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Chinese University Researcher to Command a Bacteria Legion against Water Pollution

"It could be as simple as stirring a pot of water for you to remove most of the heavy metal in the polluted water," said the senior lecturer from the Department of Biology of the Chinese University of Hong Kong, Dr Wong Po Keung. He is conducting a research project using bacterial cells to remove and recover nickel ions in effluent. The project was funded by an internal direct grant from CUHK, and won competitive funding of $500,000 and $540,000 from the Research Grants Council in 1988 and 1992 respectively.

Water pollution is a global problem, and is particularly serious in crowded cities such as Hong Kong, said Dr Wong. In general, water quality is threatened by the disposal of untreated human and animal waste into rivers and seas. Besides, industrial wastes also pose serious problems. Effluents from the electroplating industry carry large quantities of toxic heavy metals, with nickel as the most commonly occurring one. Nickel is discharged in the liquid as ions which is not degradable, but is easily absorbed by human being through the food chain (e.g. fish), according to Dr Wong who is concurrently associate director of the Centre for Environmental Studies. In fact, certain metals such as calcium and magnesium are essential for normal functioning of body cell. Some metals as nickel, however, if ingested would replace the normal metal inside the body, causing in the duplication of DNA a higher possibility of making mistakes, and would eventually result in gene mutations. Apart from this, nickel may pose hazards to the neural system.

The conventional technology for nickel recovery is chemical. Nickel ions are turned into nickel hydroxide with its precipitated sludge buried in landfills. However, it may seep from the landfill, creating further problem. Other means of treatment include the construction of sedimentation tanks for treatment of heavy metals which has been considered to be too costly.

A bioreactor with a three-step process developed by Dr. Wong has produced a breakthrough in solving the nickel problem: 1. bacteria adhere to magnetites, 2. nickel ions adhere to bacteria, 3. magnetites adhere to a strong magnet. Since nickel ions carry positive charges, it is very natural that it will adhere to the negative-charged bacteria. As the bacteria are less than 10^{-9} of a cm^3 in size, they are difficult to collect. So the positive-charged magnetite is used to attract or immobilize the bacteria. Finally, the magnetite can be separated from the effluent using a strong magnet - in much the same way as a toy magnet picks up metal paper clips.

"We've found out a bacterial cell which has a high affinity for nickel ions. Such a cell is very similar to *E.coli* and was found in the sludge near electroplating factories," said Dr. Wong, who has successfully built and tested a prototype laboratory-scale reactor with five litre capacity. It is found that the removal process could be very economic and efficient - with moderate stirring for about ten minutes.

"You just need to have the magnetite-immobilised bacterial cells and a large pot to remove the nickel. Such an unit could be established in all the small factories," Dr. Wong said. Design studies are in hand for scaling up to a 1,000 litres capacity reactor.

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Note to Editor:

Photos for pick up at Government Information Service.

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