**Catalytic performance of TiO2 and ZnO on a nsp-DBD system for the degradation of trifluralin in sandy soil**

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**ABSTRACT**

The increasing accumulation of pesticide residues (ppt – ppm range) in the terrestrial and aquatic environment and their negative impacts (genotoxic properties) resulted in the nessecity for developing cost-effective methods for their removal from water and soil. Cold atmospheric plasma (CAP) is an innovative, green and highly efficient method well-known for its efficiency towards the removal of organic pollutants from aquatic systems, while recent efforts also focus on the exploitation of CAP for soil remediation as well.1,2 Its predominance is based on the high oxidation potential of the plasma-generated reactive oxygen and nitrogen species (RONS)3. In order to enhance the energy efficiency of the process, the combination of plasma and catalysis for soil remediation could be considered an appealing approach; plasmacatalysis is an emerging field with very promising results in wastewater treatment efforts.4 Dielectric Barrier Discharge (DBD) plasma combined with TiO2 and ZnO catalysts was examined for the removal of the herbicide trifluralin from soil. DBD reactor had a cylinder-to-cylindrical grid layout, where plasma discharges were produced inside the pores of the soil in order to achieve maximum penetration of the plasma species inside the contaminated medium. To enhance further the energy efficiency, a nanosecond pulsed (NSP) generator was used for the plasma species formation with a rapid rising time (~4 ns). Detailed parametric analysis was performed in order to investigate the role of catalyst loading, water content and different injected gases. The degradation mechanism was explored by measuring NO2 and O3 in the plasma exhaust gases in the presence and in the absence of catalysts whereas the impact of 1O2 and OH radicals in the degradation process was evaluated using appropriate scavengers. From the results obtained so far, the examined catalysts had a promising performance combined with CAP, as they contributed to the increase of trifluralin degradation efficiency and degradation rate regardless of catalyst content.

**KEYWORDS:**

Plasmacatalysis; Dielectric barrier discharge; Cold plasma; Photocatalysts; Pesticides.

**REFERENCES**

[1] C.A. Aggelopoulos. (2022) *Chem. Eng. J.* *428*: 131657.

[2] C.A. Aggelopoulos et al., (2020) *Chem. Eng. J.* *398*: 125622.

[3] Y. Gorbanev et al. (2018) *Anal. Chem. 90(22):* 13151–13158.

[4] M. Russo et al. (2020) *Catalysts 10(12)*, 1438