

DEGRADATION OF ANTIBIOTIC VANCOMYCIN BY UV PHOTOLYSIS AND PULSED CORONA DISCHARGE COMBINED WITH EXTRINSIC OXIDANTS

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Antibiotics are the most frequently detected pharmaceuticals in the environment creating conditions for the development of resistant genes in bacteria [1, 2]. Vancomycin (VMN) is an amphoteric glycopeptide antibiotic used for treating infections caused by Gram-positive organisms. Incomplete removal of antibiotics and other drugs at wastewater treatment plants requires new approaches [3], such as advanced oxidation processes (AOPs), including application of UV irradiation and non-thermal plasmas.

Degradation and mineralization of VMN were examined by UV photolysis, pulsed corona discharge (PCD), and their combinations with extrinsic oxidants, hydrogen peroxide (HP), peroxydisulfate (PDS), and peroxymonosulfate (PMS). Both combinations were effective in VMN degradation and faster at pH 11 than in acidic or neutral media. Combined with the UV photolysis, HP showed a higher oxidation rate than other oxidants, whereas PMS and PDS proved to be more efficient in combinations with PCD. In contrast to low-to-moderate mineralization of VMN in the UV/oxidant combinations, PCD and PCD/oxidant combinations appeared to be more effective, reaching up to 90% of TOC removal in acidic/neutral solutions. Application of extrinsic oxidants resulted in an energy efficiency of VMN 90% oxidation improved from 36 to 61 g kW⁻¹ h⁻¹ in HP-assisted photolysis, and from 195 to 250 g kW⁻¹ h⁻¹ in PCD with additions of HP and PDS, thus showing the promising character of the combined treatment. In conclusion, the application of UV/HP at higher oxidant doses and PCD/HP and PCD/PDS combinations at moderate oxidant doses provide advantageous VMN degradation and mineralization. On the other hand, the unassisted PCD treatment provides sufficiently high energy efficiency as a chemical-free method.

References:

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