

## **What's It All About ... Algae?**

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### **No matter how clean and hermetic your facility is, algae will find their way in.**

Let's face facts; if you are managing any type of aquatic system, you are almost guaranteed to cross paths with some form of algae. Algae spores are everywhere in the environment: in the soil, in tap water, even floating in the air. Unless you understand the conditions that promote their growth and how to prevent them, algae can quickly take over.

First, let's understand the correct terminology. Algae is the plural form of the word, alga is the singular. So, it is incorrect to say "Algae is growing in the tank" but rather "Algae are growing in the tank." The reason we speak of algae in the plural form is because it is always found in the plural form. Most algae are single-celled, almost microscopic organisms that exist in large colonies, although there are filamentous and a few large erect forms – kelp, for example, are algae. Known as phytoplanktons (from the Greek phyton = "plant," and planktos = "drifters"), the single-celled variety are too small to be seen by the naked eye, but appear green when in large numbers due to the presence of chlorophyll.

There are thought to be more than 30,000 species of algae. They can be divided into four major groups: Cyanobacteria, the blue-green algae; the Chlorophyta, the green algae; the Phaeophyta, the brown algae; and the Rhodophyta, the red algae.<sup>1</sup> They cross three classifications: plant, bacteria, and protozoa, but for all intents and purposes, they are considered plants. They come in benthic (attached) and planktonic (free floating) forms. Marine botany, more specifically phycology, is essentially the study of algae, as there are only a few true plants that are completely marine. Algae differ from terrestrial plants in that they lack certain structures such as roots, stems, and leaves with vascular tissue, but liken to them in that they are photosynthetic, requiring nutrients and light to grow.<sup>2</sup> Like all plants, they photosynthesize in light and respire in darkness so, while they provide oxygen to your system during the day, they consume it at night.

The type of algae that appears is an indicator of the water quality – "good" algae, many of the green varieties, are a sign of a healthy system whereas "bad" algae, the reds, browns, and blue-greens, indicate a system out of balance. The green algae can often be seen in home aquariums, because they are more aesthetically pleasing and do not tend to overrun a tank like some other species. They can also be cultivated as a filtration system. An algal filter or "algae scrubber" consists of a bed of green algae purposefully grown to reduce nutrients from, and add oxygen to, a closed water system, and in effect, "scrub" the water clean.<sup>3</sup> In fact, the algal populations of our oceans are actually responsible for most of the oxygen in our atmosphere. Green algae are also important food sources to many aquatic species. Some grazers have a complex relationship with algae. Nudibrachs, for instance, transfer the chloroplasts from the algae they feed upon to their own tissue. There, the chloroplasts continue to manufacture food, but now for the animals instead of the algae. Because of cleaning SOPs, green algae are usually not found in facility systems as they take a long time to become established. It is the blue-green, red, and brown algae that more often first appear. These algae can quickly take over a system, much like weeds in a garden. But, while large amounts can cause problems with oxygen levels and pH fluctuations, mainly they are only an annoyance, reducing clarity and looking unsightly.

So, what causes algae to invade? Algal growth occurs when there is an abundance of nutrients, light, and CO<sub>2</sub> in the system. Temperature also influences their proliferation with many species flourishing in warmer waters. Nitrogenous waste (ammonia, nitrite, and especially nitrate) and phosphates are the primary nutrients utilized by algae, especially the "bad" varieties. The nutrients come from many sources: bodily waste, respiration, left-over feed, and other

decomposing matter. Phosphates are added to most commercial aquatics foods and are also found in tap water. Ideally, phosphate levels in the system water should be kept below 0.5 ppm. Ammonia and nitrites may be present in new systems or during population fluctuations, when the biological filter is not yet able to complete the nitrogen cycle. The nitrate load, the normal by-product of the nitrogen cycle, is only kept in moderation by replacing a portion of the system water with new water regularly. If this is not done, almost assuredly, algae will appear.

While excess nutrients in the tank encourage algae growth, algae bloom when a light source is added. This is why you first see algae in the tanks nearest the lights. Algae thrive more on red and blue spectrum lighting, although they can adapt to the yellow/green wavelengths, as well. Aging lights produce more of the red-spectrum. Often algal blooms coincide with older lights.<sup>4</sup>

As for a surplus of CO<sub>2</sub> ...photosynthesis is the metabolic process in which carbon dioxide and water is converted by a light energy into oxygen and carbohydrates. Algae photosynthesize. Need I say more?

