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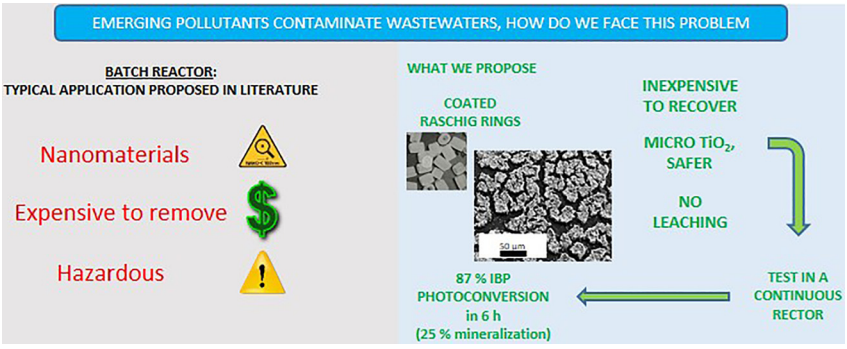
Micro-TiO_2 coated glass surfaces safely abate drugs in surface water

G. Cerrato[a,d,*], C.L. Bianchi[b,d], F. Galli[b,d], C. Pirola[b,d], S. Morandi[a,d], V. Capucci[c]

[a] Università degli Studi di Torino, Dip. Chimica & NIS Interdept. Centre, via P. Giuria 7, 10125 Torino, Italy
[b] Università degli Studi di Milano, Dipartimento di Chimica, via Golgi 19, 20133 Milano, Italy
[c] GranitiFiandre SpA, 41042 Fiorano M.se, Italy
[d] INSTM – Consorzio Interuniversitario per la scienza e tecnologia dei Materiali, via G. Giusti 9, 50121 Firenze, Italy

GRAPHICAL ABSTRACT



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ABSTRACT

The ingredients of Pharmaceuticals and Personal Care Products (PPCPs) persist in water and conventional treatment plants are not able to remove them efficiently. Sonochemical treatment is insufficient to mineralize organics such as ibuprofen into CO_2 and H_2O. TiO_2 degrades ibuprofen (IBP) under UV light; however, it does not reach a high grade of conversion. Here, we investigated the mineralization of ibuprofen to CO_2 by TiO_2 UV-C photocatalysis. We replaced nano-sized P25 (the standard catalyst) with a micro-sized commercial sample of TiO_2 to preclude the use of nanoparticles which are dangerous for human health and because typical filtration systems are expensive and inefficient. We deposited micro-TiO_2 on glass Raschig rings to ensure an easy recovery and reuse of the photocatalyst and we studied its performance both with a batch and a continuous reactor. Micro-TiO_2 mineralized 100% of IBP in 24 h. TiO_2-coated glass Raschig rings degraded 87% of IBP in 6 h of UV-C irradiation in a continuous reactor, with a mineralization of 25%. Electronspray ionization mass spectrometer (ESI-MS, positive mode) analyses identified 13 different byproducts and we hypothised a degradration pathway for IBP degradation.

1. Introduction

Industries at large produce waste that pollutes bodies of water [1,2]. These emerging contaminants are persistent [3] and untreatable with conventional water treatment plants (WTPs) [4]. Pharmaceuticals and Personal Care Products (PPCPs) account for the majority of these contaminants. They retain their concentration and structure or are converted into other compounds in aquatic matrices [5]. PPCPs

* Corresponding author at: Università degli Studi di Torino, Dip. Chimica & NIS Interdept. Centre, via P. Giuria 7, 10125 Torino, Italy.
E-mail address: giuseppina.cerrato@unito.it (G. Cerrato).

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