**Abstract RM 03**

# CONTINUOUS FLOW STUDIES FOR NITRATE REMOVAL USING NATURALLY SYNTHESIZED ZERO VALENT NANO IRON

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Although, nitrate itself is relatively nontoxic, high nitrate levels in surface waters cause a serious threat to aquatic ecosystems and human health. Due to its stability and solubility, removal of nitrate is not an easy task. Ion exchange, biological de-nitrification, reverse osmosis and chemical reduction are some available nitrate removal methods with inherent drawbacks. Chemical reduction based on nano zero valent iron (nZVI) is a promising approach; however rapid, uncontrolled oxidation of nZVI is a serious problem in applying this technique for water treatment. In this research, an alternative methodology is proposed to retard chemical oxidation of Fe using green tea in the synthesis of nZVI. The ingredients in green tea are believed to contribute to in the green tea nZVI fabrication. They assist in reducing Fe (III) into metallic Fe, and natural polyphenols ubiquitous in green tea seem to act as a cover retarding Fe oxidation. Although the exact structure of the green tea nZVI cannot be elucidated from the data, the infrared vibration band of green tea nZVI observed at 603 $cm^{-1}$ can be attributed to Fe-O stretching. After nitrate reduction, the band observed at 1568 $cm^{-1}$, which is due to N-O vibrations, confirms nitrate reduction mediated by nZVI surface. To simulate natural conditions, nitrate reduction by green tea nZVI was carried out in dynamic flow conditions. Two identical columns of 60 cm length and 2.5 cm internal diameter were used to flow the solutions at specific flow rates using a peristaltic pump. The blank column containing only sand was used to control the porosity of the column. The reactive column, which contains a mixture of sand and green tea nZVI, results in 68% efficiency of nitrate reduction by green tea nZVI. The reduction kinetics in dynamic conditions was determined to follow first order kinetics, in consistent with the batch mode. The reactor optimization with respect to flow rate, substrate reactivity, solution pH and desired products is in progress.

**Keywords:** Continuous, flow, kinetics, nitrate, n-ZVI, reduction

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