

CYANOBACTERIA CONTROL PROTOCOL FOR MARINE REEF TANKS - MAGIC OF LIFE BUTTERFLY HOUSE

Cyanobacteria are a type of prokaryotic bacteria. They have been around for 3,600 million years. Cyanobacteria photosynthesize and some can even fix nitrogen, meaning that they have both a guaranteed carbon and nitrogen source. This makes them very hard to control in a reef aquarium.

Cyanobacteria outbreaks are a serious problem for marine tanks. Severe outbreaks can kill corals in 48 hours. Polyps try to eat the cyanobacteria which is toxic and often fatal. Many corals are affected in an outbreak including Turbinarias, Wellsophyllias and Fungia.

How to recognise Cyanobacteria

The cyanobacteria form a purple skin over the rocks and corals.

WHAT IS THE CAUSE OF CYANOBACTERIA OUTBREAKS?

The main cause of Cyanobacteria outbreaks is

I) EXCESSIVE FEEDING OF CORALS AND FISH

II) NEW TANKS UNDER 18 MONTHS OLD

CONTROL PROTOCOL

- **NO feeding of corals**
- **Reduce feeding of fish by a half or three quarters**
- **Decrease lighting by a half**
- **And wait it out..**

This might take 4-6 weeks for the outbreak to subside. It is probably waiting for other microbe populations to build up in the tank that outcompete the Cyanobacteria. There is no quick fix as it probably involves microbial succession.

Additionally, in heavy outbreaks..

i) Heavily blast off rocks and sand and then skim with fine fish net and physically remove the slime.. This is important as otherwise it recycles and grows more.

ii) Turn up current and add more flow pumps.

iii) If a very serious outbreak, then move the corals into a sandless, hospital tank

Established tanks are not as affected by Cyano as new tanks, because the corals, microbes and sponges outcompete them.

DIATOMS

Diatom outbreaks are even more dangerous to a reef tank than Cyanobacteria. They can be recognised by long vertical brownish-red strings of several inches in length.

They kill corals very quickly. We eliminated diatoms when we took the white coral sand out of our aquaria on all five tanks. They are now bare-bottom or small pebbles. Diatoms need silicates from the sand and are starved without them. Again, after two years the microbiome of an established reef can outcompete the diatoms, sand or not.

Note that not all marine Cyanobacteria are bad..Some are the key players in the primary production of Earth's ecosystems e.g. *Prochlorococcus* (unknown and named only in 1996) alone produces 50% of the oxygen of the planet.

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NOTES FROM OUR REEF DIARY EXPERIMENTS COPIED BELOW

Detailing our experiments - success and failures - with Cyanobacteria.

Experiments

Using three 20 lt nano reef tanks of the same size but of different setups, the main customary suggestions for controlling Cyano were tested.. Most do NOT work.

The 2016 cyano outbreak probably started under high light intensity and frequent coral feedings with reef roids and Red sea supplements.

The only things that **work so far** are **REDUCING the light period/strength** and **blasting off the rocks every hour or so**. The latter is very time-consuming. Water changes into hospital tank with artificial saltwater also work as an emergency. Cyano disappears at night on the sand/rock surface but NOT on the glass - suspected hermit crabs/worms and other clean-up crew are controlling it but it comes back each day within 2 hours of light. (NB the cyano goes into free-floating form at night). Reducing feeding works over the long-term.

The Cyanobacteria on the main winter tank is probably due to daily feeds of Reef roids, Red sea amino acids or fish. Plus Ecotech lights up on full.

Many Corals especially Turbinaria try to eat it and get poisoned.

Green Turbinaria mesenterina is shedding skin where it was eating the cyano leaving a bare skeleton. So far only 5% of surface area but has got worse in the past.

Have put it in a hospital tank with no sand (Note this is fully recovered as of 2022 but took five years!)

Brown Turbinaria mesenterina is growing back over a period of weeks in low light/low flow hospital tank. Polyps extend in day especially after wc with NSW.

FAILURES..

Adding Phosguard to reduce phosphates **did NOT work**.

Low phosphate and nitrate **did not work**. All brands of phosphate and nitrate tests tested very low or even zero amounts in the three tanks and yet these still had high Cyano outbreaks. e.g.. **0.0 to 0.01 phosphate** and **NO3 = 0/ NH4 =0 on Seneye**. Conclusion cyanobacteria blooms are not necessarily due to high phosphate and nitrate levels. Most forums on Cyano consistently claim phosphate ad nauseum as the culprit.

