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SUNDAY AFTERNOON

New Applications of Solid Phase Adsorbents

E. Rosenberg, *Organizer*

ABSTRACTS

IEC 5

Adsorbent materials for CO_2 capture from dilute gas streams

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Separation and sequestration of anthropogenic CO_2 from power plant flue gas or other dilute sources is a rapidly expanding research area due to the growing consensus that anthropogenic CO_2 is contributing to global climate change. In this talk, the currently available adsorbent materials for CO_2 capture will be reviewed and technical challenges will be highlighted. Among the various classes of CO_2 adsorbents, the development of new organic-inorganic hybrid materials specifically designed for CO_2 capture applications will be discussed in detail. In particular, we describe the development in our laboratory of new adsorbents referred to as hyperbranched aminosilica materials, specifically focusing on synthesis-structure relationships and the utility of the structurally varied sorbents for CO_2 capture from dilute gas streams.

IEC 6

Functional sorbents for metal capture in biological samples: Toward metal biomonitoring and chelation therapies

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Two classes of sorbent materials, functionalized magnetic iron oxide nanoparticles and functionalized mesoporous silica, have been developed at PNNL for effective capture of toxic metals ranging from heavy metals, transition metals, actinides, and lanthanides. By virtue of their high surface area and chemically selective functionality even in biological matrices, the materials have been successfully evaluated as preconcentration materials at electrochemical sensors and for chelation therapies. This presentation includes the example use of the sorbent materials in detecting of metals (Cu, Cd, Pb, Ag) in natural waters and urine. It also includes their feasible use as oral drugs for limiting gut absorption of heavy metals (As, Cd, Pb, Hg, Tl) and cesium (Cs). Lastly, their potential use in hemoperfusion of rare earth metals (U, Th, Am, Pu, Gd) and in sorbent dialysis of Gd chelates (used in contrast MRI, and recently linked to a fetal skin disease, Nephrogenic Systemic Fibrosis, NSF) will be presented. Sponsors: NIEHS (R21 ES015620), NIAID (R01 AI074064), NIOSH (R21 OH008900) and LDRD.

IEC 7

New applications of AnaLig® for solid phase extraction

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New applications for AnaLig®, a solid phase extraction material, will be presented. AnaLig® is used for laboratory sample preparation to remove interferents or concentrate analytes. The SPE technique is valuable in a number of industrial and analytical applications. This presentation will provide a general overview of recent applications of the technology. The following examples will be covered: (1) automated pre-treatment of industrial wastewater and soil extract samples to determine speciation of Cr(III) and Cr(VI); (2) Pb isotopic analysis of geochemical samples; (3) determination of dissolved iron (III) in complex matrices containing organic ligands; (4) determination of trace levels

of Pb in electroless nickel plating solutions; use of ICP-AES to determine the concentration of trace levels of Pb in natural waters and in high-matrix plating solutions; (5) highly selective platinum group metals separations; (6) analysis of strontium and cesium in radioactive waste solutions; and (7) analysis of radium and strontium using AnaLig® disc formats.

IEC 8

Dendrimer-conjugated magnetic nanoparticles for heavy metal removal

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Dendrimers are novel nanostructure materials that possess a unique three dimensional molecular configuration. They have been known as a superior sorbent with high capacities of heavy metals. A combination of dendrimer adsorption with the ultrafiltration has been developed for heavy metal removal from wastewater. From the application point of view, however, the use of membrane technologies for the separation of dendrimers from the effluent is still rather costly. Dendrimer-conjugated magnetic nanoparticles (DMNP) have been developed as high capacity materials of heavy metal adsorption with an easy separation property. In addition, the dendrimer itself can serve as a well dispersant capable of stabilizing nanoparticles in the aqueous system. Batch tests indicated that DMNP effectively adsorbed various heavy metals including zinc, copper and arsenic from water. The adsorption capacity of zinc is about 24 mg/g. Desorption of heavy metals is readily achieved by adjusting pH conditions. DMNP is reusable and durable.