

## ANALYSIS AND REMOVAL OF PHARMACEUTICAL COMPOUNDS IN WASTEWATER TREATMENT PLANTS

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The presence of pharmaceutically active substances in the environment has aroused lots of concern within the scientific community, since little is still known about the possible eco-toxicological effects that their presence may cause to human health as well as non-target organisms. For this reason, it is important to set up analytical methodologies that enable an exhaustive characterization of what are the pharmaceuticals detected in both waste and surface waters and at what concentrations levels. Many studies have demonstrated that urban wastewaters are hot-spots for aquatic contamination by pharmaceuticals, since conventional wastewater treatments are not able to efficiently remove some of these substances, and consequently, they are able to enter surface and drinking waters.

This work reports on a comprehensive surveillance of 72 multiple-class pharmaceuticals in three Wastewater Treatment Plant (WWTP) located in Catalonia (North-East of Spain), covering different sampling periods. In order to assess the possible contribution of WWTP in surface water contamination by pharmaceuticals, the efficiency of the treatments applied in each plant was studied by calculating the removal rates for each pharmaceutical studied.

The analytical method used was based on off-line-solid phase extraction (SPE) followed by liquid chromatography-tandem mass spectrometry, using a hybrid quadrupole-linear ion trap (QqLIT) equipment.

The results confirmed a widespread occurrence of the pharmaceuticals studied, detecting pharmaceuticals at concentrations ranging from high ng/L to low µg/L levels. Compounds more frequently detected in both influent and effluent wastewaters were the analgesics and anti-inflammatories ibuprofen, ketoprofen, paracetamol, codeine and naproxen, the lipid regulators bezafibrate, gemfibrozil and atorvastatin, the antiepileptic carbamazepine, the antidepressant lorazepam, the antibiotics ofloxacin, ciprofloxacin, sulfamethoxazol, sulfamethazine, trimethoprim, clarithromycin and metronidazole, the β-blockers atenolol, metoprolol and propranolol, the antihypertensives enalapril and hydrochlorothiazide, the antidiuretic glibenclamide and the Histamine H<sub>2</sub> receptor antagonists ranitidine, cimetidine and famotidine.

The wide spectrum of substances and levels detected confirm that conventional treatments applied in the three WWTP cannot efficiently remove pharmaceuticals from wastewaters. Removal rates showed that analgesics and anti-inflammatories are eliminated in a high percentage (around 90%), but the other therapeutic groups presented lower rates, with average values of 60%, except the antidepressants and carbamazepine, which showed either poor or no elimination.

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