

# Alvim

## Biofilm Monitoring System

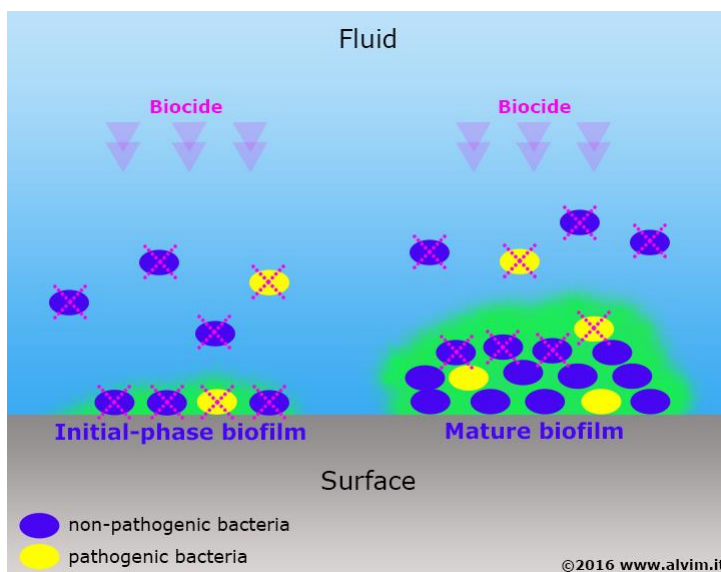
- ✓ Early detection of bacterial growth on surfaces
- ✓ Monitoring & optimization of sanitation treatments

Bacterial growth on surfaces in contact with water and other liquids, a phenomenon known as “biofilm”, is a major problem in many industrial applications. **Biofilm** can form on any surface, even in extreme conditions, and it **causes several issues**:

- ✱ **decrease in thermal efficiency of heat exchangers**, by 30% for a 20 micron-thick bacterial layer;
- ✱ **increase in inorganic deposit (fouling)**, since bacteria produce sticky substances that facilitate the adhesion of other particles;
- ✱ **settlement of bigger organisms**, known as “macrofouling”, that can constrict water flow, increasing energy consumption;
- ✱ **microbiologically influenced corrosion (MIC)**, that accounts for multi-billion dollars of industrial damages all over the world.

These problems can eventually lead to pipe blockage and plant idle. **Sanitation treatments should be applied as soon as biofilm starts to grow**, since:

- ◆ it is much more difficult and expensive to kill biofilm, with respect to free-floating bacteria; the extracellular matrix (EPS) produced by biofilm, indeed, increases its **resistance to external agents**



Effectiveness of sanitation treatments on different phases of biofilm

by three orders of magnitude (x1000). A mature biofilm has a thicker EPS matrix, thus it is much more resistant than an early-stage one.

- ◆ Biofilm is known to represent the ideal environment for the **survival and growth of pathogens**. It is therefore important to contrast biofilm formation, to minimize the risk of dangerous bacterial contamination.

- ◆ When biofilm is mature, its outermost layers tend to detach and float away. This increases the likelihood of **biofilm formation in other areas of the plant**.

## The ALVIM Biofilm Monitoring System

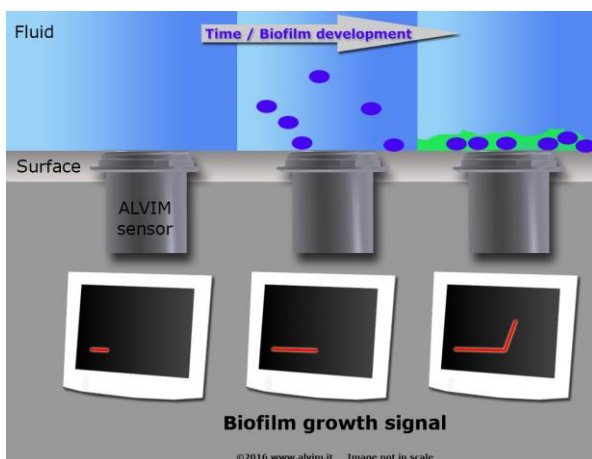
The ALVIM technology represents an effective and reliable tool for the detection of early-stage biofilm. Such monitoring is proven to be stable and highly sensitive (down to 1% of probe surface covered by biofilm).

This technology allows for a simple and flexible biofilm monitoring approach, considering different applications, such as:

- ✓ analysis and characterization of biofilm growth, in civil and industrial piping systems;
- ✓ assessment and comparative evaluation of different chemical biocides or sanitation treatments;
- ✓ real-time, continuous monitoring of water treatment systems;
- ✓ automatic and/or remote control and optimization of sanitation treatment;
- ✓ prevention of pathogens, like Legionella, Lysteria and Staphylococcus, in different applications (cooling towers, food production, drinking water, hospitals, etc.).



ALVIM Biofilm Sensors



Biofilm monitoring by means of ALVIM Technology



Optimization of sanitation treatments

### Among the users of the ALVIM Biofilm Monitoring System:

