

Bioreduction of magnetite to green rust by *Shewanella putrefaciens* in the presence of H₂

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Identified as a stable corrosion product, magnetite (Fe₃O₄) is a mixed Fe^{II}-Fe^{III} oxide with a Fe^{II}:Fe^{III} ratio of 1:2. Within nuclear waste repository in deep geological formation, magnetite plays a protective role against corrosion as a passive layer when it is formed at the surface of the metallic envelopes. However, bacteria are present in this argillaceous formation and their activity may alter the protective property of magnetite *via* microbially influenced corrosion. The presence of hydrogen (as electron donor) and magnetite (as electron acceptor) can support the bacterial growth, in particular for hydrogenotrophic iron-reducing bacteria.

This present work highlights the capability of *Shewanella putrefaciens* to reduce biotic or abiotic magnetite (Fig. 1a) in the presence of H₂ under anoxic conditions at circum-neutral pH.

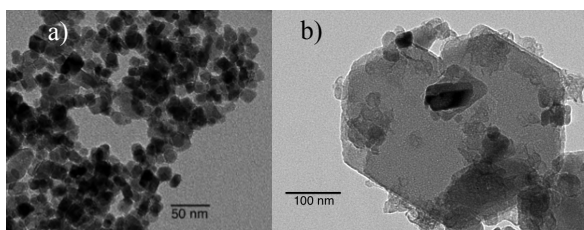


Figure 2: TEM images of nanoparticles of chemically synthesized magnetite (a) and green rust formed by iron-reducing activity in the presence of H₂ (b).

Depending on the conditions, *Shewanella putrefaciens* can reduce up to 30 % of Fe(III) into Fe(II) and leads to the formation of mixed Fe^{II}-Fe^{III} iron hydroxides : the green rust (Fig. 1b). Previous studies have already shown that magnetite could be reduced into siderite/vivianite by iron-reducing activity in the presence of organic electron donor [1], but it is the first time that the formation of green rust is reported by hydrogenotrophic iron-reducing activity.

[1] Dong *et al* (2000) *Chem. Geol.* **169**, 299-318