Journal of Basic and Applied Engineering Research
p-ISSN: 2350-0077; e-ISSN: 2350-0255; Volume 5, Issue 1; January-March, 2018, pp. 48-48

http://www.krishisanskriti.org/Publication.html

Formation of rGO-CMC-Fe^{2+}(-nZVI) Hybrid for Highly Stable and Reusable Electrode for the Electrochemical Oxidation of Organic Pollutants

Ambika Selvaraj* and Jaganathan Senthilnathan

Environmental and Water Resources Division, Department of Civil Engineering,
Indian Institute of Technology Madras, Chennai, India
E-mail: ambikame@gmail.com

Abstract—*Fenton and Electro-Fenton process have been extensively studied for the removal of persistent and emerging contaminants using nano zero valent iron (nZVI) in both suspension and immobilized form. The main complexity involved in Fenton/electro-Fenton processes is iron oxide precipitation and deposition on the electrode surface which can reduce the surface area of the electrode, increased iron content in treated water and difficulty in recovery/reuse of nZVI. In this study, CMC functionalized reduced graphene oxide (rGO) was synthesized by chemical method and nZVI was sandwiched between CMC and rGO. rGO-CMC-Fe^{2+}(-nZVI) was used as the cathode to electrogenerate H_2O_2 via oxygen reduction reaction. Further, Fe^{2+}(-nZVI) present in the electrode converted H_2O_2 into OH radical. The chemical property of rGO-CMC-Fe^{2+}(-nZVI) electrode was investigated using ATR-FTIR spectra and this showed a significant shift in the functional groups of COO^- and OH^- and confirmed their chelation with the central Fe^{2+} ion. The redox property of rGO-CMC-Fe^{2+}(-nZVI) was evaluated using cyclic voltammeter and showed distinct oxidation/reduction peaks due to the coexistence of Fe^{2+}/Fe^{3+} ions on the electrode surface. Further, the effect of cathode potential, applied current, nature of electrolyte and concentration of target pollutants were also evaluated in detail. To understand the oxidation potential of rGO-CMC-Fe^{2+}(-nZVI) electrode, phenol was used as the target pollutant and its initial and final concentration was evaluated by UV-Visible spectrophotometer analysis. Initial studies showed, almost 99% of reactive dye (initial concentration 20 mg/L, pH 7) and phenol (10 mg/L, pH 3) was degraded within 30 min of reaction time. Chemical analysis of rGO-CMC-Fe^{2+}(-nZVI) electrode before and after the reaction showed that Fe^{2+}(-nZVI) was effectively stabilized by CMC functionalized rGO and only trace amount of Fe^{2+} was observed in solution at the end of the reaction.*

Keywords*: rGO-CMC-Fe^{2+}(-nZVI) electrode, electro-Fenton process, phenol oxidation.*