

Rapid screening and identification of illicit drugs by IR absorption spectroscopy and gas chromatography

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ABSTRACT

Analytical instruments based on IR Absorption Spectroscopy (IRAS) and Gas Chromatography (GC) are today available only as bench-top instrumentation for forensic labs and bulk analysis. Within the 'DIRAC' project funded by the European Commission, we are developing an advanced portable sensor, that combines miniaturized GC as its key chemical separation tool, and IRAS in a Hollow Fiber (HF) as its key analytical tool, to detect and recognize illicit drugs and key precursors, as bulk and as traces. The HF-IRAS module essentially consists of a broadly tunable External Cavity (EC) Quantum Cascade Laser (QCL), thermo-electrically cooled MCT detectors, and an infrared hollow fiber at controlled temperature. The hollow fiber works as a miniaturized gas cell, that can be connected to the output of the GC column with minimal dead volumes. Indeed, the module has been coupled to GC columns of different internal diameter and stationary phase, and with a Vapour Phase Pre-concentrator (VPC) that selectively traps target chemicals from the air. The presentation will report the results of tests made with amphetamines and precursors, as pure substances, mixtures, and solutions. It will show that the sensor is capable of analyzing all the chemicals of interest, with limits of detection ranging from a few nanograms to about 100-200 ng. Furthermore, it is suitable to deal with vapours directly trapped from the headspace of a vessel, and with salts treated in a basic solution. When coupled to FAST GC columns, the module can analyze multi-components mixes in less than 5 minutes.

Keywords: IR Absorption Spectroscopy, Gas Chromatography, External Cavity Quantum Cascade Laser.

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