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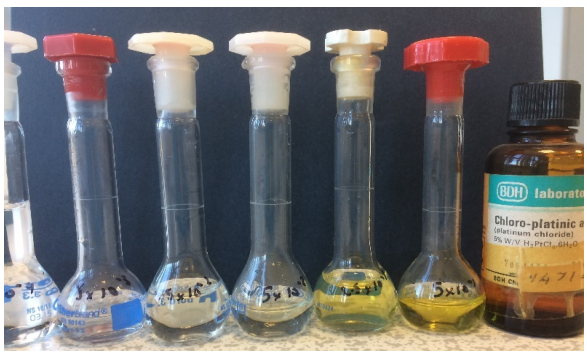
Metals IN BIOLOGY

Bioaccumulation of platinum from waste

"Finding an easier and cheaper way to reclaim of platinum which would otherwise be lost to the environment is important for global resource management." Helen Carney, Teesside University

Helen Carney and Caroline Orr, Teesside University; Frans Maathuis, University of York; Pattanathu Rahman, TeeGene Biotech

OUTCOMES: We tested several microbial species — *Shewanella algae, Pseudomonas aeruginosa, Bacillus megatherium*— that were suggested by the literature to have biosorption properties and so have the ability remove platinum from solution. Our studies showed that under the conditions tested, *S. algae* removed more platinum from a solution (hexachloroplatinic (IV) acid, see figure) than *P. aeruginosa* or *B. megaterium*. The optical density of the platinum solution was not reduced by *B. megaterium* and a reduction of only between 5.7% – 6.5% was observed with *P. aeruginosa.* However, a a 55% reduction was shown with *S. algae*. This work confirmed the findings of other studies that showed that *S.algae* could take-up platinum ions from solution. The results add to knowledge in an important area for waste management, since finding an easier and cheaper way to reclaim platinum that would otherwise be lost to the environment is important for global resource management. A logical next step to this work would be to determine the optimal conditions (salt concentrations, temperature, time) required by biosorbants to remove platinum from the two broad categories of waste – high volume, low concentration (e.g. sewage waste or mining waters) and low volume, high concentration (e.g. electroplating discharge). Additional work could consider the role of contaminants and whether uptake is passive or involves hydrogenase enzymes.



Dilutions of hexachloroplatinic (IV) acid prior to analysis. Darker solutions contain more platinum.

INITIAL AIMS: Platinum is a scarce metal, being one of the least abundant elements in the earth's crust and as such has a high material value. This research will focus on the recovery of platinum from wastewaters, where it is present as a soluble, ionic form. Platinum enters wastewater from a range of sources such as metal refining and chemical industries as well as hospital waste, where it can be found as a component of chemotherapy drugs. Bacteria can take-up and accumulate platinum using both active and passive methods, often referred to as biosorption and bioaccumulation respectively. This project, which is a collaboration between TeeGene Biotech, Teesside University and University of York, will investigate the potential of microbes to recover platinum from solutions, with the aim of recycling the recovered metal. The project aims to identify a suitable microbe that can be used in a waste refining process and identify any physicochemical factors that influence platinum recovery.

- **Ongoing business–academia relationship sustained via dissertation research**

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