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# Bioreductive deposition of noble metal nanoparticles on metal-reducing bacteria

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Microbial deposition of platinum nanoparticles was achieved at 25˚C and pH 7 using *Shewanella algae* with lactate as the electron donor. The microbial reduction of 1 mM $PtCl_6^{2-}$ ions was so fast that there was a 90% decrease in the aqueous platinum concentration within 60 min. Speciation of platinum in bacterial cultures of *S. algae* by X-ray Absorption Near-Edge Spectroscopy (XANES) showed that the tetravalent platinum ions were rapidly reduced to platinum metal in the bacterial cells. Transmission electron microscopy (TEM) of thin sections of *S. algae* cells revealed that the biogenic platinum nanoparticles of 5-10 nm were located in the periplasm.

Intracellular deposition of palladium nanoparticles was achieved at 25˚C and pH 7 using *Shewanella oneidensis* with lactate as the electron donor. The reductive deposition of palladium by *S. oneidensis* was a fast process: 1-5 mM $PdCl_4^{2-}$ ions were completely reduced to insoluble palladium within 60 min. High magnification TEM image shows biogenic palladium nanoparticles on the bacterial cells.