The UK Superfund Research Center

Nutrition and Superfund Chemical Toxicity

The UK Superfund Research Center supports biomedical and environmental science research to improve health by preventing exposures to environmental pollutants and promoting healthful lifestyles.

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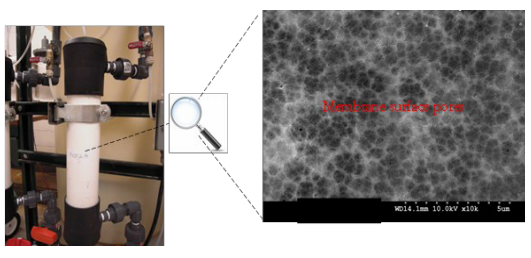
Chloro-Organic Degradation by Polymer Membrane Immobilized Iron-Based Particle Systems

The contamination of groundwater aquifers and soil in various Superfund sites by toxic chlorinated organic compounds, e.g., polychlorinated biphenyls (PCBs) and trichloroethylene (TCE) continues to be a pervasive problem preventing use of these potentially potable sources for drinking water. Despite decades of cleanup efforts, these types of organic compounds continue to be Superfund contaminants of national concern due to their high toxicity, persistence, and wide spread occurrence in the environment. Of the 14 active National Priority List sites in Kentucky, 6 are contaminated with either PCBs or TCE, including the Paducah Gaseous Diffusion Plant. The development of technologies based on the use of non-toxic chemicals and the integration of well-established polymer membrane technologies is expected to bring solutions to remediate toxic organics.

Chlorine containing organics, such as TCE (used as degreasing solvents and even in dry cleaning) and PCB (used in transformers) are known to have high toxicity. Oxidative and reductive detoxification techniques can be used either separately or in tandem to break down these pollutants by utilizing reactive iron nanoparticles. Researchers with the University of Kentucky Superfund Research Center are currently working to overcome the obstacles of nanoparticle-based pollutant degradation by integrating particles in high-throughput membranes to provide an elegant solution for remediation. This approach not only prevents clumping of particles but also eliminates particle release. UK researchers are also working with a membrane manufacturing company (Nanostone Water) to make full scale membrane filters (see picture) containing iron particles. These membranes can be rolled up (in spiral form) and placed in plastic pipes through which contaminated groundwater can then be pumped and cleaned before being pumped back into the groundwater or released to a nearby stream.



Take Home Message:

Nanoparticle-immobilized membrane systems can provide a fast, cost-effective method for pollutant degradation.

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