# Microbial Fe(III) Reduction Coupled to Oxidation of Formate: Formation of Magnetic Nanoparticles

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## Abstract

Microbial dissimilatory Fe(III) reduction in anaerobic environments is one of the most important processes in the geochemical iron cycle[1)]. Now bacteria are believed to be involved in the deposition of magnetite in marine and subsurface sediments[2),3)]. In an attempt to better understand Fe(III) reduction coupled to oxidation of organic matters in subsurface environments and to synthesize nanosized magnetic particles by microbes for latter application purpose, we isolated iron-reducing bacteria with using poorly crystalline Fe(III) oxyhydroxide as a sole electron acceptor that was chemically synthesized in laboratoty and lactate as an electron donor from ancient rock fragments of a tidal flat in Hae-Nam, Korea. Most of the isolated bacteria belonged to genus *Shewanella*. We used formate as a sole electron donor to make nanoscale magnetic particles from the Fe(III) oxyhydroxide as an electron acceptor4). The isolate utilized formate for the reduction of ferric iron to ferrous iron to form magnetite ($Fe_3O_4$) from poorly crystalline akaganeite (β-FeOOH). X-ray diffraction data showed the transformed minerals were magnetite. The average diameter of the biotransformed magnetite was about 30 nanometers in ferrofluids from the dynamic laser scattering spectral analysis and the shapes were spherical from the scanning electron microscopic analysis. And SQUID magnetometer showed strong superparamagnetism of the magnetite nanoparticles which is of interest for *in vivo* applications. Those characteristics of the magnetite nanoparticles can be applied to biomedicine such as magnetic-targeted drug delivery systems with more researches.

## References

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