Aptazyme-coated Microcantilevers for the Detection of Lead Ions

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Microcantilevers are a revolutionary sensor platform with tremendous potential for device miniaturization and ligand selectivity and sensitivity. Cantilevers have been used to detect a variety of molecular interactions, for example, DNA-DNA, antibody-antigen, enzymatic reactions, and ion trapping assays (*1-4*). Selectivity of the sensing layer is the defining parameter for development of any chemical or biological sensor. Recent efforts in molecular biology have focused on the development of highly selective oligonucleotide molecules called aptamers and aptazymes. Aptamers and aptazymes are DNA and DNA/RNA oligomers, respectively, that have been selected (via SELEX technology) for high specificity and affinity to a particular ligand. In the case of aptazymes, binding of a ligand to the specific aptazyme initiates a molecular reaction, for example polymerization or cleavage. In this study, we examine the detection of lead (Pb) ions using aptazyme-coated microcantilevers. Binding of lead ions to the specific aptazyme initiates cleavage of the oligonucleotide strand(s). Microcantilevers were coated with an aptazyme specific for lead (Pb) ions (*5*). Cantilevers were exposed to solution lead concentrations ranging from 10^{-4} M to 10^{-9} M and optical deflection was monitored. Cleavage of the oligonucleotide due to ion binding was also verified using fluorescence labeling. The presence of 10 nM lead in solution was readily detected and this value compares well with currently used technology. We envision the use of microcantilever arrays for the sensitive detection of a wide variety of ligands, limited only by the development of selective aptamer and aptazyme coatings.

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