Metal-mining bacteria are green chemists

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Biosciences laboratory

Microbes could soon be used to convert metallic wastes into high-value catalysts for generating clean energy, say scientists from the University of Birmingham's School of Biosciences, writing in the September issue of Microbiology.

Researchers have discovered the mechanisms that allow the common soil bacterium Desulfovibrio desulfuricans to recover the precious metal palladium from industrial waste sources.

Palladium is one of the platinum group metals (PGMs) which are among the most precious resources on earth. They possess a wide variety of applications due to their exceptional chemical properties. PGMs are routinely used in many catalytic systems and are the active elements of autocatalytic converters that reduce greenhouse gas emissions.

Dr Kevin Deplanche, who led the study, explained why new ways of recovering PGMs are needed. 'These metals are a finite resource and this is reflected in their high market value,' he said. 'Over the last 10 years demand has consistently outstripped supply and so research into alternative ways of recovering palladium from secondary sources is paramount to ensuring future availability of this resource.'

Previous work in the team's lab showed that Desulfovibrio desulfuricans was able to reduce palladium in industrial wastes into metallic nanoparticles with biocatalytic activity. Now, the precise molecules involved in the reduction process have been identified. Hydrogenase enzymes located on the surface membrane of the bacterium carry out the reduction of palladium, which results in the accumulation of catalytic nanoparticles. The bacterial cells coated with palladium nanoparticles are known as 'BioPd.'

The group believes that BioPd has great potential to be used for generating clean energy. 'Research in our group has shown that BioPd is an excellent catalyst for the treatment of persistent pollutants, such as chromium, that is used in the paint industry. BioPd could even be used in a proton exchange fuel cell to make clean electricity from hydrogen,' said Dr Deplanche. 'Our ultimate aim is to develop a one-step technology that allows for the conversion of metallic wastes into high value catalysts for green chemistry and clean energy generation,' he said.