

Dosing Lime Water ("Kalkwasser")



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A good supply with Calcium is one reason for a sufficient hard coral growth (photo: AquaCare, Aquarium)

What is lime water "Kalkwasser"?

Lime water "Kalkwasser" is an old method developed for waste water treatment. PETER WILKENS discovered it for coral reef tanks. To produce "Kalkwasser" you need the chemical Calcium Hydroxide (Calcium Oxide is possible, too, but it has disadvantages in handling) in a very pure quality and pure water e.g. Reverse Osmosis Water. Calcium Hydroxide is very fast soluble but you can only dissolve very low quantities (1.7 g/l at 20°C) in water:



Fresh slurry of limewash ("Kalkmilch"; right) and after about 20 min. time (left): at the bottom the limewash has settled (calcium hydroxide - water - mixture), over it there is the turbid lime water ("Kalkwasser") that you can drop into the aquarium water. Picture: AquaCare

The pH value of fresh saturated "Kalkwasser" is about 12 and 13 depending on the temperature. So lime water is strong base and dangerous. You must handle it very carefully. Children should never reach Calcium Hydroxide or "Kalkwasser"!!! At

contact with skin or eyes flush with plenty of water a go to the doctor.

There is another disadvantages: if lime water is standing in an open tank the CO₂ of the air dissolves in the water and neutralizes the "Kalkwasser" very quickly. Within 1-2 days "Kalkwasser" will be destroyed. So you must work with a fresh solution or you need a "Kalkwasser" Reactor / Chalk Mixer.

Advantages of lime water „Kalkwasser“

If lime water flows into the aquarium water the pH will rise very fast. To prevent this effect you must only drop the "Kalkwasser" into the water (about 1 drop per second and 100 liters aquarium size). At the dropping point in the water is a small place with a very high pH value. At this place phosphate will precipitate to calcium phosphate. So too much phosphate will be eliminated. In a tank with not too much fish this method will prohibit too high phosphate amounts in the water. If you use the lime water method and enough KH is in the water (minimum 7°dH) the pH will be 0.1 to 0.2 higher. With this light pH rising the balance of CO₂ - carbonic acid - hydrogen carbonate - carbonate will be a little bit more on the side of carbonate. So there is a little bit less free CO₂ in the water. The danger of too

much algae will be lower if other substances like nitrate, phosphate or iron are in the water.

Dangers with lime water

Like all methods lime water has disadvantages, too. If the pH in the aquarium is very high (over 8.3-8.4) you should not use this method - fishes may get trouble.

In aquaria with very less nutrition (hard coral tanks with less fish and less feeding) the addition of "Kalkwasser" will cause a lack of phosphate. In this case you have to feed more to get more phosphate into the tank. Artificial dosing of phosphate is possible, too. The phosphate concentration should never fall below 0.05 mg/l. If the concentration is lower you will get problems with hard corals and clams. Maybe in the future it is possible to feed the corals with living plankton extensively. Then the phosphate concentration may be at zero because the animals will get the phosphor and nitrogen with the plankton. In healthy reefs this feeding is the normal way.

The lime water dosing can cause carbonate precipitation. Therefore it is very important that the "Kalkwasser" will be dropped not in the near of pumps. Otherwise the pump will get very fast chalk crusts that will hinder the pumps to run properly. The "Kalkwasser" should never be drop-

dropped in the near of the outlet of the Chalk Reactor. The fresh produced calcium and carbonate hardness will fall out.



Especially heaters, pumps and heat exchangers will block easily at high calcium concentrations and KH (alkalinity) values. Dosing of lime water will speed up the precipitation. Picture: AquaCare

If the lime water is the only method to produce calcium a lack of carbonate hardness (KH) will occur. Please combine other methods like chalk reactor, KH-plus, triple buffer) to get enough KH into the water.

Chalk reactor, lime water and KH-plus / Triple Buffer

You can hear very often that "Kalkwasser" and Chalk Reactor are not working together very well. The only problems you can get is that both outlets "Kalkwasser" and Chalk Reactors are dropping their water together at one point. At this point Calcium Carbonate will precipitate and the efficiency of both systems will drop. But if both outlets are far away from each other or the systems will not work at the same time nothing will occur and you have the advantages from both systems: First the CO₂ in the aquarium water that is produced by every Chalk Reactor will be neutralized partially by the "Kalkwasser" (pH rising). Second the lack of buffer capacity (KH value) that will follow the "Kalkwasser" input will be compensated with a Chalk Reactor. With the combination of "Kalkwasser" and Chalk Reactor you can lower the daily pH oscillations: at night the "Kalkwasser" will compensate the falling pH and during the daytime the Chalk Reactor will reduce the rising of the pH. But therefore you need strong systems that are able to produce Calcium and KH within some hours per day. It is possible, too, to combine Carbonate Hardness supplies (e.g. KH-plus, Triple Buffer), Calcium solutions (e.g. Calcium-plus) and Magnesium solutions (e.g. Magnesium-plus). These substances are very comfortable in small aquaria if the installed systems (Chalk Reactor, "Kalkwasser" Reactor) are too weak. In some aquaria one of the both values calcium and KH are not in order. In that cases you can rise only this

value with the care substances very easily. But for this methods the same rule: only use them separately.

How many lime water?

