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Οδός Σταδίου, Πλατάνι, Πάτρα
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ΣΕΜΙΝΑΡΙΟ

ΟΜΙΛΗΤΗΣ: Professor Robert S. Bowman
Department of Earth and Environmental Science
New Mexico Institute of Mining and Technology
Socorro, New Mexico USA

ΘΕΜΑ: ***APPLICATIONS OF SURFACTANT-MODIFIED ZEOLITES TO ENVIRONMENTAL REMEDIATION***

ΤΟΠΟΣ: Αίθουσα Σεμιναρίων ΕΙΧΗΜΥΘ-ΙΤΕ

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ΠΕΡΙΛΗΨΗ

Natural zeolites are characterized by high specific surface areas and high cation exchange capacities. Zeolite surface chemistry is profoundly altered by adsorption of cationic surfactants (quaternary amines.) The resultant surfactant-modified zeolite (SMZ) is capable of simultaneous adsorption of cations, anions, and nonpolar organic molecules from water. Its versatile adsorption properties and low cost (about 450 Euro per cubic meter) make SMZ suitable for various environmental applications.
We tested SMZ at the pilot scale as a subsurface permeable barrier material. In a two-month test with a mixed chromate/perchloroethylene (PCE) contaminant plume, the SMZ permeable barrier performed according to predictions based on laboratory experiments. The adsorptive properties of SMZ can be combined with other technologies to provide simultaneous adsorption and destruction of environmental contaminants. Zeolites can be pre-loaded with nutrients such as ammonium, potassium, phosphate, and trace elements. We tested the microbial degradation of toluene (a common component of fuels and hence a common groundwater contaminant) using nutrient-amended, surfactant-modified zeolite (N-SMZ) as the microbial support, and found that the N-SMZ provided a slow-release nutrient medium for the toluene-degrading microbes. The results suggest that a toluene-degrading culture could be nurtured on a bed of N-SMZ for aboveground or in situ applications. Conditions can be optimized for biological degradation of other organic contaminants as well. SMZ can be combined with reactive metals such as zero-valent iron (ZVI) to adsorb and chemically transform toxic oxyanions and chlorinated solvents. We have shown that SMZ/ZVI pellets rapidly remove chromate and PCE from water and had higher chemical reduction rates than ZVI alone. Results from laboratory and pilot tests suggest that SMZ/ZVI barriers may provide superior hydraulic and chemical properties for destruction of groundwater contaminants.

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Τηλ.: 0610-965.278, Fax: 0610-965.223, E-mail: kleanthi@iceht.forth.gr