



Without dosing of trace elements (however it is done) these colours are not possible. Foto: Baginski.

# Chelated Trace Elements

## What are trace elements?

Trace elements are simply substance essential needed by all organisms. Mostly they are needed for creating enzymes or other complex organic structures as a central atom (ion). Without this central atom the function of the complex substance is not given.

Many trace elements are found in the group of metals, e.g. iron, cobalt, zinc, vanadium, copper, molybdenum. In high concentration these substance are toxic. So it is not easy to give the animals and plants the right amount of trace elements. On the one hand the animals should have enough on the other hand toxic reactions should be prevented. Unfortunately the toxicity depends not only on the chemical concentration but on pH, ORP, temperature and salt concentration, too.

For example: the natural copper concentration in sea water is about 0.2 to 13  $\mu\text{g/l}$  (depending on the author, overview of the elements in sea water). 50  $\mu\text{g/l}$  should be avoided in a reef tank, because

the sensibility to toxic concentration varies extremely on the organism. In a pure fish tank 0.5  $\text{mg/l}$  (=500  $\mu\text{g/l}$ ) copper is not a problem. Quite the contrary: with high copper concentration undesirable parasites like Oodinium will normally not occur. But in a shark tank is looks different - sharks are more sensitiv to copper than other reef fishes. And invertebrates dose not survive higher copper concentration, too..

## Durability of trace elements

Due to their chemical nature and the very low concentration trace elements have not a long life time in sea water. With a regularly water change you will get them into the reef tank, but you rely on the sea salt manufacture's respectability and competence. The aquarist is not sure which trace elements and in what concentration are in the sea salt mixture. Another questions is if the trace elements will survive the solution process. Some aquarists are storing fresh sea water over several weeks. In this time the suitable concentra-

tion of trace elements will lower. If the interval between two water changes exceeds two weeks the level of trace elements in the reef tank will vary considerably.

If the surviving trace elements reach the reef tank they will suffer furthermore. By oxidation and precipitation (flocculation) the trace elements get unusable or dissappear out of the water column - the bio-availability decreases. These processes accelerate by high ORP and high oxygen concentration. But in the modern reef aquaristic the aim is to create a habitat with just these high levels - as shown in natural reefs. In natural ecosystems fresh trace elements drift from the deep sea into the reefs. In an aquarium we do not have this possibility.

Happily for reef tanks readily mixed trace elements are available. But even in these concentrates the elements are not durable for ever. Before an aquarists doses the elements into his tank, the fluids were stored for perhaps several months at the dealer, the

whole saler and the manufacture. During the transports probably high temperatures will destroy a part of the trace elements ions. Sometimes you see trace elements solutions with precipitates at the bottom. These precipitates are ineffective trace elements. It is better not to take these products. Good trace elements solutions are not turbid and do not contain deposits.

A transparent bottle is good for estimating the condition of the solution. But unfortunately trace elements are sensitive against sunlight - by photo-oxidation the elements are transferred into a non bio-available state. A non-transparent packing will be better - but you cannot see the fluid. In any case the solutions should be stored out of direct sunlight (or metal halids!). Dark storing extends the sell-by-time.

Trace elements solutions should be store dark and cool (frost protected).

Shake well before using and close the bottle carefully after using.

Children should never reach these products.

### How chelating works

But even if the solutions are stored and transported optimal the trace elements are not durable for a longer time. But there is a group of substances that protects elements. These chelating substances - the most common is EDTA = ethylene diamine tetra acetic acid or its salts - are effective protections against oxidation and precipitation.

The chelating substance lay around the metal ion and prevents the approaching of oxygen. but the forces within the the chelating complex may not be too strong. Because the animals must take the trace element out of the complex. If the forces are too strong, the bio-availability is not given. So it is important to find the right chelating component.

Chelating substances have disadvantage: the are not or very heavily biological degradabel. At regularly addition of chelated trace elements the chelating substance will accumulate. Therefore a regularyl water change is absolutely necessary. If you change minimum 1% water per month the chelating substance will not accumulate to dangerous concentrations.

But not protected elements are not an alternative. Except if you mix your trace elements by yourself. But you need the right education and the right equipment: scale with minimum 1 mg accuracy. Many trace elements are toxic and the storing is not easy. So this method is only a matter for professionals. Also the price for provisioning small amounts of the pure substances are high.



Foto: Baginski