Algae
Understanding, Killing and Preventing

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There are at least 21,000 different known kinds of algae. Of these, there are only 3 categories that grow in swimming pools and spas. In fact there are only about 40-50 specific kinds of algae found in pools and spas.

The 3 categories are:

- Cyanophyta is blue-green algae -- looks black.
- Chlorophyta is green algae -- looks green.
- Phaeophyta is brown algae -- looks yellow or mustard colored.

Algae are a type of plant. They range in size from microscopic, one-celled plants like plankton to giant forms like Pacific sea kelp, which can grow to more than 100 feet long. Algae have all the same needs as any common plant – they need food and light to survive. Algae produce food through a process called photosynthesis. In the presence of light, algae use a green pigment called chlorophyll to convert carbon dioxide (CO2) and water into carbohydrates (sugars) which provide nourishment for the algae. During this process, algae give off oxygen.

Why are algae undesirable?

Algae are undesirable in a pool because:

- It makes the pool surfaces dangerously slippery.
- It harbors harmful, disease-causing organisms.
- It can cloud the water, causing an unsafe condition.
- It raises the pH of the water which causes many problems.
- It creates a very high chlorine demand once it has bloomed, matured and colonized.
- It makes the water look uninviting

What physically affects algae?

The physical conditions that affect algae are: temperature, pressure, light and turbidity. Eliminate one of the algae's chemical or physical requirements and it dies. Likewise, keeping it in the dark, starving it, pulling it out by the roots or changing the temperature and it dies. However, the best way to kill algae is to poison it.

The most popular algaecide on the market today is chlorine. Chlorine probably kills and prevents the growth of more algae than all other chemicals combined. Chlorine diffuses through the cell wall and literally burns up the algae's insides.

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Combined with good circulation, good filtration and a bit of force applied to a pool brush, and keeping the recommended sanitizer level is probably all that's ever needed to keep a pool algae free. Algae problems occur in the first place if one or more of these factors is lacking or missing.

Proper circulation is important because the sanitizer needs to be kept circulating throughout the entire pool. A 1-ppm (part per million) concentration of chlorine (also called a residual) is sufficient to prevent algae, but only as long as that 1 ppm is able to come in contact with every part of the pool. Even with a good chlorine residual, algae may still grow in areas of poor circulation – near steps, swim out platforms or ladders – or what are called "dead spots."

The amount of time that the equipment is on each day also is an important factor in algae prevention. If the equipment is only run for 2 hours a day during the summer, it's likely that the pool will start growing algae. Again, this has to do with sanitizer circulation, but it also has to do with trapping the algae in the filter. Many types of algae are floating types or have been brushed from the walls of the pool. Once the algae are trapped in the filter, it will be killed by the chlorine already in the water passing through the filter.

As mentioned earlier, algae are plants that have roots. It easily attaches to the irregular surface of plaster or the grain in vinyl. Vigorous brushing literally tears the algae off by the roots. And that's one way to kill it.

A swimming pool is a difficult environment for the survival of most algae. The ordinary fish-pond variety of algae will not survive in a swimming pool. Pool-type algae are an especially hearty breed. Even more disconcerting is that new strains of algae are constantly evolving. Mustard algae were probably born in a swimming pool. Black algae are very dense, blue-green algae. In essence, algae are getting tougher with each generation.

It is a common assumption that because algae are becoming more difficult to kill the chlorine and bromine that we use to prevent it have somehow become weaker. It's not so. On the contrary, strains of algae have adapted to low amounts of sanitizers, and it takes that much more to kill them. Swimming-pool algae should never appear if all of the preventative factors are present; circulation, filtration, brushing and sanitizer.

Keeping your pool algae-free is your responsibility. If your pool develops algae, it's your own fault. It only got there because there's something wrong with your maintenance routine or your circulation system.

In fact, anytime you are aware of something that may affect the water balance or pool sanitation, be sure to take care of it right away. Get help from other pool professionals for advice on taking care of it.

