

Organic Contaminant Degradation Using H₂O₂ Activated Biochar with Enhanced Persistent Free Radicals

Authors : Kalyani Mer

Abstract : Hydrogen peroxide (H₂O₂) is one of the most efficient and commonly used oxidants in in-situ chemical oxidation (ISCO) of organic contaminants. In the present study, we investigated the activation of H₂O₂ by heavy metal (nickel and lead metal ions) loaded biochar for phenol degradation in an aqueous solution (concentration = 100 mg/L). It was found that H₂O₂ can be effectively activated by biochar, which produces hydroxyl (\bullet OH) radicals owing to an increase in the formation of persistent free radicals (PFRs) on biochar surface. Ultrasound treated (30s duration) biochar, chemically activated by 30% phosphoric acid and functionalized by diethanolamine (DEA) was used for the adsorption of heavy metal ions from aqueous solutions. It was found that modified biochar could remove almost 60% of nickel in eight hours; however, for lead, the removal efficiency reached up to 95% for the same time duration. The heavy metal loaded biochar was further used for the degradation of phenol in the absence and presence of H₂O₂ (20 mM), within 4 hours of reaction time. The removal efficiency values for phenol in the presence of H₂O₂ were 80.3% and 61.9%, respectively, by modified biochar loaded with nickel and lead metal ions. These results suggested that the biochar loaded with nickel exhibits a better removal capacity towards phenol than the lead loaded biochar when used in H₂O₂ based oxidation systems. Meanwhile, control experiments were set in the absence of any activating biochar, and the removal efficiency was found to be 19.1% when only H₂O₂ was added in the reaction solution. Overall, the proposed approach serves a dual purpose of using biochar for heavy metal ion removal and treatment of organic contaminants by further using the metal loaded biochar for H₂O₂ activation in ISCO processes.

Keywords : biochar, ultrasound, heavy metals, in-situ chemical oxidation, chemical activation

Conference Title : ICWTTM 2019 : International Conference on Wastewater Treatment Technologies and Management

Conference Location : New York, United States

Conference Dates : October 08-09, 2019