Characterisation of chemical waste from illegal amphetamine synthesis to support forensic assessment of clandestine drug laboratories

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Introduction

1.3 million (1%) young adults (15 - 34) have used amphetamine-type-stimulants in Europe during 2015.[1] Clandestine production of amphetamine takes place mainly in Belgium, the Netherlands, Poland and the Baltic States but also in Germany.[2] 6.7 tonnes of amphetamine were seized in the EU (2013) and more than half of it was accounted for by Germany, the United Kingdom and the Netherlands.[1] One of the most common synthesis approaches for amphetamine is the Leuckart method. Large quantities of potentially hazardous chemicals like solvents, acids and bases are used for this synthesis. Aqueous synthesis waste is often disposed into the environment or the sewage system. This disposal can have serious environmental impacts[3] but can also aid forensic investigations. In order to use waste discharge for scale and frequency estimation of a production during a forensic investigation, it is important to characterise it first.

Methods

Aims

- Controlled amphetamine synthesis and characterisation of aqueous waste
- Measurement of pH and conductivity
- Determination of key compounds in synthesis waste using SPE and GC/MS
- Determination of solubility of key compounds in pure water using HPLC/DAD
- Quantification of ions in aqueous synthesis waste using CE/CAD

Results

- Key compounds were benzyl methyl ketone (BMK), N-formylamphetamine (APAAN), N-formylamphetamine-N-methyl (N-FA), amphetamine (AMP) and 4-methyl-5-phenylpyrimidin-4-one (4M5PP)
- These five compounds were chosen because they either showed a high signal intensity and/or were present in wastes from different steps (see table below)
- BMK and AMP were difficult to separate but mass spectra allowed for differentiation
- Identification of peaks was done by comparing the mass spectra with our database

Conclusion

- Controlled amphetamine synthesis following the Leuckart route was conducted
- pH and conductivity measurements were performed showing highly conductive and strongly alkaline or acidic behaviour
- Aqueous waste samples were prepared by SPE and methanolic extracts were measured directly by GC/MS
- Key compounds were: benzyl methyl ketone, N-formylamphetamine-N-methyl, amphetamine and 4-methyl-5-phenylpyrimidin-4-one (4M5PP)
- Solubilities of key compounds using a HPLC/DAD method would be found to be between <1 and 18 g/L
- Ions found were ammonium, sulphate, chloride, sodium and formate with concentrations from 0.03 - 6.2 mol/L
- Results could be used to support forensic investigations in case aqueous synthesis waste is available as evidence

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