Here are some things that will change the pool water:

- Throwing a pool or spa party
- Extra swimmers
- Fertilizing the lawn

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- Adding new landscaping
- Mowing the lawn
- Painting the house
- Adding decking, gazebos, patio covers or any other new construction
- Windstorms
- Brush fires
- Heavy rain
- Mud slides
- Any specialty chemicals you may have added such as pool sanitizers, algaecides, metal removers or stain inhibitors.

You should know that something is wrong if there is no chlorine residual on the usual day that you take care of the pool. If you normally do pool maintenance on Saturday and there is no chlorine residual, add some extra chlorine. You should also check the chlorine residual in a few days, rather than a week, to see when the chlorine runs out. If the pH rarely changes, and all of a sudden it has gone high or low, this is a sign that something is wrong. If the pool water is always clear, and now it looks a little cloudy, it is evident that there is a problem to look into.

What should you do when your pool gets algae?

Two important notices:

- There is no magic chemical on the market today that can simply be poured into a pool, and have it kill all the algae all by itself.
- If there is an algae problem, brushing the pool walls and bottom frequently and rigorously will be necessary.

This was not what you wanted to hear. Sorry to be the bearer of bad tidings. Many people only take care of pools once a week or on a weekend and there's no way that they can brush often.

However, it is your fault that the algae are there in the first place, and you should want to brush the pool as often as it takes to get rid of it.

Although it is an unsightly nuisance, algae are not a source of disease. It's kind of like dandruff. It's ugly and unpleasant, but it is not life threatening. Algae can be dangerous, however, by providing a safe haven or harbor for disease-causing bacteria which could result in an accidental release of bacteria into the water.

When confronted with the first sign of algae (a bloom), the first step is superchlorination followed by vigorous and frequent brushing, and increasing the length of time that the circulation system operates.

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To superchlorinate for algae, bring the level of free available chlorine up to 10 to 20 ppm (using sodium hypochlorite, calcium hypochlorite, sodium dichlor or lithium hypochlorite) and – this is important – maintain that level for at least 8 hours.

Vigorous brushing will pull the algae out by the roots and will expose all the algae to the chlorine, instead of just the top layer. Also, the brushing will remove the slime layer that forms on top of the algae and protects it from chemical invasion. That slime layer is produced by the algae as a defense mechanism and is called a polysaccharide.

Until all of the algae has been killed and your water is crystal clear, the filter should be run for 24 hours a day.

Once the algae start to disappear, you should not take it for granted that you have killed it all. Although you can't see it, there are still plenty of algae spores just waiting to start re-growing. Algae reproduce by cell division – that is, 1 cell becomes 2; 2 become 4; 4 become 8; 8 become 16; etc. If a cell can divide every couple of minutes, imagine how many billions of cells will be there within the course of a week.

That's why brushing well is important, even after you think you have killed all the algae. Continue this algae-killing routine for 7-10 days after the algae disappears. Simply make believe that the algae are still there, and continue brushing and chemical treatment. One of the most common complaints heard about algae is that it recurs. Actually, it probably hasn't recurred at all; it probably never went away. You just couldn't see it.

Chances are that if you stop your algae-killing routine just when you stop seeing the algae, you haven't killed it; you have simply "mowed the lawn," or “pruned the bushes” and it will return.

Before starting this algae-killing routine, make sure that your filter has been cleaned and/or backwashed and that there is good circulation and flow throughout the entire pool. If there is not, it might be the time to change the return-line fitting to a directional type, which will allow the returning water to be aimed in an appropriate direction for good circulation.

The original hydraulics designed by the builder may not be the best for proper circulation. That's why some pools seem to be more prone to algae attack than others. If your pool has circulation problems, you will have to work harder to ward off algae blooms. If this is the case, you will have to make up for it by brushing more often, vacuuming more often and making hydraulic improvements such as adding directional fittings or installing diverter valves to "fine tune" the suction between the main drain, skimmer(s) and return line(s).

If you have a small spot of algae on the pool bottom or a horizontal surface, trichlor granules or calcium hypochlorite can be used as a spot algaecide for small patches of algae bloom. The granules can be sprinkled onto algae patches on the pool floor or steps. Then, a pool brush can be used o position the material right over the algae spot. The localized change in pH and the high concentration of chlorine will kill the algae.

