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.

Project Contacts:

J. Zach Hilt, Ph.D.
Project Leader
College of Engineering
Xach.hilt@uky.edu
859-257-9844

Thomas Dziubla, Ph.D.
Co-Project Leader
College of Engineering
thomas.dziubla@uky.edu
859-257-4063

Trainees:
Rohit Bhandari, Ph.D.
rohit.bhandari@uky.edu

Angela Gutiérrez
amgu232@g.uky.edu

Irfan Ahmad, M.S.
Irfan.ahmad@uky.edu

Prachi Gupta
pgu225@uky.edu

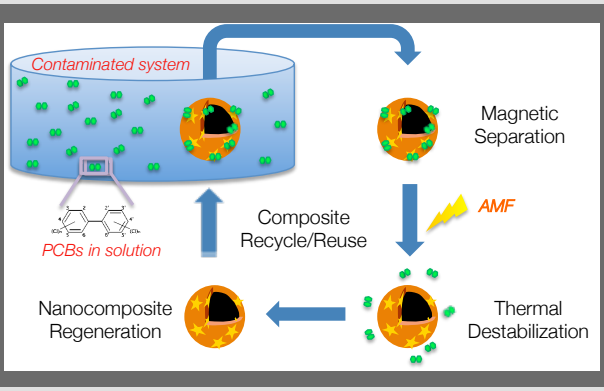
Shuo Tang
shuo.tang@uky.edu

Biomimetic Magnetic Nanocomposites as a Platform Technology for the Capture and Sensing of PCBs

Despite a production ban in 1979 and decades of remediation efforts, polychlorinated biphenyls (PCBs) remain a persistent environmental contaminant. Their continued presence in the environment has resulted in multiple potential human exposure routes, e.g., soil, riverbeds, groundwater and milk. Gas chromatography mass spectrometry (GC-MS) remains the current standard for sensitivity and specificity in detecting PCBs in the environment. However, GC-MS requires intricate, time-consuming extraction and sample purification techniques. Alternatively, affinity-based methods typically require less processing and can even be coupled to remediation strategies for a single-step purification process, but current technologies also have limitations. There remains a need for a stable system that selectively binds and captures PCBs for sensing and remediation technologies.

We hypothesize that synthetic, biomimetic PCB binding domains can be synthesized by incorporating phenolic and related moieties into polymeric coatings on magnetic nanoparticles, which can greatly enhance the ability to detect and remove/remediate PCB contamination. Polyphenols (e.g., plant derived flavonoids) and related chemistries offer an intriguing precursor for creating biomimetic affinity domains. Recently, we developed a novel strategy to synthesize polymeric networks that incorporate phenolic moieties, and in preliminary studies, we showed that PCB binding was increased through the incorporation of phenolic moieties in our polymeric coatings.

The overall goal of this project is to develop a magnetic nanocomposite platform that allows for the selective capture of PCB congeners with a range of affinities and selectivities.



Take Home Message:

Current pollutant remediation and sensing techniques are inefficient and may create toxic byproducts. This work seeks to create Green and cost-effective methods for capture, sensing, and remediation of pollutants.

The UK Superfund Research Center
900 S. Limestone Street • Lexington, KY 40536
Phone: 859-218-1343 • www.uky.edu/Research/Superfund/

NIEHS Grant Number:
P42ES007380