

ADVANCED OXIDATIVE TREATMENT FOR WASTE WATER CONTAMINATED BY PHARMACEUTICAL PRODUCTS.

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Summary

The pharmaceutical products (PPs) are introduced into the environment by domestic or hospital waste waters and they are currently poorly removed by classical biological waste water treatment plants. Yield of removal is about 20 to 50% depending on molecules polarity and hydrophobicity. Thanks to better sensibility of detection methods, traces of these PPs have been found in waste waters, source waters and even in drinking waters. The European directive called ‘the Directive cadre eau” added in July 2013 three pharmaceutical compounds (Diclofenac, 17 alpha ethinyl estradiol and 17 beta oestradiol) and in March 2015 six pharmaceutical compounds (2,6-ditert-butyl-4-methylphenol, 4-methoxycinnamate, erythromycine, clarithromycine, azithromycine and Methiocarbe) to the list of the 33 priority substances.

In the case of decontamination of waste waters, the use of (i) ozone which increases the amount of free radicals (OH^\cdot and O^*) in water, and of (ii) heterogeneous photocatalysis illuminated under UV light which involves pollutants adsorption on the photocatalyst surface and the oxidative degradation of these adsorbed pollutants, ideally into CO_2 , H_2O and other products resulting from complete oxidation, is a promising solution. The most frequently used photocatalyst is titanium oxide, TiO_2 , which is a semiconductor sensitive to UV light.

The objective of this project is to determine operational processes for advanced oxidative treatment of waste waters contaminated with PPs. This is a finishing physico-chemical process that has to be placed after a classical biological treatment in existing waste water treatment plants (domestic, industrial or hospital).

In this project, TiO₂ photocatalysts are in the shape of a transparent thin film deposited on a glass support by dip-coating from a liquid sol-gel solution (before the gelation point). Compared to the conventional processes for the preparation of thin films, the sol-gel process requires less equipment and thus it is potentially less expensive. Furthermore, in this project, aqueous sol-gel syntheses are promoted in order to decrease the nocive influences of organic solvents and TiO₂ is doped with different agents to increase the efficiency of TiO₂.

Advanced oxidative treatments are performed on a pilot scaled reactor combining Ozone and UV photocatalytic treatments and treating about 200 liters per hour of water polluted with different PPs.

Waters toxicity are evaluated before and after ozonation + UV photocatalytic treatments with daphnies according to ISO Standards.

Looking for partners

- SME active in
 - waste water treatment
 - sol gel surface coating
 - TiO₂ production
- Research Centres or Universities specialized in
 - waste water treatment
 - sol gel surface coating
 - TiO₂ production