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Degradation of pharmaceutical contaminants in water by an advanced plasma treatment

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ABSTRACT

Contamination of water bodies with pharmaceutical compounds and their adverse effects on human and wildlife has been a source of concern for many societies. The need for more effective water treatment processes has been felt to eliminate these contaminants from water. In this work, single electrode non-thermal plasma in a floating electrode streamer corona discharge (FESCD) system is utilized for effective degradation of antibiotic ampicillin and non-steroidal anti-inflammatory drug (NSAID) ibuprofen. It was found that, after 3 h of plasma treatment, 100% of ampicillin and 90% of ibuprofen was degraded in the solution. The energy yield (the amount of degraded contaminants by consuming 1 kWh of energy) was calculated to be 0.12–0.13 g/kWh. Total Organic Carbon (TOC) measurements showed 20% and 60% mineralization for ampicillin and ibuprofen, respectively. Hydroxyl radicals were found to play a major role in the degradation of both contaminants. Furthermore, in both cases, the formation of oxygenated by products implied a possible role of ozone molecules in the degradation mechanism. Finally, Fluorescence Excitation-Emission Matrix (FEEM) was utilized to track the degradation of the contaminants in the tap water through the change in fluorescence properties and the connections between FEEM signals and the identified degradation by products were outlined.

Keywords: Plasma; Pharmaceutical contamination; Energy yield; Mineralization; Degradation pathway; Fluorescence excitation-emission matrix

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