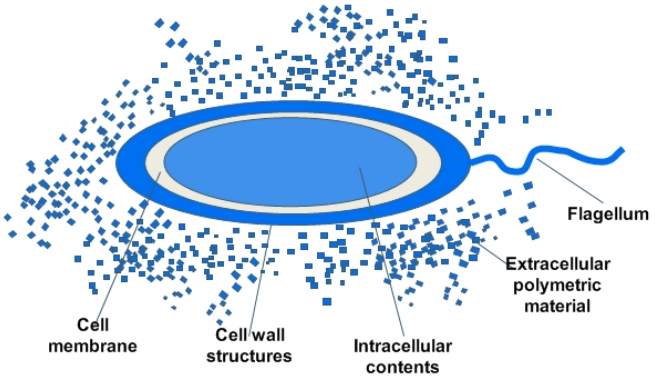
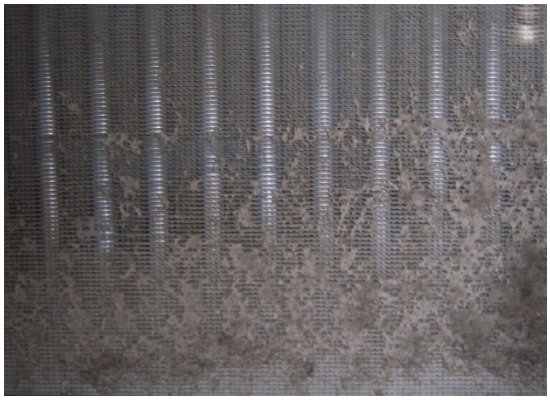
Biofilm

Biofilm is a collection of microorganisms surrounded by the slime they secrete, attached to either an inanimate or living surface. You are already acquainted with some biofilms such as the slime on river stones, and the gel-like film on the inside of a vase which held flowers for a week. Biofilm forms when bacteria adhere to surfaces in aqueous environments and begin to excrete a slimy, glue-like substance that can anchor them to all kinds of material – such as metals, plastics, soil particles and tissue. A biofilm can be formed by a single bacterial species, but more often biofilms consist of many species of bacteria, as well as fungi, algae, protozoa, debris and corrosion products.



Biofilm bacteria are "hairy"cells with extracellular polymers which stick to surfaces, attract nutrients, and protect bacteria from standard cleaners.

The first biofilm colonists ease the arrival of other cells by providing more diverse adhesion sites and beginning to build the matrix that holds the biofilm together. Essentially, biofilm may form on any surface exposed to bacteria and some amount of water. Once colonization has begun, the biofilm grows through a combination of cell division and recruitment. And, once anchored to a surface, biofilm microorganisms carry out a variety of detrimental effects depending on the surrounding environmental conditions. Microbial biofilms on surfaces cost the nation billions of dollars yearly in equipment damage, product contamination, energy losses and medical infections. Some biofilm bacteria produce corrosive chemicals like acids and hydrogen gas during their metabolism. Anaerobic zones in biofilm can have sulfate-reducing bacteria. This group of bacteria reduce sulfate to hydrogen sulfide which corrodes metal.



Biofilm build-up on an HVAC coil

Biofilms provide important survival mechanisms for bacterial cells. According to invitro studies, they can avoid attack by host defenses. For example, chlorination of a biofilm is usually unsuccessful because the biocide only kills the bacteria in the outer layers of the biofilm. The bacteria within the biofilm remain healthy,

and the biofilm can regrow. Repeated use of antimicrobial agents on biofilms can cause bacteria within the biofilm to develop an increased resistance to biocides.

The bacterial cells on the surface of the biofilm are different from the cells with the biofilm matrix. The embedded cells' behavior can change as the thickness of the biofilm changes. The surface cells, no matter how old the biofilm is, are likely to mimic surface cells of young biofilms, which are metabolically active and large. These surface cells divide and increase the thickness of the biofilm. Little oxygen is available to the embedded cells, therefore they are smaller and grow slower. The bacteria exist in a somewhat dormant state, becoming active when cells in the outer layers are killed.

Lots of bacteria are planktonic – they float around in water; microbiologists since the time of Pasteur have conducted most bacterial studies using suspended bacterial cultures. But, bacteria living in biofilm can have significantly different properties from free-floating bacteria, as the dense and protected environment of the film allows them to cooperate and interact in various ways.

Most of the bacteria that cause us problems are sessile – attached to a surface – and they live in biofilms. Once bacteria attach to a surface, they change. The most obvious change is that they begin to excrete a slimy material (which has provided the basis for coining the word biofilm). But we are learning that other changes made by attached bacteria are profound, though invisible. In fact, researchers have now shown that a bacterium which attaches to a surface "turns on" a whole different set of genes, which makes it effectively a significantly different organism to deal with. One benefit of bacteria living in biofilm is increased resistance to detergents and antibiotics, as the dense extracellular matrix and the outer layer of the cells protect the interior of the community.

“The AerisGuard™ Coil Restoration Program is designed to eliminate biofilm from your HVAC coils and to prevent reoccurrence for a minimum of 12 months”

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