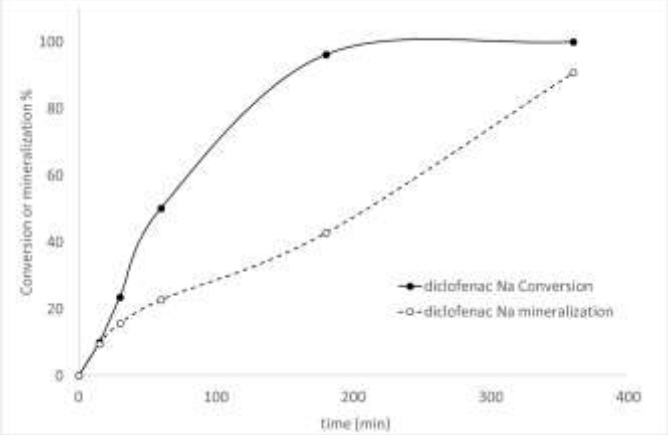
Ultrasound-enhanced photodegradation of Diclofenac Na

Daniela Meroni[1], Claudia L. Bianchi[1], Chong Fai Kait[2], Daria C. Boffito[3], Carlo Pirola[1]

1 Department of Chemistry, Università degli Studi di Milano, via Golgi 19, Milan, Italy
2 Department of Fundamental and Applied Sciences, Universiti Teknologi PETRONAS, Persiaran UTP, 32610 Seri Iskandar, Perak, Malaysia
[3]Department of Chemical Engineering, Polytechnique Montréal, Montréal, H3C 3A7, Québec, Canada
email: daniela.meroni@unimi.it

Diclofenac sodium, a non-steroidal anti-inflammatory drug, is an emerging water pollutant that cannot be removed by conventional wastewater treatment plants. Combined processes based on hydrodynamic cavitation (sonolysis) and heterogeneous photocatalysis are highly promising for the degradation and mineralization of refractory drugs [1,2]. Nevertheless, the use of nanoparticles as photocatalyst is not suitable in real applications for environmental and health hazard [3] as well as for the complex photocatalyst retrieval at the end of the process. For this reasons, we studied the photocatalyzed degradation of Diclofenac Na using micrometric titanium dioxide photocatalyst (Kronos 1077, 0.1 g/L), both bare and decorated with silver. Moreover, the synergic effect of pulsed ultrasound was tested. Initial concentrations of diclofenac sodium in the 25-50 ppm range were tested. Tests were performed in a batch jacketed reactor. A UVA lamp set sideway irradiated the solution with a power of 30 W/m^2 and an ultrasonic horn (20 kHz) sonicated the solution. HPLC-UV and HPLC-MS determined Diclofenac degradation and the main byproducts. A total organic carbon analyzer (TOC, Shimadzu) calculated the fraction of Diclofenac mineralized.

An example of photodegradation run is reported in figure. A positive synergy coupling ultrasounds with photocatalysis is confirmed, mainly with the use of Ag nanoparticles-TiO_2. We observed both a faster molecule degradation and its complete mineralization.



[1] Begal et al., *Ultrason. Sonochem* **2014**, *21*, 1035
[2] Schieppati et al., *Ultrasonics-Sonochemistry*, **2019**, *54*, 302
[3] Bianchi et al., *Environ Sci Pollut Res* **2017**, DOI 10.1007/s11356-017-9066-6