Drugs of abuse (DAs) are a group of emerging microcontaminants present in the water cycle as a consequence of their widespread consumption and poor elimination in water treatment plants. New cost-effective technologies must be implemented to avoid environmental impact and drinking water contamination. Our objective was to assess mesoporous Fe-based catalyst and H₂O₂ concentrations on a heterogeneous photo-Fenton system for drug elimination in complex natural fluvial water (Catalá et al. 2015 Science of the Total Environment 520: 198-205).

Table 1. Natural river waters (RW) are micropolluted with drugs of abuse discharged by sewage and are toxic in the development of plants (Figure 1), inducing a reduction of mitochondrial activity. Treatment plants are not able to completely eliminate them. ALCs: alkaloids, LODec: limit of determination, LSD: hygroscopic acid.

Table 2. Incomplete photo-Fenton. Photolysis (UV) eliminates most chemicals analysed. The catalyst Fe (Fe₂⁺ concentration g/L) causes negative efficiencies by the reversion to parent species of non-analysed metabolites present in complex natural waters regardless of loading. Neither treatment eliminates plant development sub-chronic toxicity (Figure 1).

Table 3. Macroscopic characterization of treated river water samples show high mineralization with all treatments.

Table 4. Efficiency of photo-Fenton in the elimination of drugs of abuse from natural river water with (A) 0.1 and (B) 0.6 g/L Fe catalyst loading at different percentages of stoichiometric H₂O₂ concentrations regarding TOC (13%, 50% and 100%). All treatments achieve an excellent performance in the elimination of the analysed chemical species.

Bioassays are mandatory to confirm water treatment efficacy

- Photo-Fenton reactions eliminate drugs of abuse in natural fluvial water.
- High chemical degradation does not ensure toxicity elimination.
- Catalyst loading is critical for an efficient toxicity elimination.
- Natural waters are extremely complex and unexpected events such as reversion to parent compound can occur.