



# Occurrence and seasonal variation of pharmaceutical compounds from four therapeutical classes in the influents of two Portuguese wastewater treatment plants

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Pharmaceutical compounds (PhCs) are one of the major classes of emerging contaminants due to their intrinsic biological activity. Their presence, even in trace concentrations, raise the possibility of causing adverse effects on both aquatic ecosystems and humans due to chronic exposure [1].

Although the occurrence of PhCs in the urban water cycle has been extensively studied, the understanding of the effects of conventional wastewater treatment processes on PhCs removal is still scarce. Wastewater treatment plants (WWTPs) are crucial barriers against PhCs, with their efficiency depending of several factors such as contaminants psychochemical properties, climate conditions, technology, operational conditions and contaminants concentration in the raw influents (WWI) [2;3]. Therefore, a detailed characterization of WWIs load is important and mandatory towards improving WWTP efficiency.

In this work, a SPE-LC-MS/MS method was optimized and validated for the measurement of 24 PhCs (10 therapeutical classes) in WWIs from two Portuguese WWTPs: Beirolas and Faro Nw. A total of 41 sampling campaigns were performed between September 2016 and July 2018 (2 years).

These two WWTPs showed similar concentration PhCs profile, being the most representative therapeutical classes analgesics (acetaminophen, APAP), psychostimulants (caffeine, CAF), NSAIDs (diclofenac, DCF, ibuprofen, IBUP, and naproxen, NPX) and antibiotics (erythromycin, ERT, sulfadiazine, SDZ, sulfapyridine, SPD, and sulfamethoxazole, SMX). Based on these results, these therapeutical classes were the main focus of this work.

Regarding seasonal behavior in Beirolas WWIs, median concentrations varied between 1.6 µg/L (antibiotics, winter 2017) and 87.2 µg/L (analgesics, winter 2018). Seasonal variations were observed in analgesics (APAP), antibiotics (mainly due to SDZ) and, in less extent, NSAIDs (mainly IBUP), particularly in autumn and winter seasons. Regarding Faro Nw WWIs, median concentrations varied between 0.95 µg/L (antibiotics, spring 2018) and 78.3 µg/L (analgesics, winter 2018). Seasonal behavior was subtler in Faro Nw, possibly due to milder climate conditions, and the variations were observed in analgesics (APAP) and, in less extent, antibiotics. For both WWIs, psychostimulants showed no clear seasonal variations.

Overall, this approach enables a more comprehensive overview of PhCs profile in WWIs, and, consequently, giving relevant information towards improving the WWTPs removal efficiency.

**Keywords:** wastewater influents; pharmaceutical compounds; seasonal behavior; SPE-LC-MS/MS

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