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Leaf-extract mediated zero-valent iron for oxidation of Arsenic (III): Preparation, characterization and kinetics

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Abstract

In recent years, leaf-extract mediated green synthesis of zero-valent iron nanoparticles is gaining much popularity as it is cost effective and an eco-friendly alternative to chemically synthesized zerovalent iron. The present study reports the synthesis and characterization of nanoscale zero-valent iron particles obtained from various leaf extracts viz. eucalyptus (*Eucalyptus globulus*), mango (*Mangifera indica*), jamun (*Syzygium cumini*) and guava (*Psidium guajava*). The synthesized nanoparticles were characterized on the basis of size distribution, UV-Vis absorption spectroscopy, Fourier transform infrared spectroscopy, Field emission scanning electron microscopy and powder X-ray diffractometer. This study further investigates the potential of these nanoparticles for oxidation of arsenite (1000 µg/L) at various pH (3, 7 and 9). Results indicate that green nanoparticles synthesized from guava leaves were capable of oxidising As(III) to As(V) at all investigated pH values, the kinetics of which varied depending on the pH. As(III) oxidation kinetic model fitted well to first order with K_{obs} values of 0.3444 s^{-1} , 0.0482 s^{-1} and 0.0155 s^{-1} for pH 3, 7 and 9 respectively. This study provides a novel mechanism for oxidation of arsenite to arsenate, thus providing an effective and sustainable solution for remediation of toxic trivalent arsenic.

Keywords: Zero-valent iron, Green synthesis, Leaf extract, Characterization, Arsenic.

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