CHEMTEX
INTERNATIONAL CHEMTEX CORPORATION

Technical Topics

Iron Reducing Bacteria

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Iron bacteria is a group of microorganisms found in industrial waters, streams, lakes, wells and potable water supplies. Recently, these organisms have gained recognition in the industry due to their effect on process equipment and finished products.

Iron bacteria is considered to be capable of withdrawing iron present in waters and depositing it, in the form of hydrated ferric hydroxide on or in their mucilaginous secretions. These large secretions, commonly referred to as slime, will impart an unpleasant odor to drinking water. As these microorganisms increase in number, the water may become more turbid, and the color of the water will turn "brick-red" . Hence, the common reference of "red water".

In addition to discoloring the water, this group of microorganisms produces undesirable accumulations in pipes, nozzles, ponds, etc. These deposits will in time slough off and plug lines, foul pumps, valves and/or effect the quality of finished products. These bacteria oxidize ferrous ions to ferric, which is precipitated as ferric hydrate. Iron may be obtained from the pipe itself or from the water being carried. These bacteria may initiate pitting and tuberculation in iron pipes. They are partial to wells, or outfalls where water enters a stream. While these microorganisms are considered as aerobic, requiring oxygen to survive, they have been found to grow in waters with very low oxygen content.

The principal distinguishing characteristics between iron bacteria and other types of microorganisms is their ability to absorb and accumulate iron and/or manganese, when grown in environments which contain these elements. These organisms deposit iron and manganese salts around their cells which result in the characteristic reddish brown-black color. Iron bacteria are considered autotrophic (self-sufficient) organisms, oxidizing iron compounds as a source of energy. In general, the bacteria prefer lower temperatures but are known to grow at temperatures which range from 0-40°C, with an optimum temperature of 6-25°C. Their pH range for growth will vary from 5.5 to 8.2 with an optimum pH around 6.5. These organisms are not affected by light and have been found to grow in exposed areas, in shade as well as complete darkness.

Identification of iron bacteria is extremely difficult. While these organisms grow extremely well in recirculating water, laboratory attempts using usual cultural media methods have not been successful in the past. Therefore, it is not possible to evaluate the number of these organisms in water supplies with the usual bacteriological procedures. The satisfactory procedure for examining the population index of these organisms is direct microscopic analysis of the water after staining. This method also proves difficult due to difficulties in culturing large quantities for analysis.

Usually surrounded by a tubular "mucilaginous" sheath that hardens and becomes impregnated with ferric hydroxide, iron bacteria can be difficult to control. Chlorination has been used for control in bulk waters for many years; however, there are inherent drawbacks in the use of these products. High chlorine demand due to organic matter and iron levels has shifted the emphasis for control to the use of non-oxidizing biocides, such as quaternary ammonium compounds, as well as organo-sulfur compounds.

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