Rapid detection of cocaine in fingerprints using ambient mass spectrometry

Fingerprint residues, commonly referred to as fingerprints, are the result of an accumulation of sweat at the fingertips which is transferred to any surface upon contact. The composition of the fingerprint residue is therefore dependant on the composition of the sweat, which is a result of natural bodily functions, diet, health state and habits. For example, if a person administers drugs of abuse, the body will break down the drugs into smaller and water soluble chemicals (known as metabolites). These metabolites will mainly be eliminated from the body through urine and sweat. Consequently, these metabolites (and the drugs) are expected to be found in fingerprint residues.

The use of fingerprint residues for drugs of abuse testing is a developing area in the fields of analytical and forensic chemistry. The non-invasive nature of the fingerprint collection procedure is an attractive feature compared with blood, urine and saliva, which require trained staff and present a potential biological hazard. Developments in this area have often been associated with the application of mass spectrometry methods which enable the measurement of the mass of single molecules and atoms under ambient conditions. Desorption Electrospray Ionisation – Mass Spectrometry (DESI-MS) is an ambient mass spectrometry method that can be used for rapid screening of samples in air. The analysis produces a mass spectrum, which shows the distribution of the molecules detected with their respective abundances. The mass of the drugs and metabolites of interest can be calculated based on their chemical formula. Peaks corresponding to the drugs and metabolites of interest will be observed in the mass spectrum if these are present in the sample.. The assignment is then confirmed by breaking down the suspected mass under controlled conditions – known as fragmentation. Each molecule fragments in a specific pattern which can be used for identification and confirmation.

For this project, fingerprints were collected from drug users at a drug & alcohol service and analysed using DESI-MS. Both the drug (cocaine) and the metabolites (benzoylecgonine and methylecgonine) were detected in the fingerprints. These patients also tested positive for cocaine in their saliva screening test (an established method for drug testing). This shows the potential of both DESI-MS and the application of fingerprints for drug testing purposes. The detection of the metabolites is crucial in this context because it confirms that the drug was ingested and excreted by the body rather than being picked up by contact with a contaminated surface (bank notes, for example).

The development of a fast and cost effective method will have many prospective applications such as police road-side testing, rehabilitation centres and workplace screening.

Publication

Rapid detection of cocaine, benzoylecgonine and methylecgonine in fingerprints using surface mass spectrometry.

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Analyst. 2015 Sep 21