The Use of Raman Spectroscopy to Profile Seized Ecstasy Tablets

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AIMS: The use of Raman spectroscopy with near infrared excitation (785 nm) applied to the analysis of ecstasy tablets is well documented. High sample throughput is essential if a technique is to be useful for operational analysis and intelligence gathering applications. Clandestine laboratory seizures often comprise several hundred thousand tablets and composition analysis of active drug and excipient components is required. The aim of this work was to determine if Raman spectroscopy could be used to distinguish between batches of tablets containing chemically similar ring-substituted phenethylamines and multiple excipients, to give useful composition profiles for drug intelligence work. Ecstasy tablets, seized from clandestine laboratory raids, were obtained from the Federal Police in Belgium.

METHODS: The tablet was mounted on a microscope slide and placed under the microscope for Raman spectral collection using a Renishaw Raman Microscope equipped with a 785 nm laser. Typically, the laser was line focused onto the sample enabling collection of a series of line images. Spectra were collected from three areas (top, middle and bottom) on the tablet to maximise the total area sampled and to compare any similarities and or differences across the tablet. The total analysis time per tablet was 15 minutes. Reference standard spectra were collected for comparison.

RESULTS: The spectral similarities between MDMA, MDA and MDE when present as a mixture make it difficult to assign the presence of a particular drug. This is compounded by the crude methodology used to manufacture the tablets, resulting in the presence of multiple derivatives rather than MDMA itself, which is typically sought. Additionally, the smearing effect of the tablet casting machines may amalgamate the particles further complicating the spectral representation. Consequently, the phenethylamine derivatives peak positions were averaged to facilitate comparison with the identified excipients. Interestingly the disparities in peak positions identified in the phenethylamine derivatives were not observed with the excipients (glucose, sucrose, cellulose and sorbitol). It is thought this might be related to the quality control in production of these by licensed manufacturers.

Analysing three areas per tablet and averaging the peak position and peak intensity data gives representative data that can be used to compare tablets within a batch and between batches. The tablets showed variability in the phenethylamine derivatives and excipients across the batches but also revealed trends within the sub-batches.

CONCLUSIONS: Overall this study has shown that ecstasy tablet composition profiling can be undertaken with some degree of success using Raman spectroscopy. Whilst it is not possible to specifically identify the phenethylamine present, using averages of the responses collated from multiple areas on the tablet and comparing these to the excipients can still produce useful data for comparison within batches and between batches. Analysis can be undertaken with virtually no sample preparation with higher throughput than traditional methods.

Keywords: Raman spectroscopy, Ecstasy, Profiling