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Editorial

A Study of Iron-Oxidizing Bacteria

Trevor Hancock*

Department of Microbiology, Carleton University, Ottawa, Canada

EDITORIAL NOTE

Iron-oxidizing bacteria are chemotrophic bacteria that derive the energy they need to live and multiply by oxidizing dissolved ferrous iron. They are known to grow and proliferate in waters containing iron concentrations as low as 0.1 mg/L. However, at any rate 0.3 ppm of disintegrated oxygen is needed to carry out oxidation. Iron is a significant component required by living organisms to carry out numerous metabolic reactions such as formation of proteins involved in biochemical reactions, like iron-sulfur proteins, haemoglobin and coordination complexes. This element has a widespread distribution in the planet and is considered as one of the most abundant in the Earth's crust, soil and sediments. Iron is one of the trace elements in marine environments. Its role in the digestion of some chemolithotrophs is probably ancient.

As Liebig's law of minimum says, the element present in the smallest amount (called limiting factor) is the one that determines the growth rate of the population. Iron is the most common limiting element that has a key role in structuring phytoplankton communities and determining its abundance; it is particularly significant in the HNLC (high-nutrient, low-chlorophyll regions), where the presence of micronutrients is mandatory for the total primary production and iron is considered as one of those restricting factors.

At the point when de-oxygenated water reaches a source of oxygen, these commonly called iron bacteria convert dissolved iron into an insoluble reddish brown gelatinous slime that discolors stream beds or can sustain plumbing fixtures, and clothes or utensils washed with the water carrying it. Organic material dissolved in water is often the underlying cause of an iron-oxidizing bacteria population. Groundwater may be normally de-oxygenated by decaying vegetation in marshes. Useful mineral deposits of bog iron ore have formed where that groundwater has historically emerged to be exposed to atmospheric oxygen. Anthropogenic hazards like landfill leachate, septic drain fields, or spillage of light petroleum fuels like gasoline are other potential sources of organic materials permitting soil microbes to de-oxygenate groundwater. A similar reaction may form dark deposits of manganese dioxide from dissolved manganese, however is less common because of relative abundance of iron (5.4%) in comparison to manganese (0.1%) in normal soils. The sulfurous smell of decay or rot sometimes associated with iron-oxidizing bacteria results from enzymatic change of soil sulfates to violate hydrogen sulfide as an alternative source of oxygen in anaerobic water.

FERROUS ION OXIDIZERS IN THE MARINE ENVIRONMENT

In the marine environment the most well-known class of iron oxidizing-bacteria (Fe-OB) is zetaproteobacteria. They are the major players in marine ecosystems; being generally microaerophilic they are adapted to live in transition zones where the oxic and anoxic waters mix. The zetaproteobacteria are available in different Fe(II) rich habitats, found in deep ocean sites associated with hydrothermal activity and in coastal and terrestrial habitats, been reported in the surface of shallow sediments, beach aquifer, and surface water.

Mariprofundus ferrooxydans is one of the most common and well-studied species of zetaproteobacteria. It was first isolated from the Loihi seamount vent field, near Hawaii at a depth between the range of 1100 and 1325 meters, on the summit of this shield volcano. Vents can be found ranging from slightly above ambient (10°C) to high temperature (167°C). The vent waters are rich of Carbon dioxide, Fe(II) and Mn. Around the vent orifices can be present heavily encrusted enormous mats with a gelatinous texture made by the Fe-OB as a result (iron-oxyhydroxide precipitation), these zones can be colonized by other bacterial communities, those can able to change the chemical composition and the flow of the local waters. There are two different types of vents at Loihi seamount: one with a focus and high-temperature flow (above 50°C) and the other with a cooler (10°C-30°C) diffuse stream. The former creates mats of certain centimeters near the orifices; the latter produces square meters mats 1 m thick.

Correspondence to: Trevor Hancock, Department of Microbiology, Carleton University, Ottawa, Canada, Tel: +1 691-554-2400; E-mail: thancock@oic.ca

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