Bioelectrical Approach for Controlling Mineral Formation in Landfill Leachates

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Bioelectrochemical systems (BES), in which solid electrodes serve as either electron donor or acceptor for microbial metabolism, enjoy potential applications ranging from treatment of agricultural and chemical waste to generating power for remote sensing devices [1]. We examine the applicability of a three-electrode BES for controlling the fate and transport of iron and arsenic at landfills where these redox-reactive metals are dissolved and mobilized from minerals in subsurface sediments by metal-reducing bacteria (Albrectsen and Christensen, 1994).

Recent research demonstrates that electrode surfaces can support iron-oxidizing bacteria by serving as the sole source of electrons in lieu of Fe(II) (Summers, *et al*, 2013). Our research uses a similar approach, with the exception that electrodes buried below grade serve as anodes to stimulate the oxidation of Fe(II) under fully anaerobic conditions. Controlling these reactions using this method avoids the formation of iron and perhaps arsenic-bearing minerals at the surface where they may threaten wildlife and domestic drinking water sources. Moreover, this method may serve to concentrate iron and arsenic and reduce the overall volume of problematic leachates by converting the anode into a cathode and allowing iron-reducing bacteria to use freshly precipitated iron oxides as electron acceptors. The resulting small volume of water containing high iron and arsenic concentrations can then be collected for offsite treatment or disposal.

[1] Rabaey, K. *et al* (2007) *ISME J.,* vol. **1**, pp. 9-18 [2]Albrechtsen, H. J. and T. H. Christensen. (1994). *Appl. Environ. Microbiol.,* vol. **60**, no. 11, pp. 3920-3925, [3]Summers, Z. M. *et al* (2013) *mBio*, vol. **4**, no. 1, pp. 1-4,