Abstract RM 04

CHEMICAL DESTRUCTION OF EXCESS NITRATE IN WATER BY GRAPHENE NANO ZERO VALENT IRON COMPOSITE

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Excess nitrate in drinking water is classified as a priority contaminant by WHO, and it is mandatory to maintain NO_3^- at 50 ppm. Nitrate pollution of potable water systems in Sri Lanka is a national issue. Although metallic Fe (Fe^0) offers an attractive alternative for the destruction of nitrate, it undergoes rapid oxidation when in contact with water. In this study, a simple strategy based on treatment of nitrate-contaminated water with graphene nano zero valent iron (Graphene – nZVI) has been proposed. Natural green tea leaves (GT) were used for the synthesis of grapheme – nZVI. Polyphenolic compounds, mainly catechins present in GT extracts, act as a capping agent and convert Fe^{2+} to Fe^0. Thus, extracts of GT were very productive for the synthesis of stable nZVI. Primarily, the core consists of metallic iron, and acts as the electron source for reduction. Due to the oxidation of metallic iron, a protective shell around the iron core is formed, and it facilitates sorption of contaminants including nitrate through electrostatic interactions and surface complexation. Through the nZVI oxide shell, electron transfer may be relatively slow and hardly consequential. Characteristic band of the Fe-O stretching vibration observed at 608 cm^{-1} indicates the successful synthesis and surface oxidation of grapheme - nZVI composite. New transmittance band present at 1395 cm^{-1} is mainly due to the NO_3^-- H_2O anti-symmetric stretching vibrations. According to 1 pK Stern layer model, the activity of $[FeOH_2^+.NO_3^-]$ was calculated as a function of pH. The important feature of the proposed method is that the conversion of nitrate into NH_4^+ is greater than 90% with no detectable amount of nitrite. The nitrate reduction by graphene - nZVI synthesized by GT is hypothesized as a surface mediated process.

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