Abstract No: 442 *Natural Sciences*

Synthesis of zero valent iron nanoparticles and application in nitrate reduction

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Iron nano particles have received greater attention due to its potential application in nitrate (NO_3^-) reduction in drinking water. Zero valent iron nanoparticles (nZVI) have more advantages over micro scale zero valent iron (mZVI) due to high surface area and small size. nZVI were synthesized by a chemical method where, ferrous ions were reduced to ZVI by sodium borohydride. Characterization of the surface of synthesized nZVI was done by X-ray diffraction spectroscopy (XRD), Fourier Transform Infra-red (FTIR) Spectroscopy, Zeta potential, surface titration, Mossbauer Spectroscoy, Scanning Electron Microscopy (SEM), redox potential (Eh) and X-ray photoelectron spectroscopy (XPS). These data suggested that bare ZVI particles tend to undergo oxidation and aggregation. To overcome the above problems, poly ethylene glycol (PEG) was used as the stabilizer. Synthesized nZVI were used in nitrate reduction effectively. Nitrate reduction efficiency of nZVI was investigated as a function of pH values and initial iron loading. Observed data confirmed that similar to mZVI, nZVI can be used in NO_3^- reduction where it has higher efficiency over mZVI. Ammonia (NH_3), nitrous oxide (N_2O) and nitrite (NO_2^-) was observed as the product of nitrate reduction by nZVI. NH_3 and NO_3^- were determined using ion selective electrode (ISE), N_2O by gas chromatography (GC) and NO_2^- by colorimetry.

Financial assistance given by the National Research Council (NRC-13-130) acknowledged.