Meetings International SciTechnol

J Pharm Sci Emerg Drugs 2018, Volume: 6
DOI: 10.4172/2380-9477-C6-021

INTERNATIONAL MICROFLUIDICS CONGRESS
&
International Conference on
ADDICTION RESEARCH AND THERAPY

August 13-14, 2018
San Diego, USA

A portable microfluidic sensor for quantification of environmental sulfide with polydimethylsiloxane membrane pervaporated sampling and fluorescence detection

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A portable microfluidic sulfides sensor was developed with a near 100 % recovery rate (RSD=0.86%; n=3 for 0.1 mg•L^{-1}). The sensor is based on in situ pervaporative sample pretreatment chip in which a ca. 4-μm gas-permeable polydimethylsiloxane membrane intercalated in both acid-base donor/acceptor solution channel and it quarantines the produced H2S from redox interferences such as oxygen and sulfite in the samples. The pervaporated H2S gas was across the membrane and recovered to sulfide ions in the acceptor stream and online derivatizatized with N,N-dimethyl-p-phenylene diamine in the presence of dichromate ion in a 4 mol•L^{-1} HCl medium to produce fluorescent methylene blue, and sulfides were determined by produced fluorescence intensity of methylene blue at λem=682 nm (λex=660 nm). A sodium bicarbonate solution was introduced into the sample stream as a chemical pressure regulator. Under the optimized conditions, the sensor allows for rapid and precise determination of aqueous sulfide in a concentration range of 5 to 100 μmol•L^{-1} (R=0.9992), with the detection limit of 0.23 μg•L^{-1}.

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