NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE
School of Electrical and Electronic Engineering

COEB PHOTONICS
COEB - Centre for OptoElectronics and Biophotonics

Trace-level heavy metal ion screening using surface functionalized tapered optical fiber-based sensor

Overview

Heavy metal toxicity happened when metal ions tend to bio-accumulate over time and the accumulation rate is faster than human body excretion rate. Heavy metals pose serious health threat even at trace-level concentration.

Solution

A portable heavy metal ion sensor using surface functionalized tapered optical fiber (TOF) was developed for on-site water quality screening. The TOF was functionalized with chelating agent such as EDTA that is highly specific to the targeted metal ion.

Experimental Arrangement

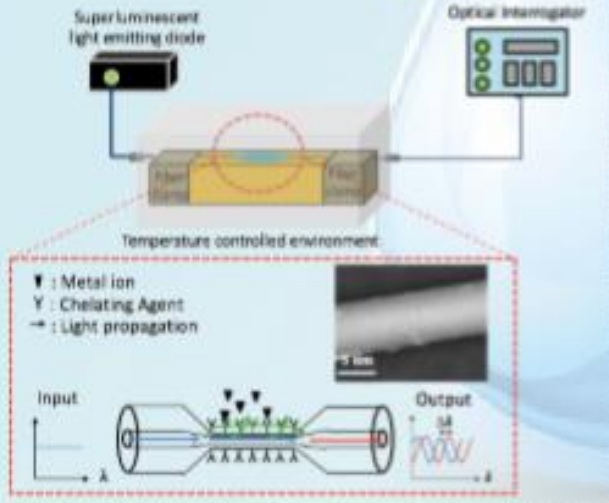

Figure 1: Experimental setup and sensing mechanism of the TOF-based heavy metal ion sensor. Inset shows SEM image of the EDTA-functionalized TOF with bright metallic nanodots that appear to be cadmium ions being trapped on the TOF surface. The amount of wavelength shift, $\Delta\lambda$, shown in the output spectrum is proportional to the measured heavy metal ion concentration

Product Development

Technical Specifications

Limit of detection	Pb^{2+}: 5µg/L Cd^{2+}: 10µg/L Cu^{2+}: 10µg/L
Resolution	5µg/L
Types of detectable metal ion	Up to 24 types of metal ion (e.g. Zn^{2+}, Ar^{2+}, Fe^{2+} etc.)
Sample volume	Less than 1ml
Measurement time	~ 4.5 minutes
Power consumption	5V / 0.6A (rechargeable battery)
Dimension (L x B x H)	203 x 149.5 x 65 mm^3
Weight	0.9 kg
Others	Mobile app available

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