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Guest Editorial

Water Technologies at Johnson Matthey

In this issue the theme is water remediation. Johnson Matthey is working on a number of high technology purification products for applications in the water industry. We are focusing our research and development efforts on creating technology to remove a range of low level toxic contaminants, such as mercury, from water.

Johnson Matthey is known for its expertise in adsorbent materials, such as Smopex®, with which readers of this journal may be familiar for their use in the recovery of precious metals from both waste and product streams (1, 2). In 2013 the company acquired further advanced ion exchange technology from Purity Systems Inc, forming the company's Water Technologies business. This combination of technology fits well with Johnson Matthey's core competences in advanced materials and catalysts. We place particular emphasis on some key challenges facing the mining and chemicals industries, where problem contaminants, increasing legislative requirements and focus on environmental and cost issues often mean current technologies are being stretched.

Providing Effective Solutions

The need for clean water is of major significance across the world, with growing populations requiring access to improved quality water resources. Environmental legislation and regulation mean that there is increasing need to clean up effluents from industrial processes such as mining, agriculture and manufacturing. Pollutants including metals, non-metals and organic compounds may be present due to either man-made or natural processes.

An example of such a pollutant, selenium, is discussed in the article by Mac Namara *et al*. in the present issue of the *Johnson Matthey Technology Review* (3). In this article the performance and mechanisms of a new material based on the Smopex® range of ion exchange materials is described for Se remediation in effluents from coal combustion plants and oil refineries. A common co-contaminant is sulfur which poses significant problems for previous generations of ion exchangers, although the technique of ion exchange offers attractive benefits over existing technologies (whether chemical or biological) which all have disadvantages in terms of high cost or high volumes of materials required. Strong-base functionalised materials were identified by Johnson Matthey as being the most promising candidates for selective sorption of selenium ions and the article presents results and fundamental studies on these materials showing promising results in both fixed bed and continuous stirred tank reactor trials.

Gold mining is another area which suffers from the presence of water soluble pollutants, in this case species of the heavy metal mercury which is frequently associated with gold in ore deposits. The health and

From mining to molecules – Johnson Matthey's innovative processes and advanced scavenger technologies, built on and underpinned by continuous research and development, can help recover valuable metals and purify active pharmaceutical ingredients environmental implications of mercury are well-known, however it is a major challenge to remove the mercury from the gold processing circuit; technical difficulties also exist since the most widely used method for extracting gold, employing cyanide as lixiviant, also extracts mercury and other metals along with the gold. It is therefore essential to identify a method that will remove only the mercury; any loss of gold during the process is deemed unacceptable. Johnson Matthey has now developed solid adsorbents which can achieve selective adsorption of mercury from gold cyanide bearing process streams and the technique is described in detail in this issue of the journal (4). Testing of the material in real process feeds is described and a pilot plant trial is now underway in Nevada, USA.

A Collaborative Approach

Johnson Matthey is always open to new collaborative efforts to solve problems for our customers. One such collaboration is with Professor Edward Rosenberg, University of Montana, USA. He develops advanced silica polyamine composite materials for metal ion separations and recovery from industrial and mining waste streams. Most recently these materials are being applied for uranium remediation with the University of the Witwatersrand in South Africa, and a forthcoming article in this journal is expected to present some further details on this project.

It is worth noting that many techniques based on naturally occurring substances, bioremediation and even waste products are in use for removing heavy metals from water – but more technically advanced materials are required for heavy metal contamination arising from high technology industries in developed countries. For example, ion exchange is the go-to technology in the USA, where it constitutes a multi-billion dollar a year market. The technique of ion exchange shows great promise to help remediate wastewater streams around the world and provide safer, cleaner water for greater numbers of people than ever before.

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