DEVELOPMENT OF A PORTABLE PETROLEUM BY-PRODUCT CHEMICAL (HYDROCARBON) SENSOR, NYSDOT SPR RESEARCH PROJECT C-02-08

PROJECT DESCRIPTION: Petroleum-contaminated soil and groundwater are the most common contaminants encountered by transportation agencies, and the New York State Dept. of Transportation spends over $1 million each year to identify and dispose of petroleum-contaminated soil while building and maintaining New York’s roads and bridges. Traditional contaminant screening relies on imprecise field instruments such as photoionization detectors (PIDs), or the slower but more exact use of off-site laboratories for chemical analysis. This project will explore the development of chemical sensors based on nanoparticles embedded in a polymer matrix for the sensitive and selective detection of hydrocarbons in a field instrument.

PROJECT OBJECTIVES:
• Develop an optical fluorescence and chemiresistor based detection system with nanoparticles acting as the sensitizing agents.
• Tailor semiconductor nanoparticles bound to both metal and chalcogen surface sites that respond with unique changes in electron configuration after exposure to various hydrocarbons.

• Modify the surface of selected quantum dots (QDs) using various ligands such as those shown in the diagram above to form π-complexes with the capability to discriminate between contaminant species.
• Test and calibrate the chemiresistors to determine the optimal geometry of the array for detecting target compounds at concentrations ranging from less than one microgram per kilogram (part per billion) to 1,000 grams per kilogram (part per million).
• Use thin-walled capillary tubing packed with sorbents as standard pre concentrators for the target compounds to increase the selective detection of contaminant compounds.

DURATION: 12 months; Anticipated start date - March 2004

TOTAL FUNDING: $150,000

RESEARCH GROUP: State University of New York at Albany

NYSDOT PROJECT MANAGER: Jeanne Hewitt, Environmental Analysis Bureau