The ability to identify different types of algae will help with deterrence. Here is a list of the more common types of algae and methods of prevention.



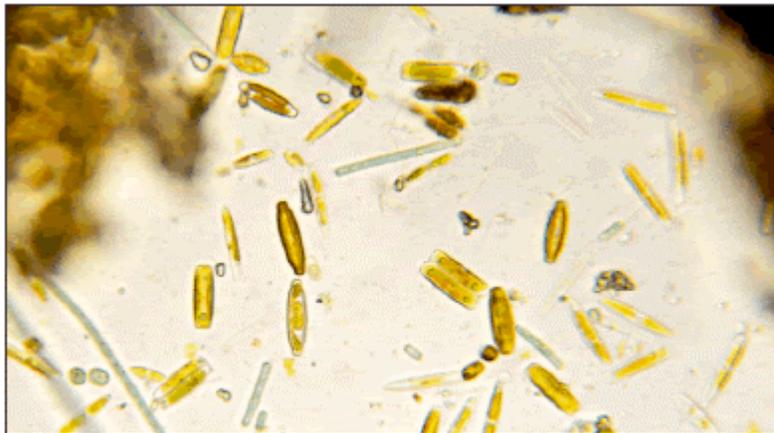
Algae, while usually not harmful, are a nuisance because they obstruct the view and are considered unsightly.



### **Blue-Green Algae**

While the correct name for blue-green algae is cyanobacteria, it is more commonly known as “pond scum.” It comes in many forms, from unicellular to planktonic, and is actually a type of bacteria capable of photosynthesis. It grows rapidly, covering everything it can, and when disturbed, often comes off in large, slimy sheets. It gives off a “fishy” or “swampy” odor. Despite the name, colors range from black to blue green, from orange-yellow to red-brown, and sometimes it almost seems fluorescent. It is believed that the Red Sea got its name from a red species bloom of blue-green algae. It has been around for over 3.5 billion years.

Blue-green algae growth occurs when there are too many nutrients in the water, especially nitrates and phosphates. It has the ability to fix nitrogen (convert inert atmospheric nitrogen into an organic form, such as nitrate or ammonia) and therefore can appear even if nitrate levels are low, instead feeding off high phosphate levels. It tends not to like low pH and prefers high CO<sub>2</sub> levels.



Seen here under the microscope, diatoms utilize silicates to form beautiful glass shells.

### **Suspended Algae or Green Bloom**

If the system water takes on a greenish hue, it is most likely due to the presence of suspended algae. It most often occurs in the presence of excess light and ammonia. This algae bloom is often

termed “new tank syndrome” because the nutrient source upon which it thrives is available due to the lack of the nitrifying bacterial population in a newly installed system.

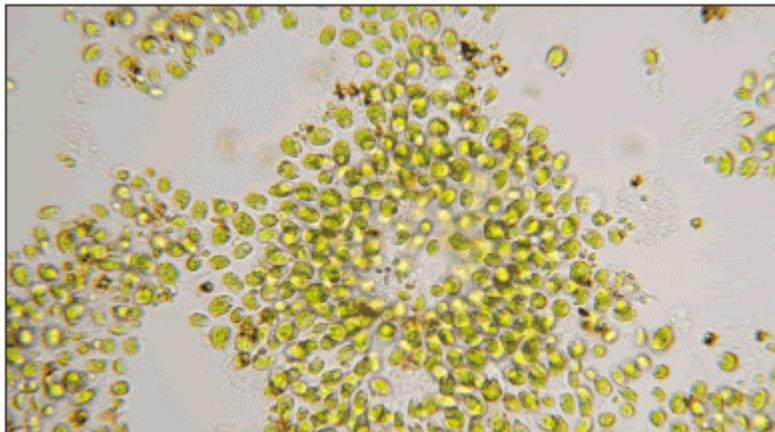
There are hundreds of species of suspended algae. Diatom and micron filters will aid in the removal of suspended algae and UV sterilizers will prevent their bloom in the first place by killing them as they pass by the light.

