Portable Membrane Inlet Mass Spectrometer for Illegal Human Migration Detection

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Border security and defence worldwide faces tremendous challenges due to threats from terrorism and/or national/transnational criminal organizations. More specifically during the last few decades, a continuous increase of transportation of illicit substances and weapons as well as illegal human trafficking has been noticed and is of particular concern. Human body odor chemical fingerprints are parts of an innovative and demanding research field. They are of interest in homeland security and forensics applications as well as for medical applications to aid diagnosis and provide sources of medical information.

This study demonstrates the use of a portable membrane inlet mass spectrometer (MIMS) for the detection of Volatile Organic Compound (VOC) emissions from human body in a confined space. In our experiments the confined space used was a small size shipping container simulator. The tests ran under reproducible conditions for over a month and were done both for single man and three man-participants. Different types of membranes were tested to examine their selectivity. During the tests, VOCs with masses in the range 1-200amu from human breath, sweat, skin and body glands were emitted into the simulator ambient air and constantly monitored. The observed VOCs can be used as characteristic markers (alarms) of human presence. Components such as NH_3, CO_2, CO, water, acetone, isoprene, carboxylic acids and many hydrocarbons were detected and their relative abundances were recorded, resulting in characteristic chemical profiles for human presence.

Airports, ports and land borders are harsh and demanding environments facing a wide range of security issues. Onsite MIMS could potentially be used to provide accurate and fast detection of hidden personnel at border checkpoints and in shipping containers of cargo services.