

**Mercury Speciation Using Piezoresistive Microcantilever Array Sensors**  
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Mercury contamination is a significant environmental problem, as mercury and its compounds are implicated in a huge range of both acute and long-term health effects. Alkyl mercury compounds, and methylmercury in particular, are of particular concern, as they are water soluble, acutely toxic, and can be concentrated in predator organisms. As part of a multi-faceted research program to study the production, transport, and demethylation of methylmercury, this research represents the development of a high-throughput sensing system that can be used to monitor the rise and fall of methylmercury levels in microbial samples. Most existing methods for the determination of alkylmercury, and methylmercury in particular, require the collection of samples followed by analysis in a laboratory. Some of the most sensitive methods used for the determination of methylmercury involve a chromatographic separation followed by cold vapor atomic emission spectroscopy, while other established methods include GC, GC-MS, and voltammetric electroanalytical techniques.

A recently proposed sensing system uses a microcantilever functionalized with a selective coating. Microcantilever sensors have been shown to be effective sensors for a wide variety of analytes in the gas and liquid phase. Microcantilever sensors operate on the principle that a chemical interaction that is confined to one side of the cantilever will result in a differential stress, which can be measured using a variety of methods, including optical and piezoresistive methods. Using piezoresistance as a method to measure the deflection of a microcantilever beam has many advantages. Perhaps the most important practical advantage is that it is miniature. This permits the detector to be part of a very compact device, and also allows large numbers of cantilevers to be used in arrays for high-throughput applications. Other advantages include simple electronics for readout and low cost.

Work has been done towards developing a high-throughput sensor system for the detection and speciation of alkylmercury compounds. A piezoresistive microcantilever sensor array platform is used, as it can be easily multiplexed to afford the capability to do multiple simultaneous analyses. Piezoresistive microcantilevers were functionalized with 1,6 hexanedithiol self assembled monolayers and used to detect methylmercury in milliliter volume aqueous samples using flow injection. Adsorbed methylmercury resulted in a stress change on the cantilever beam with a limit of detection of 1ng/mL. Experiments are presently underway to improve selectivity and sensitivity of cantilever based detection.