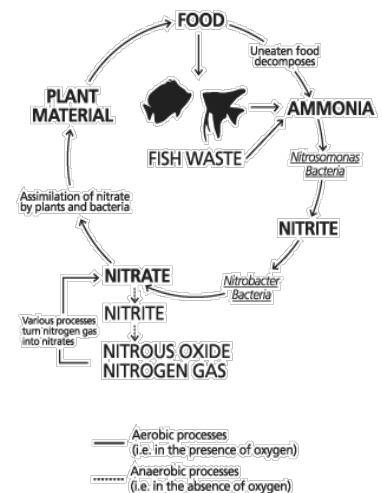
### Carbonate Cycling:

When corals grow, they are constantly absorbing minerals out of the water. Inside the coral tissue they combine all of the minerals together to create skeletal mass. Hard corals, or scleractinian reef building corals, form a distinctive large mass of white skeletal material that underlay's the soft tissue on top. Soft corals, or non-scleractinian corals create many small skeletal slivers called spicules, that are held together with connective tissue. This skeletal mass is majorly comprised of Calcium Carbonate.

As growth occurs, the relative amount of minerals in the water will begin to deplete as it is bound into skeletal components. In a closed system like an aquarium it is critical to replace these minerals in the correct amounts for corals to grow and thrive. Using a high quality salt will replace some of these minerals as you do regular water changes. However, in a most systems, the rate of mineral uptake is greater than replenishment via water changes.

The Carbonate cycle involves many compounds. Calcium, pH, alkalinity all have major roles in carbonate chemistry. By monitoring these three components we can get a handle on the uptake rate and overall system stability. Testing the water will reveal how much is depleted on a daily basis. These minerals will need to be replaced on a regular basis, usually weekly, ideally daily. Below is a list of mineral supplements that are essential to replace in order to achieve good coral growth and health.

### NITROGEN CYCLE





### Aquavitro calcification™:

calcification™ is a concentrated (140,000 mg/L) optimized blend of ionic and bioavailable gluconate-complexed calcium designed to restore and maintain calcium to levels found in natural seawater, without affecting pH. These two forms of calcium are combined in calcification™ to provide the hobbyist with a convenient way to ensure peak coral growth and health.

Ionic calcium is readily available, while the gluconate-complexed calcium confers several benefits. The uncharged calcium in calcification™ is readily absorbed with less physiological work than is required for the absorption of ionic calcium. Using calcification™, it is not necessary to maintain the excessively high concentrations of calcium (about 450 mg/L or more) often recommended by others. In fact, excellent growth of corals and coralline algae is achieved with total calcium concentrations as low as 380 mg/L. Used up to four times recommended maintenance dose, the gluconate polymer will not accumulate or encourage the growth of undesirable algae. The polymer itself is beneficial as a food source not only to the corals and other invertebrates, but also to denitrifying bacteria, actually promoting the natural anaerobic denitrification process in live rock and other substrate. Furthermore, the use of this gluconate polymer allows calcium, strontium, and magnesium to be utilized more readily than they would otherwise and also helps to stabilize them in solution without depleting alkalinity.



### Aquavitro eight.four™:

Many competing buffers for reef aquaria are simply sodium bicarbonate. Such buffers have a pK of only 8.0 in saltwater and simply are unable to maintain a pH above 8.0. The low buffering pK is a function of the low carbonate/bicarbonate ratio.

eight.four™ supplies a properly balanced (carbonate/bicarbonate) buffer system that yields an industry leading pK of 8.6 which makes pH maintenance of 8.3-8.5 easy. A higher pK increases the buffer's ability to counteract inevitable acidic sources in the water. eight.four™ will safely raise marine pH while adjusting alkalinity. eight.four™ contains a concentrated, balanced blend of bicarbonate and carbonate salts designed to restore disrupted buffer systems and increase carbonate alkalinity.



If an alkalinity of 6 meq/L has been reached and a pH of at least 8.20 has not been attained, the system may be ionically unbalanced. Check magnesium levels. If magnesium is low, use ions™. However, if magnesium levels are within optimal range, the buffer ratio has likely been disrupted (the buffer ratio changes as a natural consequence of the buffer's ability to counteract acidifying sources such as organic acids). You can raise pH without raising alkalinity using balance™.

