Quantification of cocaine and benzoylecgonine in wastewater by gas chromatography-mass spectrometry: mapping cocaine abuse in the Belgian university city of Leuven.

DIETER WAUMANS, STEVEN PAUWELS, NOËL BRUNEEL and JAN TYTGAT

Laboratory of Toxicology, Campus Gasthuisberg, O&N2, Herestraat 49, P.O. Box 922, B-3000 Leuven,Belgium

AIMS: After we demonstrated the presence of cocaine (COC) and its metabolite benzoylecgonine (BE) in untreated wastewater of the Belgian city of Brussels (circa one million inhabitants), we were interested whether it would be possible to detect COC (and BE) in the wastewater of smaller cities as well. We selected Leuven, a small university town with a proportionally large number of students and also the hometown of our laboratory.

METHODS: Wastewater was collected from Aquafin's water treatment plant in Leuven. The water (1L) was filtered over a Nalgene filter after prefiltration over celite. Extraction of the target compounds from the filtrate was effected via solid phase extraction (Oasis MCX cartridges). The sample thus obtained was derivatized with BSTFA/TMCS and analyzed by gas chromatography-mass spectrometry (GC/MS) operating in the selected ion monitoring (SIM) mode and using deuterated standards (cocaine-d3 (COC-d3) and benzoylecgonine-d3 (BE-d3)) for quantification.
GC-MS: Agilent 6890 GC coupled to Agilent 5973N mass selective detector (MSD), using a Varian EZ-Guard VF-5MS FactorFour capillary column (30.0 m × 0.25 mm × 0.25 um + 5 m guard column) and helium as carrier gas (1 mL/min). Temperature programming: 50°C (hold 1 min), rise to 200°C at 35°C/min and subsequently further increased to 270°C at 10°C/min. (hold 10 min). MSD: 1106 + 200 eV (electron impact). SIM: 182 (COC), 185 (COC-d3), 240 (BE.TMS), 243 (BE.TMS-d3).

RESULTS: Calibration curves (0-1000 ng/L) for COC and BE exhibited correlation coefficients 0.9988 and 0.9946, respectively. The recovery was more than 90% for both compounds. Usage estimation: The water treatment plant collects the sewage of 108000 people. The amount of COC/day is estimated from the influent flow and the concentration of BE, keeping in mind that circa 45% of COC is excreted as BE by humans. A dose is considered 100 mg (4 lines of 25 mg).

Date	COC (ng/L)	BE (ng/L)	FLOW (m^3/day)	COC/day (g)	doses/day
Th 13/04	123	529	30020	37,0	370
We 03/05	163	761	25628	45,4	454
Th 04/05	70	495	25584	29,5	295
Mo 08/05	78	559	25800	33,6	336
Fr 12/05	112	950	27500	60,9	609

DA-p-17

CONCLUSION: Our results indicate that the analysis of wastewater via GC/MS is a viable technique for monitoring cocaine abuse. A large number of doses/day has been calculated for water collected on Friday, which may correspond with Thursday evening being a favourite student party time in Leuven. It is estimated that 0.3-0.6% (1.0-1.8% aged 15-34) of the people connected to the Leuven water treatment plant are cocaine users.

KEYWORDS: *cocaine, benzoylecgonine, GC/MS*

Corresponding author: jan.tytgat@pharm.kuleuven.be