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**Environmental Applications**

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## Selective photooxygenation vs photodehydrogenation in solution using original visible-light silica-supported sensitizers

PC-3-76

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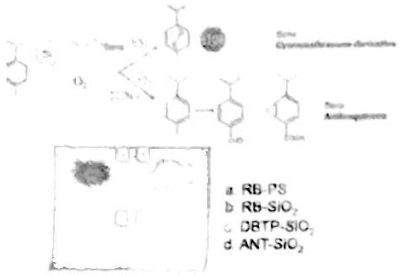


Three original silica-supported photosensitizers based on Rose Bengal (RB), a cyanoanthracene derivative (DBTP) and anthraquinone (ANT) were prepared and characterized. For photooxidation of α-terpinene in solution, DBTP-$SiO_2$ was more efficient and selective than RB–$SiO_2$ or than commercial RB on polystyrene. An alternative reaction course was observed with ANT-$SiO_2$, which gave selectively the dehydrogenation product, p-cymene, the latter further oxidized with time to cuminaldehyde. The mechanisms (energy transfer *vs* electron transfer) will be discussed on the basis of these results, of transient spectroscopy and of singlet oxygen quantum yield determinations. High selectivity to either reaction product was thus achieved using visible light (>420 nm), opening the way to green chemistry.

## Design of a Prototype Photoreactor for Standardised Photocatalytic Activity Tests using a Computer-Controlled UV LED Light Engine

PC-3-77

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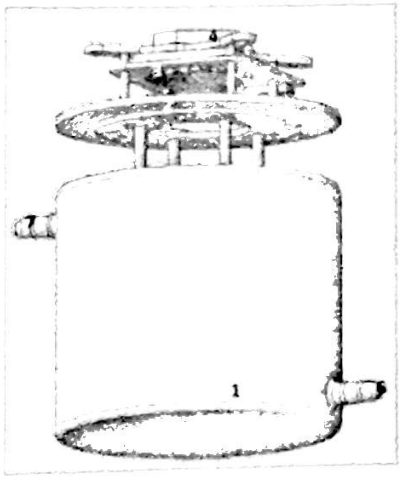


Comparison of the activity of photocatalytic materials developed in different research groups and locations remains a matter of scientific concern. Despite the existence of several ISO standards to carry out standardized activity measurement, few researchers apply them due to specific limitations. The goal of this work was the design of an innovative photocatalytic batch reactor with a minimum level of complexity to facilitate routine tests but with a rigorous chemical engineering approach that guarantees control of the chemical kinetics of the process by ensuring the absence of heat and mass transfer limitations, allowing the comparability of the results among different laboratories. Equivalence of irradiation conditions, one of the keys for transferability of the results, is achieved by the use of a computer-controlled UV LED light engine.

## The Influence of the Catalyst on the Photocatalytic Synthesis of Vanillin

PC-3-78

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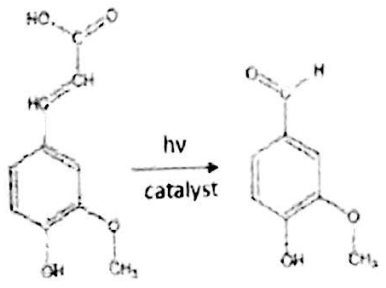


ferulic acid vanillin

This work reports on the influence of the catalyst on a "green" catalytic process. Vanillin was synthesized by photocatalytic oxidation.of ferulic acid in aqueous suspensions at room temperature by using commercial and home prepared samples as catalysts. Different values of selectivity were obtained depending on the physico-chemical properties of the single samples. In particular, a selectivity of 21% was reached with a mixed sample containing 10% of $WO_3$ with respect to $TiO_2$.
The production of vanillin rather than the mineralization of ferulic acid was ascribed to the presence of two types of sites on the surface of the catalysts which are specific for the occurrence of mineralization or partial oxidation of the substrate.

## Degradation of Orange G by Photo-Fenton-Like Process with Waste Iron Oxide Catalyst in a Three-Phase Fluidized Bed Reactor

PC-3-1

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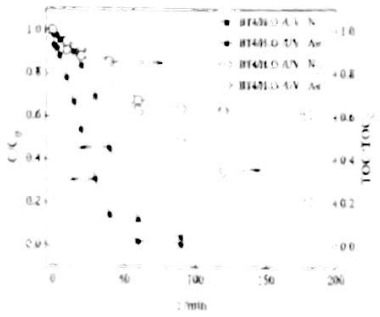

This study used a waste iron oxide (BT4), which was a by-product of the fluidized-bed Fenton reaction, as the catalyst for the heterogeneous photo-Fenton process to degrade Orange G in a three-phase fluidized bed reactor. Scanning electron microscopy (SEM), energy dispersive spectra (EDS), X-ray powder diffraction (XRD) and Fourier transform infrared (FTIR) were used to characterize BT4. The effects of catalyst loading, $H_2O_2$ concentration and initial pH on the degradation of Orange G were investigated. The reuse experiment indicated that the catalyst was still active after four cycles. The intermediate products were identified by GC-MS and a degradation pathway of Orange G was proposed.

## Removal of Rhodamine B with Fe-supported Bentonite as Heterogeneous Photo-Fenton Catalyst under Visible Irradiation

PC-3-2

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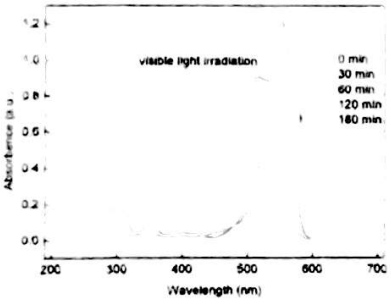


Fe-supported bentonite (Fe-B) was prepared as a heterogeneous catalyst for photo-Fenton degradation of Rhodamine B in aqueous solution. The Fe-B composite was found to act as both adsorbent and catalyst for the removal of RhB. However, the removal of RhB after adsorption equilibrium was due to the degradation in the coinstantaneous presence of Fe-B catalyst and $H_2O_2$ under visible light irradiation. Moreover, the results obtained from COD removal and iron leaching concentration as well as UV-vis spectral confirmed the occurrence of degradation of RhB in the visible light heterogeneous photo-Fenton process.

## Process intensification by using ozonation coupled with $TiO_2$ photocatalysis for treating bromide and/or bromate ions containing water: the role of co-present model organic compounds.

PC-3-3

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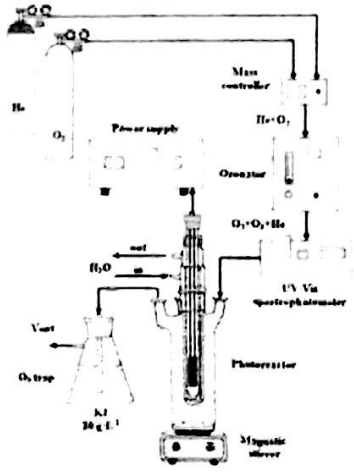

In the present work the integration of photocatalysis and ozonation was studied and optimized to improve efficiency of the photo-oxidation of formate species in the presence of bromide or bromate ions along with the mutual conversion of bromide and bromate. The case of 4-nitrophenol as another probe co-present molecule was deeply investigated. Nitrate ions obtained from 4-nitrophenol degradation were able in acidic media to oxidize bromide ions to bromine. This side reaction must be considered not only when nitrogen containing compounds are oxidized but also when gaseous nitrogen is fed to the ozonator as it happens if air is used in substitution of pure oxygen.