

# **AUTOMATED ANALYSIS OF ILLICIT DRUGS AND METABOLITES IN WATER ALONG THE EBRO RIVER BASIN: OCCURRENCE IN THE ENVIRONMENT AND ESTIMATION OF CONSUMPTION PATTERNS**

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The present work describes the development and application of the first fully automated on-line solid phase extraction-liquid chromatography-tandem mass spectrometry (SPE-LC-MS/MS) method described in the literature for analysis of drugs of abuse in waste and surface water. Compounds measured, seventeen in total, belong to the classes of amphetamines and methamphetamines, cannabinoids, cocaine, opiates, LSD, and their metabolites. The main advantages of the method developed are (i) full automation, (ii) fairly high throughput (analysis time per sample is 2×35 min.), (iii) low sample volume requirements (10 mL), which facilitate sample preservation and storage, (iv) minimum sample manipulation, limited to filtration and addition of surrogate standards, (v) high sensitivity (limits of determination between 0.69 and 5.97 ng/L), (vi) good repeatability (relative standard deviations usually below 14%), and (vii) high selectivity and reliability of results (4 identification points).

This method has been used to estimate the patterns of consumption of drugs of abuse in seven of the most populated riverine cities along the Ebro river basin (Miranda de Ebro, Logroño, Pamplona, Tudela, Zaragoza, Lleida and Tortosa) in October 2007. Although several surface water samples were collected from the Ebro River and some other tributaries, consumption estimation is based on the concentrations detected in the sewage water influents of the sampled sewage treatment plants (STP) giving service to these cities, as other data required to do the estimate, such as data about the population served by each STP, the STPs inlet flow rate, and the drugs excretion rates, are well known. The results obtained indicate that cocaine is the most consumed drugs of abuse, followed by ephedrine and amphetamine. The doses/day/1000 inhabitants of cocaine vary between 1.6 (Logroño) and 16 (Lleida).

The potential risk of these emergent contaminants in the aquatic environment derives directly from their good elimination by the STPs; therefore, the removal efficiency of these compounds in the investigated STPs has been as well addressed. In the light of the results, average elimination of cocaine in STPs reaches 94 %, whereas negative values are occasionally obtained for other compounds, such as ecstasy. Concentrations in the receiving river waters are much lower than in influent waste water (by 1 to 3 orders of magnitude, maximum detected concentration 158 ng/L of benzoylecgonine (BE), the main cocaine metabolite, in the Huerva river, tributary of the Ebro river).

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