This question is very easy. Fill up all the evaporated water with "Kalkwasser". Be carefully only in aquaria with a very high pH (over 8.3 to 8.4). If you fill up the "Kalkwasser" too quickly a calcium carbonate precipitation will occur. The water will get turbid very fast - you can see only a few cm into the water. This is not dangerous for the animals! It is important to react in the proper way: stop the "Kalkwasser" dosing at once. You will see that the "white" water will disappear within some hours. If the water is clear again check calcium and KH value. It will occur that the concentrations will be lower than normal. You can raise them carefully with care products.

Supply of lime water by hand

The most simply method of dosing "Kalkwasser" is to use a plastic tank with cap. Fill about 1 tea spoon per 5 liters water (1 gallon) into the plastic tank. Add reverse osmosis water (or very soft water) to the powder, close the tank with the cap and shake it. If the tank (or the cap) has small valve you can open it after about 1 hour and the clear "Kalkwasser" will drop into the aquarium water. In top of the tank there must be a small hole to let air into the tank - otherwise the "Kalkwasser" will not drop out. It is very important to use a closed plastic tank (with a very small hole at the top). Otherwise the CO₂ of the atmosphere will lower the efficiency of the "Kalkwasser" very fast. A part of the "Kalkwasser" will transform to a hard chalk crust. You will see that the outlet valve and tube must be maintained very often. If any drop will go out of the valve you must clean it with a weak acid. The dosing by hand is a very low cost system but you must maintain it very often. The "Kalkwasser" must be produced very often (every 2 or 3 days) because after this time the efficiency will lower very fast. The handling with very big tanks is very complicated and dangerous. Remember: the lime water is a strong alkaline substance (pH 12-13). It is not easy to control the volume of the outlet with a valve and the evaporation rate of the aquarium is not constant every day.

Automatically supply of lime water – the lime water reactor / chalk water mixer



The AquaCare lime water reactor KWR has a rigid pump that circulates the lime wash (chalk milk). Picture: AquaCare

It is very comfortable and safe to use an automatically working system to dose "Kalkwasser" to the aquarium. The maintenance intervals are longer. A "Kalkwasser" Reactor or Mixer is a close tank with Calcium Hydroxide and reverse osmosis water. A pump or stirrer will mix both substances all the time or if "Kalkwasser" is needed. If fresh reverse osmosis water is pumped into the reactor "Kalkwasser" will flow out of the system. It is important that the "Kalkwasser" is mixed regularly (minimum every 24 hours). Otherwise the Calcium Hydroxide will build a sediment layer at the bottom. There are some systems with different methods to mix the Calcium Hydroxide on the market. All systems will work if the units are constructed well.

- pumps that mix the limewash
- stirrer mounted at the top of the reactor
- stirrer at the bottom with a magnetic coupling

The best system for dosing "Kalkwasser" is a dosing pump. But the method is expensive. So most systems are working with a circulation pump. The water flow is reduced with a ball valve. If you combine the "Kalkwasser" Reactor with a Level Control. The evaporated water will be refilled with "Kalkwasser" automatically. If the "Kalkwasser" should be dosed only at night you can com-

bine the level control with a simple timer. It is important that the pump that pumps the water from a reverse osmosis tank into the "Kalkwasser" Mixer is reduced with a ball valve. The fresh "Kalkwasser" should only drop into the aquarium water. Otherwise the pH will raise very fast. And if the level control will not work properly not too much water will flow into the aquarium. If too much water will flow through the "Kalkwasser" Reactor solid Calcium Hydroxide will flow into the aquarium.

Important hints for buying a lime water reactor

All system - driven with pumps or stirrers - will work very good if the components are very rigid and the unit is assembled in a professional way. Here are some arguments if you want to buy a "Kalkwasser" Reactor:

- The volume of Calcium Hydroxide is the most important factor for the power output. The more powder is in the reactor - without blocking!!! - the longer the period from one filling to the next. Per gram Calcium Hydroxide you can produce maximum 1.4 liters "Kalkwasser". A reactor with e.g. 100 g capacity will produce maximal 140 liters "Kalkwasser". If 1 liters per 100 liter aquarium volume will evaporate daily one filling of the reactor is good for about 28 days. But if the evaporation rate is about 5 liters per 100 liter and day the filling is only sufficient for 6 days.
- It is not possible to calculate the maximum filling volume from the volume of the reactor. The mixing methods are too different! You will find 5 liter reactors with a capacity from 50 g to 500 g.
- In the reactor a definite phase between clear "Kalkwasser" and white Calcium Hydroxide must exist. Otherwise the danger of filling Calcium Hydroxide into the aquarium is too big.
- All built in parts must be very rigid, because the abrasion caused by Calcium Hydroxide is high.
- The reactor must be air tight. So CO₂ from the atmosphere is not able to destruct the "Kalkwasser".
- If a power loss occurs the reactor should run again after this without problems.

- Larger models should have a ball valve to drain the volume of the reactor. You can maintain an empty reactor more easily than a heavy one.
- The reactor needs a free outlet. All components for dosing or preventing water back flow should be in the inlet. Parts in the outlet tube will calcify very fast. The outlet must have a big diameter. Otherwise the outlet tube will block very fast.
- The top of the reactor must be maintained very easily.
- There must be a warning at the "Kalkwasser" Reactor. The filling of this unit is a very strong alkaline.

Pure hard coral tanks with many rapidly growing



ing SPS corals need high amounts of calcium, a not too low pH value and very low phosphate concentrations. All conditions will be produced by lime water. Only the carbonate hardness (alkalinity) must be produced by other means. Picture: J. Frotz.