Very high wet skimming for 14 days - **did NOT work** ie taking 2 litres of skimmate out of tank clearing cyano blasted off with turkey baster with a net in the water **did NOT work**. Maybe needed to do this for four weeks.

Adding Red slime remover 3 X at 48 hour intervals at recommended dose - **did NOT work** - lots of skimmate though **some of the other brands work fine but you need to skim out the rest. eg Cyano control but this still takes a long time.

Frequent water changes **did NOT work** with NSW - even 90% water changes did not work.

High current flow **did NOT work** ie MP10 at 75% on nano emergency tank of 25 lt rocking tank but still did not dislodge from sides unless blasted with the turkey baster.

Changing the Kelvin rating on the Ecotech from 7000 to 20,000K **did NOT work** (or slight 10-20% reduction probably related to reduced lux)

No feeding **did NOT work** (it might eventually) The cyano continued to bloom in a natural seawater frag tank under full ecotech lights despite NO feeding. Complete cleaning this tank and adding Red Sea artificial saltwater seems to have stopped the Cyano growth on the corals despite high LUX (after 24 hrs check this in 72 hours). This suggests that cyano surviving on whatever is in the seawater - e.g. DOC etc. Although seawater was also used in the only tank with **no cyano** ie the small 20 lt Heliofungia tank with sand in base. NB this might have been Diatoms - that need silicates in natural sea water.

SUCCESSSES

Most tanks are free from cyano most of the time as long as feeding is kept down.

Control nano tank. Never got Cyano DESPITE **No skimming at all and very low flow. Kelvin 6000, but v. LOW LED lights on 12 hours a day, occasional feeds of white fish** to Heliofungia. Coral bases had Cyano introduced. Suggested **success** in this tank due to **low LED LUX. Prevention is best**.

Hydrogen Peroxide at 0.5 ml/lt of 12% H2O2 **did work** to rid a tank of Cyano but the levels were so high that the snails were damaged. This is therefore not an option for full reef tanks.

Ultra violet light (18 watts) **did work** on ridding one nano tank from Cyano but not on others. This may have been diatoms and not cyano. And there are different types of Cyanobacteria.

Blasting temporarily dislodges, Low LED light works.

Worst-affected corals are Turbinaria mesenterina and T. reinformis that show tissue necrosis where they ingest cyano. GSP also close up.

Conclusion - Given a HIGH LIGHT REGIME cyano blooms are possibly related to dissolved organic carbon DOC and its decay products Cyano live on incredibly small differences in DOC once started.

CYANO both photosynthesise AND fix nitrogen meaning they probably do best in a very nutrient poor tank - just what everyone is saying you should aim for!

Need to try carbon dosing and Ca nitrate dosing..they would go up at first and then slowly the others would outcompete them..

**Have swapped out all sand in reef tank and Frag tanks - the problem has abated (could be diatoms in this case) considerably with no poisoning of Turbinaria etc - it comes back briefly if I've overfed.. NB Sprung says use Kalkwasser to pH 8.4 to get rid of outbreaks

Diatoms are brown stringy colonies over the rockwork. Like Cyano they can form in just hours. Diatoms are even more toxic than Cyanobacteria. We found that Diatoms are correlated with the white coral sand bought in shops. We changed all our tanks over to small pebbles or bare bottom and **this worked** to rid us of Diatoms.

NB VIBRANT used to rid algae from tanks. Works after 6 weeks - however all the nutrients used by the algae are then left in the tank water - and this invariably encourages a cyano outbreak. Nutrients will never be left unused in a tank - either cyano comes (bad) or algae (bad) or you need huge amounts of corals to remove all those excess nutrients.

Future Cyano experiments

1. Add calcium nitrate to tank to see if the increased nitrogen readdresses the favour of the balance towards other microflora that can outcompete Cyanobacteria. Cyanobacteria are unique in that they can make their own nitrogen so can possibly outcompete other microorganisms when in low nitrogen.
2. Do complete water changes at night instead of in the day. Cyanobacteria coalesce together in the day on rockwork and sides - in the night they are free-floating.