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Photocatalytic glyphosate degradation in a combined process with microalgal biologic treatment

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The rapid population increase has driven a surge in food demand, leading to intensive agricultural practices so the use of herbicides in agriculture has grown and glyphosate is one of the most widely employed[1]. Its excessive use has raised concerns about its potential impacts, being classified as a likely human carcinogen[2]. Heterogeneous photocatalysis is an effective technology for treating wastewater in order to oxidise persistent pollutants and TiO_2 has been identified as one of the best photocatalysts[3]. The photocatalytic degradation of pollutants before the mineralization can give rise to chemical intermediates that are also toxic and cannot be released in groundwaters. In this study, photocatalysis and microalgae treatments were combined in photobioreactors to study the glyphosate degradation. The aim of the work is combining both processes for the complete mineralization of the pollutant in a two stage process, i.e. the photocatalytic degradation of glyphosate in the presence of commercial Evonik P25 TiO_2 would lead to the formation of products such as glycine, phosphate, nitrate, ammonium, along with acetic, oxalic and formic acids that are nutrients for microalgae, that represent an emerging and efficient microorganism for wastewater biologic treatment[4]. Coupling the photocatalysis with a biological microalgae-based treatment, in a two-step process, enhances the mineralization efficiency, achieving removal global efficiencies higher than with the single separated processes. This study, hence, demonstrates that photocatalysis and microalgae combined treatment is an eco-friendly method for the treatment of glyphosate-polluted wastewater. Figure 1 represents the evolution of glyphosate and some of its products during the irradiation under UV in the presence of P25 and the microalgae grow in the solution after the photocatalytic process.

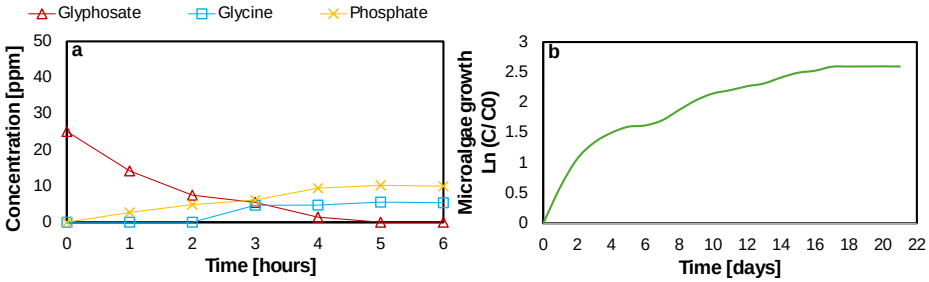

Figure 1. (a) Glyphosate, Glycine and Phosphate trend during the photocatalytic treatment; (b) Microalgae growth in the solution obtained after photocatalysis.

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