### Aqua Vitro Balance™:

A frequent occurrence in reef systems is low pH, while calcium and alkalinity are at optimal levels. Raise one and the others may fall. One of the primary reasons for this is an improper carbonate/bicarbonate ratio. The buffer ratio changes as a natural consequence of the buffer's ability to counteract acidifying sources such as organic acids (produced naturally from waste) or introduced from non-pH controlled husbandry





products. In this case, adding more buffer would unnecessarily result in a rise in alkalinity and a drop in calcium. The first product of its kind, balance™ ends this see-saw effect. It resets this ratio by converting bicarbonate into carbonate in order to reassert a higher pH without affecting calcium level.

### Aquavitro ions™:

Like calcium and strontium, magnesium is used in the calcification of skeletons of reef organisms. In many cases, magnesium is used in place of calcium for calcification. In addition to its role in calcification, magnesium is used by organisms ranging from bacteria, to coralline algae to fish.

How can you be sure if magnesium levels are deficient? There are a couple of indications; severely depleted levels of magnesium (below 800 mg/L) can cause depressed pH levels and an inability to maintain proper calcium levels (more on ionic imbalance). The best way to tell if you need a magnesium supplement, though, is to test for it using a magnesium test kit such as Seachem's Reef Status™: Magnesium & Carbonate and Borate Alkalinity.

If you've determined your magnesium levels are low, supplementation with ions™ is necessary. ions™ restores magnesium by employing the most concentrated (90,000 mg/L), fully dissolved magnesium and does so without adding any ammonia. Other liquid magnesium supplements inherently contain ammonia because the magnesium chloride used in their production contains ammonia. This is a result of the mechanisms for deriving and/or producing magnesium chloride. aquavitro™ has gone to considerable lengths to remove this contaminant and a proprietary process makes ions™ the first and only liquid magnesium supplement that does not contain ammonia.

Using a fully dissolved magnesium is critical. Some magnesium supplements use a magnesium source that is simply not soluble, that is, unavailable. This means it can never be utilized by reef organisms, and is, consequently, of no value. If the product itself is milky white or the instructions direct the user to shake well, more than likely, a substantial amount of magnesium is not being utilized (the same is true of calcium products). ions™ also includes strontium and boron in the NSW ratio of 1.7:1 to avoid ionic imbalance with long term use.

### Aquavitro Vibrance™:

Iodide is a critical element for the health and formation of soft tissue in invertebrates (such as gorgonians, sarcophytons, etc). It has also been shown to be critical for the development of pigments in corals, corallimorpharia, and anemones, both the golden brown of zooxanthellae and the green and red colors of accessory pigments.

Most iodide supplements on the market are simply potassium iodide. When added to an aquarium environment, iodide becomes unstable converting to elemental iodine (which is biocidal) and iodate (which is useless to corals, toxic at elevated levels, and can't be tested for). Iodide is the only form of iodine available to corals for uptake. Because of this instability, iodide must be stabilized for aquarium use.

vibrance™ is a highly concentrated (10,000 mg/L) naturally stabilized potassium iodide source for reef aquaria that will restore and maintain iodide levels to those found in natural sea water. Our proprietary stabilization process makes vibrance™ the most stable iodide supplement available. It's also the most concentrated and comes with a





pipette for precision dosing. It is formulated to provide a safe source of iodide that will not convert to toxic free iodine under storage or reef conditions.

### Aquavetro Fuel™:

fuel™ is a comprehensive carbohydrate, vitamin, amino acid, polyunsaturated fatty acid, and trace element supplement developed to address nutritional requirements commonly associated with corals. fuel™ contains ascorbic acid in a base of chlorella, which contains a rich assortment of amino acids and vitamins. The health benefits of chlorella are widely known and while spirulina, a similar algae, has been regularly used in the industry, aquavetro™ is the first to utilize the vastly superior chlorella. fuel™ is formulated to provide nutrients available from natural tropical reef waters.

Chlorella is a unique algae that grows in fresh water. It is extremely high in enzymes, vitamins and minerals, including the full vitamin-B Complex. It is over-flowing with unsaturated fatty acids, amino acids, and proteins. There are also vitamins found in Chlorella including: Vitamin C, pro-vitamin A (B-carotene), thiamine (B1), riboflavin (B2), pyridoxine (B6), niacin, pantothenic acid, folic acid, Vitamin B12, biotin, choline, Vitamin K, lipoic acid, and inositol. Minerals in Chlorella include: phosphorus, calcium, zinc, iodine, magnesium, iron, and copper. It contains a higher level of amino acids than spirulina and is FDA approved for use with ornamental fish.