If you have a small spot of algae on a vertical surface, such as the wall or the sides of the steps, you can try this old pool man's trick: Put some trichlor in a piece of cotton or an old

sock or put a trichlor tablet in a plastic bag with a few holes cut in it. Put a string on the sock or bag and hang the sock or bag in the vicinity of the algae bloom by placing a rock or other heavy object on the other end of the string. This will also prove fatal to the algae.

Caution!

Do not use any kind of granular chlorine or trichlor tabs as spot algaecides on a vinyl liner, colored plaster, acrylic or fiberglass pool. They will bleach or damage the liner!

If superchlorination fails

If you have superchlorinated, brushed like crazy, changed the pool hydraulics and run the filter 24 hours a day and the algae still won't go away – you are going to need some additional help. Now is the time for chemical warfare.

Secret formula for algae

There is no such thing as a "secret formula" for an algaecide, because in order to be marketed as an algaecide, a product must be registered with the Federal Environmental Protection Agency (EPA) as a pesticide. An EPA registration requires that all of the active ingredients and their concentrations be printed on the front label.

This makes comparison easy. Even though you may not be able to pronounce the names of the active ingredients, you can certainly hold two bottles up side by side and compare the labels to see if the products have the same ingredients and are in the same concentration.

If a product does not have an EPA registration, then it cannot be called an algaecide, and the manufacturer can make no claims that it kills or destroys any living thing. (They could, however, claim that their product enhances the ability of another product -- such as chlorine – to destroy algae. Yellow Out®, Yellow Treat™, Yellow Stop are examples.)

A plan of attack

Faced with an algae bloom, here is a logical, step-by-step approach to the problem. The first step is to identify what you've got living in the water.

Make sure that you're dealing with a living organism and aren't trying to kill a stain, a wheel mark or a metallic deposit. Scrape a bit of the stuff into a container and add a couple of drops of liquid chlorine or bleach or add a pinch of dichlor or cal-hypo. Stir it up, and let it sit for an hour. If it disappears, you're dealing with a life form. If it doesn't, you're dealing with a stain or deposit.

If it is a life form, look at it closely and determine the color. Of the three common groups of algae that attack pools and spas, green is probably the easiest to deal with; yellow is tougher; and black is the most difficult. It is possible for any one of the algaecides described later in the algaecide section to work on any one of these types of algae. However, some are better suited or specially formulated for a particular type of algae.

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The top choice for all kinds of algae is to superchlorinate and brush like crazy, making sure that the circulation and filtration are proper and the water is balanced.

If you need to use an algaecide, follow a logical line of attack.

1. Determine the color of the algae – green, blue-green, brown, black or yellow.
2. Observe the algae's other physical characteristics
    - Green algae is typically free floating and turns the water green
    - Yellow, yellow-brown or mustard algae looks like settled dust and is sometimes mistaken for sand
    - Black algae ranges in size from a pinhead to quarter sized spots on the pool's surface
3. Determine which areas of the pool it covers
    - Whole Pool
    - Sunny side of pool
    - Dead spots
    - Steps
    - Large or small area

For a few spots of any color algae:

Use sodium dichlor or trichlor or cal hypo directly on the spot or a trichlor tab in a sock or bag and hang near algae spot. (For white plaster pools only.)

For green algae over a large area:

Use copper or chelated copper, poly quats, borates or enhancers.

For black or blue-green algae over a large area

Use silver or bromine-based enhancers.

For yellow, brown or mustard algae over a large area

Use enhancers, copper, polyquats or borates.

For pink algae

There are no pink algae. There could be red but it has never been found in a swimming pool. If it is pink, it is a mold or bacteria. Lots of chlorine and brushing should kill it. Start with the type of algaecide recommended, and follow the label directions for use. If it does not succeed against this particular type of algae, switch to one of the other types of algaecide. When you find a type of algaecide that works well on a particular type of algae in your pool, stick with it and recommend it to your

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friends. But remember: Algae can evolve and change. What works one season may not work the next.

