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Prediction of reaction parameters on reaction kinetics for treatment of industrial wastewater: A machine learning perspective

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Abstract

Industrial wastewater is a major cause of pollution of surface water bodies since it is often discharged into these water bodies without adequate treatment. Past attempts at treating industrial wastewater have led to emergence of multiple approaches for removal of impurities. These include conventional techniques like biological, physical and chemical techniques, recently advanced oxidation processes that have, under certain specific conditions, produced desired results through decomposing contaminating organic compounds into water, carbon-di-oxide or less harmful molecules. This study examines removal of phenol in industrial wastewater using Photo-Fenton reagent on account of its cost effectiveness and possibility of rapid results. The effectiveness of removal of contaminants was assessed based on rate of reaction (k1). Data collected through laboratory experiments was then put through various Machine Learning classifiers including Neural Network, CHAID, Generalized Linear Model, Linear Classifier and Random Trees using IBM SPSS Modeler and models trained. An accuracy of 97.2% was observed for Deep Neural Network. Further it is observed that for a specific level of impurities in industrial water, pH of solution, intensity of light and amount of Hydrogen Peroxide (H_2O_2) are the most important factors in predicting rate of reaction with concentration of [Fe^{3+}] ions and catalyst TiO_2 playing smaller roles.

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