WATER POLLUTANTS DETECTION AND QUANTIFICATION USING A LIQUID JET WAVEGUIDE SENSOR

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Experimental methods based on autofluorescence detection in combination with an UV excitation offer the possibility to detect a very wide range of organic compounds ranging from polycyclic hydrocarbons [1] to bacterial cells [2]. Autofluorescence offers several advantages over conventional methods, such as no need for reagents or sample preparation and continuous online monitoring (particularly useful in early warning system). In this work, we apply a system based on a high speed liquid jet to detect water pollutants by means of UV fluorescence. Water jets, acting as an optical waveguide, only recently have been proposed for spectroscopic application and the working principle has been tested [3]. Using a self-aligned configuration, the liquid jet, that acts at the same time as optical waveguide and as the solution to analyze, is directly coupled with a multimode optical fiber collecting the fluorescence towards the detection system.
Experimental measurements have been performed on water solutions containing typical water contaminants as aromatic hydrocarbons or bacteria showing low limit of detection (LOD).
Measurements results on aqueous solutions of o-xylene and naphtalene demonstrate the sensor's ability to perform contaminant analyses showing an LOD of 28 and 2.2 ppb respectively.
Bacterial cell detection and quantification have been performed on water solutions containing Bacillus subtilis in different concentrations. The interest in this micro-organisms is related to their properties as antrax simulant. Experimental measurements shows an LOD of $1.7x10^4$ bacteria/ml, this value is competitive also if compared to results obtained considering different detection approaches.

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