Things to know about algaecides

- Copper-based algaecides are good at killing visible algae. Use either copper sulfate or chelated copper to prevent staining. Time, chlorine and oxidizers can break down the chelating agent and allow copper to stain. The Total Alkalinity must be below 150 ppm. Copper algaecides work best when total alkalinity is near 60 ppm. They also work better at a pH of about 8.0 to 8.4. Copper algaecides are not the most effective on black algae. They are effective on green, yellow, or mustard algae.

- Silver algaecides are very effective on black algae. They should not be used as a preventive as they cause sunlight induced silver oxide staining especially on vinyl.
- Polyquat algaecides are good at prevention and killing algae. They are non-foaming. They remain in the water for only 4 to 7 days because they are similar to clarifiers. They have a positive electrical charge and attract algae and negative dirt particles. Therefore, they will end up in the filter within a few days where they will not be an effective algaecide. They are effective on green algae.

- Quats are inexpensive and are good at prevention but they cause foaming.
- Sanitizer enhancers are not really algaecides but enhance or convert other sanitizers into algae killers.
- Ammonia based products are good at killing visible yellow algae. They require the pH to be adjusted to 8.0. They require a low starting chlorine level. The exact amount of chlorine must be added to get correct ratio of chlorine to product. Too much or too little chlorine and product does not work correctly. They also require a large amount of chlorine to re-establish a free available chlorine residual (reaching breakpoint) after using. They are effective on yellow, mustard and green algae.
- Bromine based algaecide products convert chlorine in the pool water into the killing form of bromine (HOBr) which can kill algae. The bromine (HOBr) returns to being bromide (Br –) where chlorine will reactivate it into bromine (HOBr). The recycling of bromine to bromide to bromine will continue. They will switch the pool from chlorine-based to bromine-based temporarily. Chlorine usage will increase after use because bromine is not protected by conditioner or stabilizer. Eventually the bromide will get used and chlorine will re-establish. Also, hypobromous acid (HOBr) and sunlight produces bromates. Bromates are cancer causing but at the present time not regulated in swimming pool water.

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- Borate is a CO2 (carbon dioxide) scavenger and it raises pH. Algae need CO2 for photosynthesis. Removing CO2 temporarily can therefore kill algae. The CO2 will eventually return to the water because the water is exposed to the atmosphere. Lowering pH brings CO2 back into the water.
- Phosphate removers remove a major nutrient source for algae. Many pools have a high level of phosphate and the algae seems to return frequently. High levels of phosphate require higher levels of chlorine or bromine to keep algae from growing. Keep phosphate below 125 ppb. Sequestering agents, stain removers and preventers, chelating agents and scale or corrosion control chemicals can be a source of phosphates.

If you still have algae

If you have followed the above advice and corrected any problems, superchlorinated, mega-chlorinated, brushed, vacuumed, used an algaecide or two a couple of times, cussed and prayed and you still have algae, there are a few tings left that you can try or that you may do as a final thing before draining.

1. Check for high TDS
2. Check for high cyanuric acid level
3. Check for Phosphates
4. Check for Nitrates

High TDS

TDS is Total Dissolved Solids. All water has some TDS. It is the total amount of all the dissolved chemicals that have gone into the water. As water evaporates, only the pure water evaporates. The salts, minerals, carrier chemicals and used chemicals all stay behind. As more water is added, more TDS stays behind. In time the TDS builds up to the point that it can cause water to discolor, make water taste salty, leave a residue on tile and decks and even surround bacteria and algae and make it hard for sanitizers, disinfectants, oxidizers and algaecides to do their job. Industry guidelines recommend a TDS maximum level of about 2500 ppm. This is measured with an electronic TDS meter or can be done with test strips.

If the pool water has a TDS of more than 2500 ppm, lower it by draining part of the water and refilling. Tap water has a TDS of around 200-300 ppm TDS. So draining half of the water and refilling will just about cut your TDS by 50 percent.

