

# Effect of bicarbonate concentration on iron biomineralization by psychrotolerant bacteria

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Anaerobic Fe(III)-reducing bacteria are known to be able to reduce crystalline and amorphous Fe(III) oxides. Anaerobic Fe(III)-reducing bacterial reduction can induce several kinds of secondary minerals (Fe(II) containing minerals) such as magnetite, siderite, vivianite [(Fe<sub>3</sub>(PO<sub>4</sub>) · 2H<sub>2</sub>O)], and iron sulfide (FeS) according to variety of geochemical and biological conditions. It is generally known that key factors controlling the formation of those minerals are medium composition, electron donor and acceptor concentration, and iron-oxide surface condition. However, the influence of the factors affecting Fe(III) reduction and the biogenic mineral formation by psychrotolerant Fe(III) reducing bacteria (PV-4, *Shewanella pealeana*) in the anaerobic condition is not well understood. In the previous research, psychrotolerant Fe(III) reducing bacteria (PV-4, *Shewanella pealeana*) were investigated on iron reduction process and mineral formation under several conditions such as pH/Eh, salinity, and temperature. In this study, as a result, the bicarbonate concentration, one of the key factors of mineral formation by iron reducing bacteria, was evaluated. According to the variation in concentration of bicarbonate, the different mineral phases formed. When the medium solution inoculated with PV-4 is high in concentration of bicarbonate (210mM), the siderite phase was dominant as an end member. But when the medium solution inoculated with PV-4 is low in concentration of bicarbonate (30mM), the magnetite phase was dominant as an end member. As the bicarbonate concentration in the medium solution became higher, several mineral phases such as green-rust (considered as transitional-stage mineral), magnetite, and siderite formed, which indicates that the concentration of bicarbonate in solution has the important effect to enhance or reduce the rate of Fe(III) reduction process.

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**Key words:** psychrotolerant Fe(III)-reducing bacteria, iron reduction, magnetite, siderite, green-rust, bicarbonate concentration

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