Geographic information systems to stablish the distribution of drugs of abuse in the Turia River and ecotoxicological assessment

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The aim of this study establishes the influence and the effects of the human pressure in a typical Mediterranean River Basin as Turia River to establish accurately the point sources of contamination and its types, through an environmental forensics methodology. Forty-two phychoactive substances were analysed in surface water samples collected from 35 sampling sites distributed along the river for 2 consequtive years. Analysis of the target drugs was performed following a previously method based on solid phase extraction and liquid chromatography coupled mass spectrometry (SPE-LC-MS/MS). To determine spatial incidence of phychoactive substances, analytical results of target compounds were georeferenced and integrated into a geographical information systems (GIS) together with tabular data, GIS layers and fieldwork. Ecotoxicological risk of drugs of abuse detected in the Turia River was evaluated in this study by calculating risk quotient (RQ).

According to their occurrence, phychoactive substances can be clasified in three groups: (i) Drugs detected only in one sampling point. In 2012, 3,4-methylenedioxymethamphetamine (MDMA) and 4-methoxyphencyclidine (4-MeO-PCP) were detected at a concentration of 22.8 and 37.6 ng/L, respectively. In 2013, 4-MeO-PCP was detected in a different sampling point of 2012 at a concentration of 7.55 ng/L and ecgonine methyl ester (ECME) was detected at a concentration of 15.03 ng/L. (ii) Drugs detected only in a few sampling points. Bufotenine (BUF), methadone (MET) and para-methoxyamphetamine (PMA) were found out in 3 or 4 sampling points at concentrations <70 ng/L in 2012. Ephedrine (EPH) and codeine (COD) were detected in 3 sampling point at average concentrations of 11.6 ng/L for EPH and 91.3 ng/L for COD in 2013. (iii) Drugs detected in more than 5 sampling points. The compound more detected along the river was benzoylecgonine (BECG), a cocaine metabolite, with an average concentration of 25.4 (2.91 – 76.8) ng/L in 2012. In 2013, MDMA was detected in 5 sampling points (mean of 4.67 ng/L, ranged from 2.34 to 7.21 ng/L) and BECG and MET were detected in a total of 8 and 7 sampling points, respectively, each one at a mean concentration of 14.02 (1.83 – 12.7) ng/L for BECG and 11.4 (2.29 – 401) ng/L for MET.

The distribution of these compounds along the river, provided by GIS, shows that the highest concentrations and frequency of phsychoactive substances run into places with the highest population density. The RQ obtained from measured concentrations of detected drugs predict that no short-term environmental risk might be expected. Further research in surface waters is needed to establish relationships with human pressure in a river basin.