High CYA (cyanuric acid)

Cyanuric acid is used to protect chlorine from being destroyed by sunlight. It really does a great job. Sunlight destroys the killing or active form of chlorine called HOCl (hypochlorous acid) at the rate of 90 percent in just 2 hours. With CYA the chlorine stays in

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the water 6 to 10 times longer. However, too much CYA can slow down the rapid kill rates of chlorine. Mind you, it will not lock up all the chlorine and prevent it from doing its job. But it will slow it down a bit.

Sodium dichlor is about 50 percent CYA and trichlor is 55 percent CYA. Therefore if you use these products for very long in your pool as a regular chlorinating source, you will have an excessively high CYA level. Commercial or public pools are regulated by state and usually county health departments. The maximum level for CYA in pool water is 100 ppm. There is no guideline or code for residential pools. However, for up to 5.0 ppm of chlorine in the water, 100 ppm of CYA is no better at protecting chlorine from sunlight than 50 ppm. It is a waste of money and there is a potential for slowing down chlorine's killing power.

So the recommended level for CYA in pool water is 30 to 50 ppm. Test the water for CYA level. This is done with a liquid reagent test kit or with test strips. If the CYA level in a pool with algae is more than 50 or maybe 100 ppm, I would recommend lowering the level. This is usually done by partial or complete draining and refill. There are CYA reducing chemicals in the marketplace but they work by precipitation of CYA. You add a pound of reducer and it precipitates along with a pound of CYA. One pound in 10,000 gallons of water is 12 ppm. So if you want to remove 100 ppm of CYA you need 8.5 pounds of reducer and it will precipitate 8.5 pounds of CYA. The 100 ppm will mean 17 pounds of precipitate in the pool. This will have to be filtered out or vacuumed to waste. You would be better off just draining and refilling.

Phosphates and nitrates

Many pools with continuing, recurring or returning algae have high levels of phosphate and nitrate. In many cases the pool owner, pool operator or service technician is unaware of the problem. Algae use phosphorus, nitrogen and sulfur to grow. These elements are all present in fertilizer.

Removing these possible nutrients from the water can slow algae growth. Phosphate is one of algae's major sources of nutrient. Test the water for phosphates. This is done with a phosphate test strip. The phosphate level should be below 125 ppb (parts per billion).

To lower phosphates you can drain part or all of the water or you can use a phosphate reducer. Phosphate reducers are very effective at removing high levels of phosphate.

Nitrates represent the final stages of decomposition of nitrogen-containing compounds in water. Nitrate is one of algae's sources of nutrition. High nitrates usually indicate that there has been an insufficient sanitizer level in the water to destroy the contaminants as they are introduced. Then super-chlorination or shocking is applied to remove the contaminants afterward.

Draining water is the only way to lower nitrates. Nitrates can not be oxidized or superchlorinated. Nitrites and most other nitrogen-containing compounds can by oxidized by superchlorination.

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If all else fails

If you have tried everything and nothing succeeds, there is only one last resort. The pool should be drained and given a chlorine wash. This done by making up a solution of chlorine that is 200 ppm or greater. Many people just use laundry bleach or maybe mix it with an equal part of water. You scrub the chlorine solution right onto the plaster. No need to drain, just fill up the pool when you are done.

Caution!

Do not chlorine wash a vinyl liner, colored plaster, acrylic or fiberglass pool. It may bleach or damage the vessel's surface!

It may also be necessary to give the pool an acid wash. Again, do not acid wash a vinyl liner, colored plaster, acrylic or fiberglass pool. It may bleach or damage the vessel's surface!

Remember that the best cure for algae is prevention. With good sanitation, good circulation, good filtration, and a good algae prevention system, algae should never become a problem.

Algaecides

There are many varieties of algaecides available on the market, but they generally fall into five categories:

- chlorine compounds
- metallic algaecides
- polymers
- chlorine enhancers,
- phosphate removers and quats.

The following discusses each type.

Metallic algaecides

Metallic algaecides kill by acting as a roadblock to the algae's metabolism, blocking the formation of enzymes that the algae need to carry on its life function. Even though algae and green plants need a trace amount of copper to produce chlorophyll, too much copper interferes with their ability to feed and breathe.

