

Pharmaceuticals in the Ebro river basin: Occurrence and distribution between aqueous and solid phase

Damia Barcelo^{1,2}, Bianca Ferreira da Silva¹, Aleksandra Jelic¹, Rebeca Lopez¹, Mira Petrovic^{1,3}

¹ Department of Environmental Chemistry, IDAEA-CSIC, Jordi Girona, 18-26, 08034 Barcelona, Spain Phone: +34-(93)-400 6100

E-mail: dbcqam@cid.csic.es

² Catalan Institute for Water Research (ICRA), Parc Científic i Tecnològic de la Universitat de Girona, Edifici Jaume Casademont, 17003 Girona, Spain

³ Catalan Institution for Research and Advance Studies (ICREA), Passeig Lluís Companys 23, 08010 Barcelona, Spain

Introduction: Thousands of tones of pharmacologically active substances are annually used in human medicine for treatment and/or prevention of illnesses. Pharmaceuticals residues in the environment and their potential toxic effects have already been recognized as an emerging research area in environmental chemistry. A better knowledge of the occurrence and fate of pharmaceuticals release to the environment will attain a proper risk assessment for river basins, wetlands and other related ecosystems. Concerning the pharmaceuticals market, Spain has raised its position over the recent years. Such high consumption may lead to the conclusion that the problematic associated with the aquatic contamination by pharmaceuticals may be an important issue that needs to be assessed and, since data regarding contamination of Spanish aquatic systems is still sparse, it is necessary to set up surveys at national or basin scale. In the light of these concerns, the aim of the study was to identify the loads of pharmaceuticals discharged into the Ebro river through municipal wastewater effluents and to study their distribution between different phases, i.e. water and sediment.

Methods: The sampling of the sediment and the river water samples was done at 25 points along the river Ebro basin (North-East of Spain), and the effluent water was collected from 6 wastewater treatment plants (WWTP) that discharge the water into the Ebro river. The occurrence of 73 pharmaceuticals of major consumption was determined in effluent and river water, and in sediment along the basin. Target compounds included major analgesics, anti-inflammatory drugs, antibiotics, β -blockers, antihistaminics, lipid regulators etc. To extract target compounds from solid samples pressurized liquid extraction (PLE) followed by SPE clean up is used, while separation and detection is done using high performance liquid chromatography coupled to a hybrid triple quadrupole – linear ion trap mass spectrometer (HPLC-QqLIT- MS/MS).

Results: The obtained results showed presence of 32 compounds in effluent waters in concentrations ranging from low ng/L to a few $\mu\text{g/L}$ (e.g. some anti-inflammatory drugs), while in the river water samples concentrations were typically lower than 100 ng/L due to significant dilution factors.

In sediment samples 25 pharmaceuticals were detected in ng/g concentrations. Calculations regarding the distribution between aqueous and solid phase as well as regarding elimination during wastewater treatment were made and discussed.

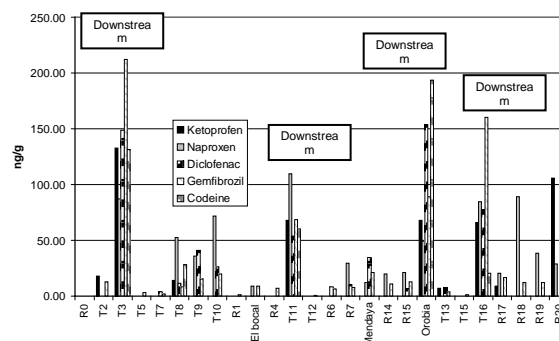


Figure 1. Example of occurrence of several pharmaceuticals in sediment samples

Acknowledgments. The work was financially supported by the Spanish Ministry of Education and Science, project CEMAGUA (CGL2007-64551/HID) and Consolider-Ingenio 2010 project SCARCE [CSD2009-00065].