

Biofilm, Water and Sphagnum Moss

"It's not yet well known, but chlorine and other chemicals used to kill bacteria are actually absorbed by biofilm — rendering those chemicals ineffective — especially in the pipes, liners and other pool and spa areas." — Vance Fiegel, Microbiologist, Chief Scientific Officer, CWS



*Even a brand new spa can exhibit biofilm buildup
(foam and brown area appear during flushing process)*

The slimy rocks in the lake. The tarter on your teeth. That foam in your spa. All of those things and more are caused by biofilm, nature's protective way of providing bacteria in moist or water-filled areas with a suitable environment (a shell-like secretion) in which to proliferate, communicate, and survive, especially in harsh environments. Only within the last decade have scientists and researchers gained a better understanding of how bacteria live, communicate and grow in a water environment.

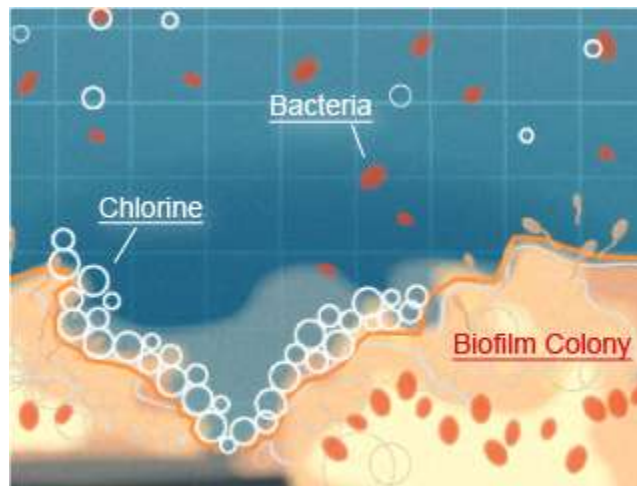
Biofilm's unique protective coating and extraordinary survival mechanism is made up of complex sugar molecules. These sugar molecules provide a backbone for the additional accumulation of proteins, DNA, calcium and other inorganic materials and substances that flow over the bacteria's protective shield and become incorporated into the biofilm mass.

Contrary to common beliefs, bacteria gravitate to the inside surfaces of pipes and the liners of pools and spas rather than remain suspended in the water. More than 99 percent of all bacteria in a water system may live within biofilm. **Once the bacteria adhere to the surface, they begin the process of colonization and biofilm formation. The biofilm maintains the moist environment, captures and holds nutrients, and provides protection from toxins, such as chlorine and bromine.**

Up to 80% of water management issues are directly attributable to contamination by biofilm
Only when bacteria are released from biofilm's protective shield are these free-floating, unprotected planktonic bacteria vulnerable to deadly chemicals and sanitizers such as chlorine and bromine. But research — at Montana State University's Center for Biofilm Research* and other research centers, including CWS — has confirmed that **as little as 1-percent of the bacteria stay in suspension. Bacteria actually migrate to a surface and quickly attach themselves.**

That's why up to 80% of water management issues are directly attributable contamination by biofilm.

*To learn more about biofilm research, visit the website of Montana State University's Center for Biofilm Research <http://www.erc.montana.edu/>.



Biofilm colonies growing on an underwater surface.

Continuing studies likewise demonstrate that biofilm is resistant to typical concentrations of most pool and spa chemicals. According to Vance Fiegel, Microbiologist and Chief Scientific Officer for Creative Water Solutions (CWS), “It’s not yet well known, but chlorine and other chemicals used to kill bacteria are actually absorbed by biofilm — rendering those chemicals ineffective in the pipes, liners and other pool and spa areas. With biofilm present, testing the water in a pool or spa doesn’t detect the chlorine absorbed by biofilm. **Adding more chemicals doesn’t help: they simply bind to the increased amount of biofilm.**”

If external conditions deteriorate, the bacteria can remain alive but go dormant for very long periods of time. When conditions again become favorable for growth, the bacteria then start to proliferate and re-colonize. Almost immediately, pieces from the active bacterial colony break off with the biofilm and then attach to new areas where they start growing. This happens very quickly over just a few hours and is repeated thousands of times. **Removing or preventing biofilm from forming on surfaces is very difficult and can require strong and toxic acids. This important aspect of bacterial contamination has defied most conventional efforts of inhibition or eradication.**

Biofilm will rapidly remove all sanitizers from water in pools or spas with lots of biofilm

If a pool or spa has a lot of biofilm, it will rapidly remove all sanitizers from the water. Pools and spas using the PoolNaturally or SpaNaturally systems have very stable sanitizer levels. After years of testing, CWS found the sphagnum moss conditions water through its activity as an absorptive filter, as a buffer, and by releasing conditioning substances. Moss actively removes ions from water through an ion-exchange process located within the pores of the leaves of moss. This ion-exchange process binds specific molecules such as iron, calcium, mercury, lead and cadmium. Once bound the molecule is removed from the fluid.

CWS has determined the unique characteristics of sphagnum moss can naturally reduce biofilm accumulation and bacterial proliferation — and help condition water in three ways:

- **Nearly a decade of studies shows that this species of sphagnum moss has the ability to control the growth and proliferation of various bacteria.**
- **The ability of the moss to reduce biofilm leaves bacteria exposed and vulnerable to chlorine and deadly sanitizing chemicals. Because bacteria are exposed, fewer chemicals are needed to effectively control bacteria.**
- **Moss has strong natural buffers that stabilize pH and reduce the need for additional chemicals. With fewer chemicals, water chemistry is easier to balance and maintain.**