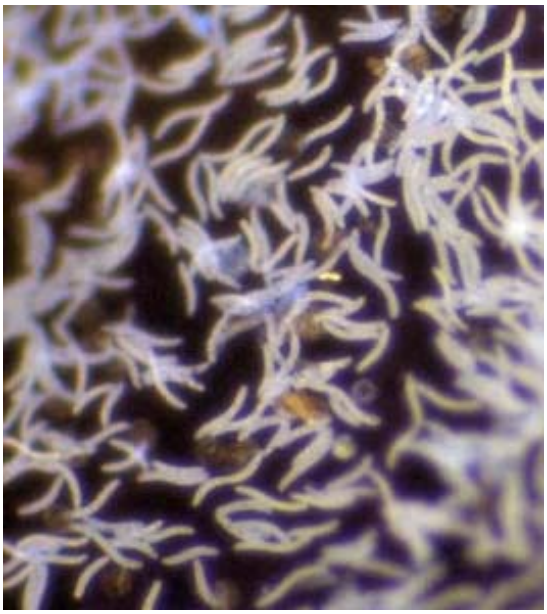
Sulfate Reducing Bacteria (SRB)

Sulfate-Reducing Bacteria (SRB)



Sulfur occurs in living matter chiefly as a component of certain amino acids. Sulfur is present in the soil primarily as a part of proteins and is taken up by plants in its oxidized form, sulfate (SO_4^{2-}). The sulfur- containing proteins are first degraded into their constituent amino acids by enzymes and then excreted by numerous soil organisms as hydrogen sulfide (H_2S). Hydrogen sulfide (H_2S), immediately identified by its pungent odor, is highly toxic to most biological systems, if it was ever to accumulate. Under aerobic conditions, H_2S oxidizes spontaneously to sulfate, which its most readily utilized form by sulfate bacteria. However, under anaerobic conditions, sulfate-reducing bacteria can reduce sulfate to H_2S.

In cooling systems, corrosion and fouling are frequently attributed to SRB. The organism is often found in sludge in the basins of cooling towers. In these systems the bacterium, using sulfate as a hydrogen acceptor, produces hydrogen sulfide and ferrous sulfide, which in combination form a malodorous black slime. In severe cases of biological fouling, bubbles of hydrogen sulfide rise through the water in the basin causing objectionable odor in the area.

Corrosion occurs where biological matter settles or attaches to surfaces. Biologically produced chemicals such as ammonia, hydrogen sulfide and acids can increase general corrosion rates in a system, near and away from the generating organisms. The corrosion of iron by SRB is rapid, and unlike ordinary rust, is not self-limiting. Tubercles formed by sulfate-reducing bacteria consist of an outer shell of red ferric oxide mixed with black magnetite iron oxide. Beneath the shell is a soft black center of ferrous sulfide, under which there is usually a deep pit. When cleaned, the interior surface of the pit usually has a characteristic bright silvery appearance.

Even though the sulfate-reducing bacteria are obligatory anaerobes, they may survive but not actively grow if exposed to oxygen. The bacterium is present in most natural waters including fresh, brackish and seawater, and most soils and sediments contain sulfate reducers. Sulfate or sulfite must be present for active growth. The bacteria may tolerate temperatures as high as 176°F and a pH from about 5 to 9.

Contamination Identification.

The presence of sulfate reducing bacteria is not easily identified through microbiological tests. Even the determination of total anaerobic bacteria suddenly provides precise early warning, before the population will rise to unacceptable levels and remarkable irreversible damage already had taken place to the system.

Being SRB an anaerobic and sensitive organism, it is very common to be eliminated through the sampling and cultivation procedure, and being present in the original sample, cannot finally be determined

Most of the specialists are using the technique to take under anaerobic conditions sample of biofilm, if such a colony is accessible, and test it for SRB. The danger of SRB elimination during sampling is lower then, but always exist.

In a well monitored open recirculating cooling water system, the grow of SRB can be early warning through the simultaneous:

a. Decrease of the p Alkalinity into the system, without acid addition

b. Increase in the pitting attack tendency without increase in the general corrosion rate monitored, under constant and well-controlled addition of the corrosion inhibitor.

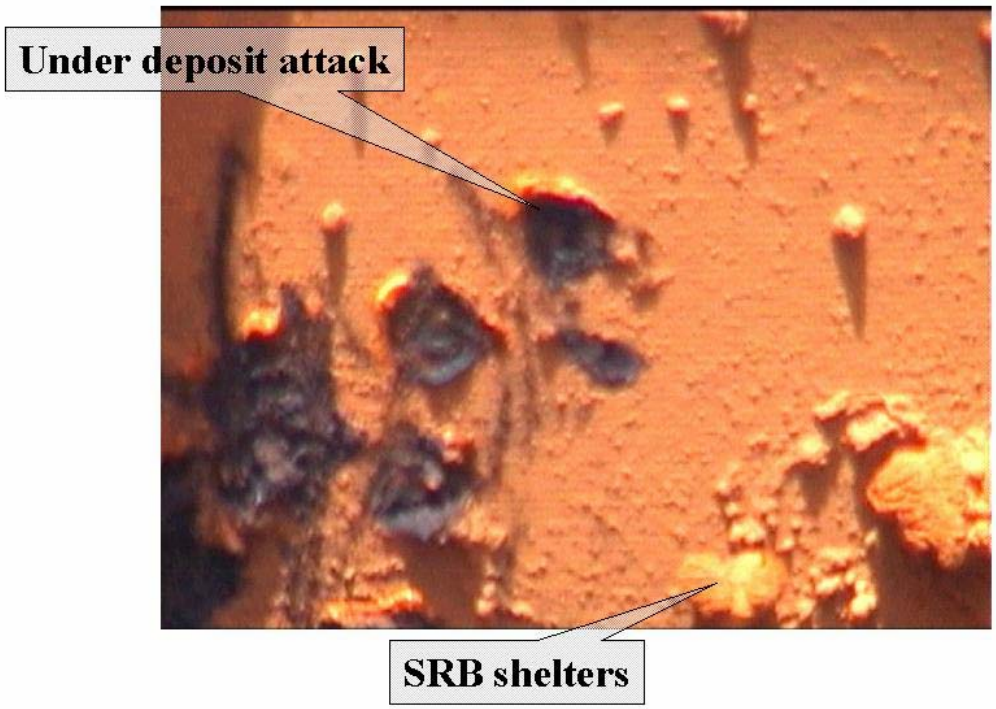
The decrease of the p-Alkalinity reduction should be identified solving the material balance with the help of a computer, while using a suitable corrator should identify pitting tendency and general corrosion.

Under service conditions, the presence of SRB colonies is very characteristic. They are externally rust-red, while black inside, voluminous oxide deposits. The appearance is also characteristic, being mostly like broken pieces of stone, attached to the metal surfaces than typical deposits.

When those "stones" are detached from the metal, severe corrosion of the base metal is observed at the point where the colony was attached.

Control of SRB

Control of sulfate-reducing bacteria requires a comprehensive biocide program and regular bacteria levels monitoring. Care should be taken to the microbiocides selection, because most of the efficient microbiocides, like isothiazolines, bromine and chlorine derivatives are deactivated, even in a minor presence of SRB.




www.water-services.info
Water Services Ltd


Water Services Ltd
www.water-services.info