Synthesis, Characterization and Anodic Dissolution of Reduced Graphene Nano Zero Valent Iron Composite in Aqueous Solution of Na_2SO_4

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Electrocoagulation (EC) is a proven technology for water treatment. One of the serious issues in Al based EC is the residual aluminium in treated water is known to be toxic. Iron is non-toxic and low cost as an alternative substitute for Al and therefore is encouraged in EC. However, rapid corrosion of iron is the biggest problem in iron-based EC. With an intention of reduction of corrosion of iron, Reduced Graphene Nano Zero Valent Iron (RGnZVI)composite was-synthesized and tested for corrosion.

Modified Hummers method was employed to fabricate RGnZVI. Graphene oxide was prepared and then incorporated with $FeCl_2$. Under facile conditions, one step reduction method was used to synthesize RG – nZVI composite through $NaBH_4$ reductant. TEM analysis shows, folding nature of graphene sheet with a maximum length of 4.12 nm, relatively dense and randomly, spherical nano zero valent iron particles dispersed on the graphene sheet. The full scan XPS spectra show photoelectron lines at binding energies 286.2, 530, and 719.6 eV attributed to C 1s, O 1s and Fe 2p. The peaks at 711.5 eV, 725 eV for Fe $2p_{3/2}$ and Fe $2p_{1/2}$ correspond respectively to oxidized iron (III) due to the surface oxidation during the synthesis process. In electrochemical analysis of RGnZVI, it was found that the open circuit potential to be -0.467 V, in 0.2 M Na_2SO_4 electrolyte and polarization resistance was found to be 0.04 Ωι. at room temperature (25 ^{0}C). Exchange current density calculated by Tafel plots showed slow anodic dissolution.

Keywords: Electrocoagulation, graphene oxide, nano zero valent iron, open circuit potential, corrosion