Treatment of petroleum refinery wastewater using TiO2-Mediated photocatalysis

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Abstract

TiO_2-mediated Photocatalytic Degradation (PCD) of both individual and mixed aqueous systems of S_2O_3, p-cresol, NH_4^+, CN and SCN was studied under several different conditions. Significant degradation of the target pollutants, for individual PCD systems, was observed. For the individual systems, the PCD rates were obtained to be a function of pH. For the S_2O_3 and p-cresol studies higher PCD rates were obtained at lower pH values whereas for the NH_4^+, CN and SCN systems, higher PCD rates were obtained at higher pH values. Oil was typically noted to decrease the S_2O_3 and p-cresol degradation. For the mixed studies, varying PCD trends were noted. For the tertiary NH_4^+/S_2O_3/p-cresol system at pH 10, the target pollutant species were found to be preferentially degraded in the following order: $NH_4^+ > S_2O_3 >$p-cresol. Also for the pH 10 experiments, the following trend was noted for overall NH_4^+ removal results at 1 h of illumination: S_2O_3/p-cresol $> S_2O_3 >$p-cresol>CN>SCN> NH_4^+ -only. However, at pH 12 this trend almost reversed for results at 6 h: $S_2O_3 <$p-cresol <CN <SCN < NH_4^+-only. At pH 12 for the 10 mg/l CN system, complete substrate removal was obtained at about 1 h whereas for the 20 mg/l CN this time almost doubled. For the combined effect of NH_4^+ and CN on SCN degradation at pH value of 12, a consistent decrease in SCN removal was obtained with the addition of CN and also CN/NH_4^+ together. However, a significant SCN removal was still noted, indicating efficiency of the PCD process to degrade SCN under several mix system scenarios.