Years ago, copper sulfate was used to kill algae. It is still used in streams lakes and ponds but it is not used in pools. Copper will stain a swimming pool, swimmer's hair and fingernails a blue-green color.

Today, many copper-based algaecides contain what is known as chelated copper (pronounced KEYlated) – copper that is combined with other substances that prevent the copper from staining. The copper still kills algae but it does not stain.

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There is another metallic algaecide on the market. It is called silver algaecide. Silver algaecides work in the same way as copper algaecides do. The silver used is called colloidal silver which means that the silver particles are very small – much smaller than the average filter can remove.

Polymers and polyquats

Polymers are huge molecules that contain many parts called monomers. The prefix mono means "one." The prefix poly means "many." Because algae have a negative electrical charge, the strong positively-charged polymers are attracted to the algae, where they hang onto the surface of the plant. The polymer disrupts the membrane of the algae cell, and the algae suffocate.

The use of polymer algaecides does not result in eye irritation and it does not require long waiting periods before swimming. Polymer algaecides are also safe for use in painted, colored plaster, vinyl liner, and fiberglass pools.

Polymer algaecides are compatible with other common swimming pool chemicals when in the water, but they must never be mixed with any chemical, especially concentrated dry or liquid chlorine. Follow label instructions carefully when handling, storing, or disposing of this chemical.

Chlorine enhancers

These products do not kill algae by themselves and therefore cannot be legally called algaecides, either in advertising or on their packaging. In addition, because they make no pesticidal claims, they do not have to be registered with the Environmental Protection Agency (EPA). The active ingredient therefore does not have to be stated on the label.

Chlorine enhancers work by combining with chlorine that is already in the water or chlorine that is added at the same time as the chlorine enhancer. The chlorine enhancer is most likely something that algae recognizes as food. When the algae ingests what it thinks is food, it gets a lethal dose of chlorine along with it.

By itself, the chlorine may not have killed the algae. And by itself, the chlorine enhancer cannot kill algae. But together, they formed a deadly combination. This type of action is known as synergism. The combination is stronger than the sum of its parts.

Quats

The word "quat" is short for quaternary ammonium compounds. These chemical compounds all contain some form of ammonia and they have a positive electrical charge.

Because algae have a negative electrical charge, quats are attracted to the algae, where they hang onto the surface of the algae. The quat disrupts the membrane of the algae cell wall and begins to suffocate it. Quats a similar in chemical structure to surfactants and will cause some amount of foaming.

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Phosphate removers

One of the newest methods of algae prevention is to remove one of algae's largest food sources – phosphate which then allows sanitizers to prevent algae growth. As you may know, algae are plants and just as the plants and grass at your house need and even thrive on fertilizer, so does algae.

Extensive research worldwide, including work done by the US Environmental Protection Agency (EPA) has proven that phosphates are the limiting nutrient (plant food) for algae growth in lakes and rivers. When phosphates are removed from wastewater, algae growth is greatly reduced or eliminated, even though all of the other nutrients are present to support algae growth. That's the reason that phosphates were removed from laundry detergents back in the 1970s.

This science is also true in swimming pools. When phosphates are removed from the pool water, normal levels of sanitizers such as EPA approved chlorine prevent algae growth.

Phosphate removers are formulated from processed lanthanum (rare earth) compounds. When added to your skimmer, a thin coating of this lanthanum is formed on the filter and phosphates are removed to a very low level as water flows through it.

Maintaining a near zero phosphate level together with an EPA approved sanitizer results in clear water, no water line ring, no chemical odors and no algae.

In conclusion

Algae are ever-changing, living, mutating plants and a pool is a dynamic constantly changing aquatic environment. The water is different in every pool. No two of them are the same. As you have probably discovered, many, many factors contribute to algae growth and survival. And no one product kills or prevents algae. If there was such a product we would all be using it and there would be no discussion about what works best. What controls algae in one pool will not necessarily control algae in another? Hopefully you will not ever get to the point of last resort and have to drain and chlorine wash a pool to get rid of the algae.