#### **Hair and Thread Algae (Green Algae)**

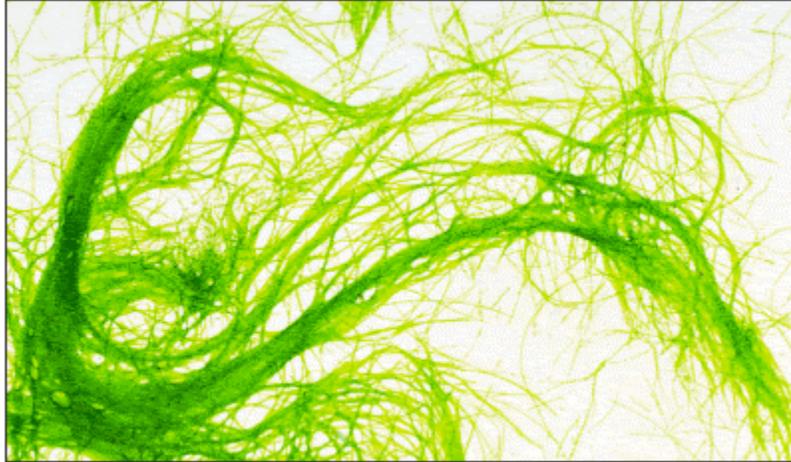
This type of algae, which forms long wispy threads up to 20 cm, can grow fairly quickly and take over a tank within a few days.<sup>5</sup> Though considered a “good algae” in general, its filamentous form can clog filters and pumps.

#### **Brown Algae**

Brown or rust colored patches on the tank are diatomalgae. This eukaryotic species can be traced back to the Cretaceous period. They require silicates to survive, using them to produce a fistula – a beautiful glass shell – and can feed off silica emitted by the silicon gel used to seal standard glass aquaria. Viewed under the microscope, their glass structures appear in two shapes: Pennates (pen-shaped) and Centric (cylindrical).<sup>6</sup> Fresh water diatoms are generally pennates. Diatoms prefer low light levels and are more easily dislodged than green algae.



*Chlorella* sp. is just one of the free-floating, single-celled algae that appear as “green water.”



Hair algae grow in long threads that are easily removed by twirling them around a toothbrush.

### Red Algae

Red algae are mostly found in macro forms, such as seaweed, and are an important food source in some Asian countries. Along with green algae, they are one of the oldest algal groups.<sup>2</sup> In addition to chlorophyll, red algae have red phycoerythrin and sometimes, blue-green phycoerythrin. One type of red algae that occasionally appears in aquariums is brush or beard algae. It can range in color from red, silver, dark gray, purple, or black; and grows in tufts, resembling a hair or fur. In general, it is found in brackish and salt waters, though a few species live in fresh water. Its presence is due to high nutrient levels in the tank and will usually disappear spontaneously if the water conditions are corrected. Though difficult to dislodge manually, it is a slow growing algae and therefore, not usually an issue in facility aquatic systems.

### Algae Eaters

I have occasionally heard of facilities introducing snails, such as Ramshorn, Trapdoor, or Apple, to the tanks to control algal growth.<sup>7</sup> Unfortunately, this practice only works for certain types of algae because it is the “good” types that most snails (and algae eating fish) actually consume. Since it takes more time for the “good” algae species to grow, the snails slowly starve to death even though it may look like there are plenty of algae present, for them to feed upon. The blue-green, brown, tuft, and beard algae actually give off allopathic chemicals to inhibit predators.<sup>8</sup> To make matters worse, most snail species are prolific reproducers, and overpopulate quickly. Water quality problems are compounded as the excess of starving snails die and decompose. Snails are often carriers of parasites, as well.

### Prevention

Algae appearance is just nature’s way of correcting an imbalance that is occurring within your aquatics system. To prevent algae growth:

- **Do not overfeed.** Without the adequate clean-up crew found in the wild, leftover feeds decompose and leave behind large quantities of organic phosphates.
- Keep flow rates reasonable so that food is not immediately swept from the tank and allowed to decompose in the filtration system.
- Slowly introduce animals to new systems so that the biological filter has time to establish itself and maintain ammonia and nitrite levels properly.
- Carefully watch nitrogenous waste levels during population fluctuations.
- Do regular weekly 5-10% water exchanges to keep nitrate levels down.
- If possible, do not position racks directly under overhead light fixtures.

- Use properly sized UV sterilizers on your system.

### **Conclusion**

Because of the delicate balance of a closed water system, it's almost impossible not to observe some traces of algae in your system. Algae are merely the symptom of a water quality problem. They are nature's way of correcting an imbalance that is occurring within your aquatics system. Understanding the catalysts that promote algal growth and maintaining a balance is the key to keeping your system as algae-free as possible.

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