Antibody-based Chemical Sensor Development at VIMS: Basic and Applied Research

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Objectives

The overall goal of this proposal is to validate a new field deployable sensor technology for differentiating and quantifying specific petrogenic PAH’s from pyrogenic PAHs in aquatic systems. This will provide water quality managers, as well as environmental monitoring and compliance officer’s access to real-time data, allowing knowledge-based decisions.
Sensor Development & Validation: Basic and Applied Research

Using real time chemical analyses to answer difficult questions for science and environmental management

**Elizabeth River: The ideal PAH study site**

Can We Differentiate Contaminant Sources?
Develop New Antibodies

Oil, Creosote, Groundwater, Stormwater Runoff
PAH’s in the Elizabeth River, VA

Creosote and Oil- Sources for Polycyclic Aromatic Hydrocarbons (PAH)

Unsubstituted PAH Common in Samples from Pyrogenic Sources

- Naphthalene
- Anthracene
- Phenanthrene
- Pyrene
- Chrysene
- Benzo[j]fluoranthene
- Benzo[a]pyrene

Examples of Alkyl Substituted PAH Common in Petroleum

- 1,3-Dimethyl-naphthalene
- 1,3,5-Trimethyl-naphthalene
- 2,6-Dimethyl-phenanthrene
- 2,3,7-Trimethyl-phenanthrene
- 2,3-Dimethyl pyrene
PAH induced liver lesions and cancer in *Fundulus heteroclitus*

Where PAH are high
Tumors are high
Money Point: ERP site targeted for sediment remediation
ERP: THE GOO MUST GO!

First voluntary sediment remediation project in Virginia

Many people are watching!

Dredging in E. River: Are PAH released? Can we define any PAH plume?

PAH in sediment

Fish tumors
June 9, 2009 Dredging begins!

VIMS uses the biosensor to monitor dissolved PAH
Data reported to shore by cell phone
Money Point sampling (during dredging) – 9 June 09

3-5 ring dissolved PAH

Correlation between Biosensor and Chemistry-determined PAH concentrations

\[ y = 1.1109x + 0.1206 \]

\[ R^2 = 0.9977 \]

na = not available (yet)
Money Point sampling (after dredging) – 24 June 09

3-5 ring dissolved PAH
Industry and Agency Partners

Potential end users of sensor technology are interested

Atlantic Wood Industries, Inc.
Comparison of PAH in Water Soluble Fractions
Creosote vs Oil Sources

Comparison of PAH in Elizabeth River Sediments
Atlantic Wood vs. Money Point

Future goals:
New antibodies to distinguish PAH sources
Target compounds?
Multi-compound/antibody analysis

Two ring and alkylated antibodies under development