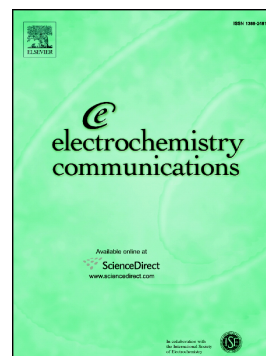


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## Heavy metal ion detection on a microspot electrode using an optical electrochemical probe

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### Abstract

Electrochemical sensors can be used to create portable, attractive, high-sensitivity devices to detect heavy ions in water at a reasonable cost. A novel method of measuring local redox on an electrode using the differential reflectivity measured on an approximately 6 micron diameter spot using a He/Ne laser beam is described. Field focusing and electrode modification enhance the sensitivity, making the method ideal for miniaturization and multiplexing multiple analytes on a monolith electrode. The method is demonstrated by detecting Pb, Hg, and As ions at ppb and ppt levels.

**Keywords:** Heavy metals; electrochemical analysis; electrode size; dielectrophoretic effect; water pollution; electro-optics

### 1. Introduction

With ever-decreasing sources of water for the growing world population, the search for new sources and need to recycle water have made the issue of heavy metal ion contamination a ubiquitous problem and intensified the need for new detection systems, in terms of sensitivity, specificity, and portability. Toxicity of heavy metal ions is well documented [1-3] with several toxic metals, such as As, Cd, Pb, and Hg, having no known biological function [4]. Heavy metal ions are toxic to the reproductive organs of females [5] and males [6], and some are also carcinogens [7]. Concentrations of Pb, Hg, and As at ppb levels in a normal human body pose serious health hazards, such as plumbism, hypertension, emphysema and even cancer, with chronic, irreversible damage to organs such as kidneys, skeletal muscles, and soft tissues [8]. Highly sophisticated methods, such as inductively coupled plasma–mass spectroscopy (ICP–

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