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Monitoring biogeochemical changes in the subsurface

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The enormous influence that microorganisms have on biogeochemical cycling of minerals is well established. One intriguing aspect of microbial/mineral interactions is the ability of many microorganisms to derive energy for growth through chemical interactions with inorganic compounds. Especially interesting is the ability of some microorganisms to transfer electrons directly to soluble metal oxides or even solid phase minerals. These microbial processes provide technical opportunities for monitoring the subsurface. For instance, chemical changes in the subsurface brought about by microbe/metal transformations can alter subsurface conductivity which can be detected through impedance techniques. Collaborators from the Savannah River National Lab. and Oklahoma State Univ. are developing techniques that correlate impedance parameters to specific biogeochemical processes in order to evaluate subsurface biogeochemical dynamics, especially related to bioremediation and contaminant detection. Another approach to subsurface monitoring involves the incorporation of metal oxide reducing bacteria into electrodes for nutrient detection and quantification. This work is being done in conjunction with collaborators at the University of South Carolina/Aiken. The technique involves the conversion of microbial metabolic activity into an electric current that can be used to quantify and track nutrient concentrations at various locations in the subsurface. Electrogenic bacteria immobilized onto anode materials are being used to provide reliable and repeatable results without the dependence of the formation of a bacterial biofilm for nutrient detection in-situ. These techniques offer potential for less expensive and more comprehensive strategies for monitoring in-situ biogeochemical changes than are currently in practice.

Biography

Charles Turick received his Ph.D. from the University of New Hampshire and is a Science Fellow in the Biotechnology Department of the Savannah River National Laboratory, a U.S. Department of Energy facility. His research involves microbial ecology and physiology for bioremediation strategies and energy production. Academic service includes adjunct professor in the Biosystems Engineering Department and the Biology Department of Clemson University. He has authored numerous peer-reviewed publications and holds four patents in biochemical engineering and environmental microbiology. Dr. Turick's research interests include mechanisms of electron transfer from microorganisms to inorganic compounds, including soluble metals, solid phase metal-oxides and electrodes.

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