

Treatment of Pharmaceutical Industrial Effluent by Catalytic Ozonation in a Semi-Batch Reactor: Kinetics, Mass Transfer and Improved Biodegradability Studies

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Abstract : In this study, the biodegradability enhancement along with COD color and toxicity removal of pharmaceutical effluent by O_3 , O_3/Fe^{2+} , $O_3/nZVI$ processes has been evaluated. The nZVI particles were synthesized and characterized by XRD and SEM analysis. Kinetic model was reasonably developed to select the ozone doses to be applied based on the ozonation kinetic and mass transfer coefficient values. Nano catalytic ozonation process ($O_3/nZVI$) effectively enhanced the biodegradability ($BI=BOD_5/COD$) of pharmaceutical effluent up to 0.63 from 0.18 of control with a COD, color and toxicity removal of 62.3%, 93%, and 75% respectively compared to O_3 , O_3/Fe^{2+} pretreatment processes. From the GC-MS analysis, 8 foremost organic compounds were predominantly detected in the pharmaceutical effluent. The disappearance of the corresponding GC-MS spectral peaks during catalyzed ozonation process indicated the degradation of the effluent. The changes in the FTIR spectra confirms the transformation/destruction of the organic compounds present in the effluent to new compounds. Subsequent aerobic biodegradation of pretreated effluent resulted in biodegradation rate enhancement by 5.31, 2.97, and 1.22 times for O_3 , O_3/Fe^{2+} and $O_3/nZVI$ processes respectively.

Keywords : iron nanoparticles, pharmaceutical effluent, ozonation, kinetics, mass transfer

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