October 2013
Thematic Issue 43
LIFE Projects

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Source: Satyawali, Y., Schols, E., Van Roy, S., *et al.* (2010). Stability investigations of zinc and cobalt precipitates immobilized by in situ bioprecipitation (ISBP) process. *Journal of Hazardous Materials*. 181: 217–225. DOI: 10.1016/j.jhazmat.2010.04.119.

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To cite this article/service: "Science for Environment Policy": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.

1. http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.createPage&s_ref=LIFE05%20ENV/B/000517&area=2&yr=2005&n_proj_id=2857&cfid=136396&cftoken=cf08e43e2395bc26-9CFB8288-9935-7D83-D78CB23BDE269874&mode=print&menu=false

Science for Environment Policy

Bacterial remediation of groundwater depends on environmental conditions

New low cost methods using bacteria to remove toxic metals from groundwater have been investigated using both actual contaminated groundwater and artificially controlled systems. Environmental conditions, such as changing levels of acidity or alkalinity, can have a significant effect on the removal of toxins, results show.

Contamination of soils and groundwater with toxic metals, such as lead and zinc, is now a global concern. It has been estimated that more than 60% of contaminated brownfield sites are polluted with these hazardous metals, which can then leach into local groundwater, presenting serious health risks. Most current remediation methods for polluted groundwater are based on pumping the water through a treatment facility. However, this is costly and impractical if the contamination is spread over a wide area, and the volumes of groundwater are large.

In this study, partly conducted under the LIFE project INSIMEP[1], researchers investigate low-cost *in situ* techniques which use bacteria to immobilise toxic metals and convert them into harmless solids (precipitates), which cannot dissolve into groundwater. These bacteria do not change the quantity of toxic metals, but can safely remove them from water.

One important aspect of the treatment is the stability of the precipitates produced by the bacteria under different environmental conditions. If stability is high, these metal compounds will not be able to revert to their former state, however, low stability could mean that toxic metals are able to dissolve back into the groundwater.

Researchers used two different systems, one artificially controlled and one natural, to examine the stability of precipitates. The artificially controlled system was a mix of sand, a source of carbon for bacterial growth, and water contaminated with specific concentrations of zinc. The natural system consisted of sediment and groundwater collected from three sites in Belgium that were known to be contaminated with both zinc and cobalt.

These solutions were then left for five to nine months, to allow the bacteria time to produce the precipitates. To examine the effect of environmental conditions on the stability of the precipitate compounds, researchers altered the pH of the solution to more or less acidic, and the availability of oxygen, both of which can affect the chemical reactions within the solution. In the natural system, the source of carbon for the bacteria, such as glycerol, soy oil or molasses, was also altered.

The results showed that stability of the precipitates was good regardless of the availability of oxygen. However, lowering the pH to 5 resulted in a significant loss of stability and resulted in 58% of zinc being released back into the groundwater. In natural systems, the source of carbon also had an effect on the stability of precipitates, however, this varied between contaminated sites. Researchers conclude that although such approaches are promising, bio-precipitation methods should be careful to take into account changing environmental conditions, such as pH, because this can substantially influence the outcome.