Licensing Opportunity

Ultra-sensitive Detection of Environmental Contaminants and biologically important molecules Using Coated Quantum Dots

Advantages
- Efficient, consistent and inexpensive methods for reagent generation
- Effectively detects heavy metals, explosives, and biological samples up to parts per trillion level
- Innovative sensing mechanism
- Reagents can be functionalized to selectively interact with specific contaminants

Invention
Methods and apparatus for efficiently generating the reagents (quantum dots with a partial and/or fully semi-conducting outer shell for the selective detection of several substances) and the optical system for detecting said substances.

Background
The rise of industry has provided humanity with numerous benefits. Unfortunately, harmful byproducts often result from these advancements. For example, heavy metals such as lead, arsenic and mercury are often introduced into air and groundwater via coal-burning plants and other industrial facilities. Harmful chemical contaminants in explosives including TNT, picric acid, and peroxides, find their way into the environment through construction and military uses. Finding new methods and devices for detecting even lower concentrations of these harmful contaminants is critical to life safety.

Research scientists from UCF and University of Florida have developed a novel method of environmental contaminant detection. The method is capable of sensing the presence of harmful substances up to parts per trillion (ppt) levels. The method utilizes functionalized quantum dots (semiconductor luminescent nanocrystals) which have been coated with a variety of semiconducting shells. These quantum dots have shown strong sensitivity in laboratory testing when exposed to a wide variety of heavy metals, peroxides and amino acids. The quantum dots absorb and emit light at a very specific wavelength (absorbance and emission spectra). The emission spectra show unique changes based on the specific substance the quantum dots are exposed to and the concentration of that substance. This change is easily detectable and highly reproducible. In material samples or environments where multiple substances are potentially present, a mixture of quantum dots with different shells could be used. Since contaminants bind to the quantum dots directly, the reagents could additionally be used for the removal and remediation of said substances.

Application
Functionalized quantum dots can be utilized for the detection of heavy metals, explosive nitro compounds, reactive oxygen species, and amino acids. The technology may be of particular interest to the EPA, homeland security, medical industry and environmental remediation organizations for the detection and removal of contaminants.

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Selected References

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