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APPLICATION OF NANOSCALE ZERO VALENT IRON FOR THE REMOVAL OF HUMIC SUBSTANCES

S.S.R.M.D.H.R. Wijesekara[1]*, I.N.K. Darandakumbura[1,2], A.R. Siriwardana[1,3], B.F.A. Basnayake[4] and M. Vithanage[1]

[1]Chemical and Environmental Systems Modeling Research Group, Institute of Fundamental Studies, Kandy, Sri Lanka
[2]Faculty of Science, University of Peradeniya, Sri Lanka
[3]Postgraduate Institute of Science, University of Peradeniya, Sri Lanka
[4]Department of Agricultural Engineering, Faculty of Agriculture, University of Peradeniya, Sri Lanka
**wijesekara84@gmail.com*

Humic substances (HS) are the least understood component of wastewater, yet one of the most important materials which may adversely affect to the human health through the production of trihalomethane during chlorination process. Though, the HS are extremely difficult to degrade with the conventional wastewater treatment, no considerable attention have been laid to study them in municipal solid waste leachate, especially in the tropical region. Nanoscale zero valent iron (NZVI) was recently reported as an ideal candidate for remediation of HS and common pollutants present in wastewater. Hence, this study was carried out to investigate the different HS in the landfill leachate from Gohagoda open landfill, Kandy, Sri Lanka and their removal using NZVI. The percentages of HS; Humic acid (HA), Fulvic acid (FA) and Hydrophilic fraction (Hyd) in the leachate were accounted by the resin techniques. The air stable starch coated nano zero valent iron (S-NZVI) was synthesized using borohydride reduction method. Edge experiments were carried out with a stock solution of 0.5 g/L S-NZVI and HA loading 50 mg/L. Isotherms were conducted in a selected pH condition (pH 3) for 50 to 850 mg/L HA loadings in 298, 308 and 318 K based on the preliminary experiments. Finally, the kinetic experiments were performed up to 4 hrs. The TEM results confirmed approximately spherical shape aggregate particles with 20-200 nm as average particle size. In humic substances, Hyd was the dominant fraction which accounted for about 61% while HA and FA constituted about 21 and 17% respectively. The results showed that the HA was successfully removed by the S-NZVI at a wide range of initial pH values (~2.5-9). The isotherm studies revealed that the efficiency of HA removal by the S-NZVI increases with temperature. The calculated maximum removal percentages at 298, 308 and 318 K were about 87, 92 and 98% respectively. The removal reaches the equilibrium after 90 minutes and a high rate of removal occurs in first 50 minutes. Hence, use of the S-NZVI as an effective material for the removal of HA and can be integrated with other cost effective treatment methods. Further studies are ongoing with the Fourier Transmission Infrared Spectroscopy (FT-IR) analysis focusing detail characterization of HA before and after sorption with S-NZVI.