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ADVANCED OXIDATION PROCESSES (AOPs): INTERESTING SOLUTIONS FOR THE DEGRADATION OF EMERGING CONTAMINANTS IN REAL LIQUID PHASES

L. Foti, G. Bianco, S.A. Bufo, L. Scrano

Università degli Studi della Basilicata, Potenza, Italy

Wastewater, as a result of the anthropic and industrial activities, contains many recalcitrant organic compounds such as pesticides, pharmaceuticals, surfactants, colouring matters and endocrine disrupting chemicals. In particular, the PPCPs (Pharmaceutical and Personal Care Products) have been detected in surface, ground and in drinking waters. Prolonged exposure over time of these substances, at low concentrations, can cause:

- allergies;
- development of antibiotic-resistance (antibiotics);
- effects on the endocrine system (hormone-acting drugs);
- cytolytic or cytostatic effects (antitumoral drugs).

All these represent a big problem for the health and for the environment, and are linked to the modern lifestyle [1]. People use many chemical-based products every day, which remain (as original or transformed compounds) in wastewater because the treatment plants (WWTP) were not designed to take out these chemicals. After that, these compounds end up in all liquid phases (lakes, rivers, sea) causing the problems described above.
Advanced oxidation processes (AOPs) have been proved as innovative and promising alternative route for the treatment of wastewater to destroy many kind of emerging pollutants [2].
This study examines the photocatalytic activity of titanium dioxide (TiO_2) towards removal of persistent organic pollutants (POPs) from water. Fluoroquinolones and benzodiazepines, antibiotics and psychoactive drugs respectively, commonly prescribed and used, have been selected as the object of study.
Two experiments were carried out using (i) TiO_2 as dispersed powder, and (ii) TiO_2 immobilized on borosilicate tubes (Figure 1). A cooled solar simulator equipped with a xenon lamp with 1,500 W total power, 500 W/m^2 irradiance, in the wavelength range 290-800 nm at 25°C constant temperature was used for sample irradiation.

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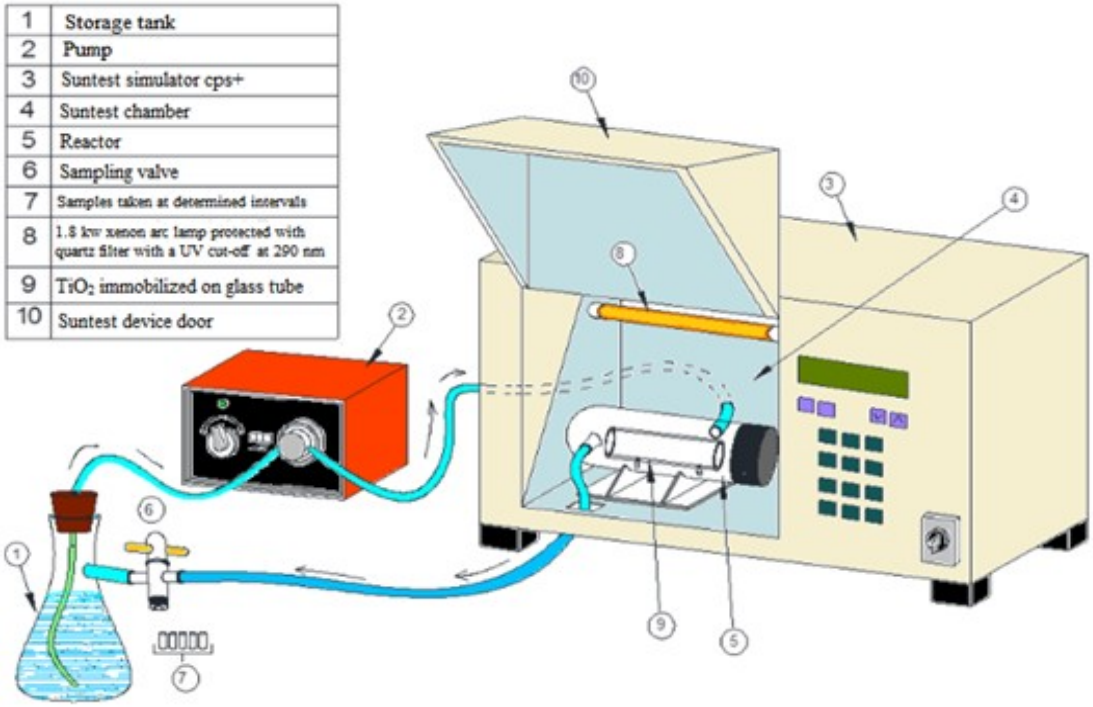

Figure 1. Cooled solar simulator equipped with TiO_2 immmobilized on glass tubes.

Kinetics of photoreactions were determined, and the identification of the photoproducts was performed using liquid chromatography coupled with micrOTOF-Q-II-Mass Spectrometer (LC-MS, Bruker Daltonik GmbH, Bremen).

The overall results suggest that active thin layer of TiO_2 immobilized on borosilicate surface can avoid the recovery problems related to the use of TiO_2 powder in heterogeneous photo-catalysis and may be a promising tool towards protecting the environment from emerging contaminants [3].

References

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