

## **Fate and risk of pharmaceuticals and illicit drugs in the Iberian river basins of Ebro and Llobregat: Challenges and Solutions using advanced treatment technologies.**

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Occurrence of emerging contaminants in environmental waters is directly related to their removal in wastewater treatment plants (WWTP) and the flow rate of the receiving waters. Mediterranean rivers are characterized by important fluctuations in the flow rates and heavy contamination pressures from extensive urban, industrial and agricultural activities. This translates in contamination levels most often higher than in other European basins. For instance, the Llobregat river basin (Catalonia, NE Spain) suffers from extreme and frequent flow ( $1\text{--}100\text{ m}^3\text{ s}^{-1}$ ) fluctuations and receives the effluent discharges of more than 55 waste water treatment plants (WWTPs), and at some points, especially in drought periods, the effluents may represent almost 100% of the total flow of the river. Thus, it is not strange to find considerably high levels of organic contaminants along the river and increasing concentrations when moving downstream due to the also increasing number of WWTPs and population pressure. Besides conventional contaminants such as pesticides, Hg, organochlorine compounds, polycyclic aromatic hydrocarbons (PAHs), alkylphenols and polybrominated diphenyl ethers (PBDEs), emerging contaminants (pharmaceuticals and personal care products and illicit drugs) represent an overgrowing portion of trace organic contaminants of concern in these two rivers (Ebro and Llobregat).

This presentation summarizes the findings of several studies and monitoring programmes conducted with the aim of getting a better insight about the sources and fate of pharmaceuticals and illicit drugs in NE Spain. The presence of pharmaceutically active compounds and illicit drugs is discussed in relationship to their removal in WWTPs, influence of hydrological conditions in the receiving river waters, sediments and dilution factors. The risk posed by these emerging contaminants in both surface and effluent wastewaters was assessed towards different aquatic organisms (algae, daphnids and fish) by determining the hazard indexes.

Advanced treatment technologies such a pilot-scale membrane bioreactor (MBR) and photocatalytic treatment are being investigated for the removal of selected pharmaceuticals such as acetaminophen and atenolol and the illicit drugs cocaine and methadone. Finally, the identification of major intermediate products produced using different advanced technologies as well as the toxicity evaluation will also be shown in this presentation.