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Green zero-valent iron nanoparticles synthesised using herbal extracts for degradation of dyes from wastewater

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ABSTRACT

Nano zero-valent iron (nZVI) is an effective way to degrade different compounds. The green synthesis of nZVI showed potential as an alternative to $NaBH_4$ synthesised nanoparticles. In this study, a comparison among different nanoparticles (green, bare and polyacrylic acid coated) was carried out. Based on the higher stability of green nanoparticles, new extracts obtained from herbal aromatic leaves (rooibos, lemon verbena and camphora) were evaluated for the synthesis of nZVI. Two different extraction procedures were compared: decoction and infusion. The results showed that using a constant temperature of 100°C during the extraction increases the quantity of polyphenols and antioxidants extracted. The antioxidant content was highest in green tea (*Camellia sinensis*), but reactivity of synthesised nanoparticles of zero-valent iron is higher when using rooibos (*Aspalathus linearis*) extracts. Synthesised rooibos green nZVIs have been applied to degrade a textile dye, Reactive black 5, directly and as catalyst in an electro-Fenton process, reaching a decolourisation of 90% and 70% in 60 min, respectively. The synthesised nanoparticles demonstrated a good performance in the treatment of the polluted wastewater.

Keywords: Green nZVI; Rooibos; Nanoparticles; Lemon verbena; Dye; Fenton; Zero-valent iron; Green synthesis

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