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SRI LANKAN VEIN GRAPHITE AS A POTENTIAL SUBSTRATE FOR ZERO VALENT IRON STABILIZATION FOR POLLUTANTS ABATEMENT

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Minerals and the value-added mineral products are essential for determining and improving the economic performance of a nation. Sri Lankan vein graphite is renowned globally for its extremely high purity; however, Sri Lankan vein graphite or its derived products are deprived in Sri Lankan industry. Our project was aimed at developing electrochemical water treatment technology to mitigate excess fluoride and hardness in groundwater using graphite and its derivations. Therefore, the objective of this work is to fabricate a novel electrode material for electrocoagulation (EC) technique where anodic dissolution facilitates flocculant formation to remove excess fluoride and hardness in groundwater. Presently Aluminum electrodes are used for EC. However, their use is often distracted due to potent toxicity of free Al^{3+}, which is generated by the process. Environmentally benign metallic Fe offers an attractive alternative for the fabrication of anodes. The major drawback of metallic Fe is, its uncontrolled dissolution when in contact with the aqueous medium. Therefore, fabrication of metallic Fe with controlled dissolution is a forefront global research priority. Due to their 2-D structures, graphite and their allied products are efficient to reside metallic Fe with controlled dissolution. Nano metallic Fe – graphene composites were synthesized to accomplish the aims as mentioned earlier. Graphene was synthesized by modified Hummers method at low temperature using Sri Lankan vein graphite. Polyphenols in natural green tea was used to reduce Fe^{2+}/ Fe^{3+} into metallic Fe. Widely used $NaBH_4$ method was also used to produce metallic Fe. The resulted composites are designated as green tea derived Fe – reduced graphene (GO -1) and $NaBH_4$ derived Fe- reduced graphene (GO-2). Both GO-1 and GO-2 can propose as alternative anode materials for electrocoagulation. Conventional and spectroscopic methods extensively characterized the GO-1 and GO-2 composites before their applications. 2D Raman bands appeared at 2715 cm^{-1} for GO - 1 confirm the presence of multilayer structure while the bands at 2680 cm^{-1} for GO - 2 confirm the presence of the single layer structure of graphene. The BET method indicates that the specific surface area of GO – 1 was 16.1 m^2g^{-1} while GO- 2 was 31.2 m^2g^{-1}. It is obvious that the graphene Fe (0) synthesized by $NaBH_4$ method had a high surface area due to the nature of the reducing agent. In the TEM image, the folding nature of the graphene sheet can be observed. Spherical characteristic of Fe nano particles with a maximum length of 4.12 nm were dispersed on the graphene sheet with a relatively dense and random distribution.

Keywords: Sri Lankan vein graphite, Electrocoagulation, Groundwater

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