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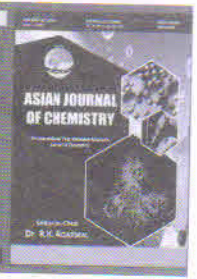

Green Synthesis of Ni-Fe co-doped TiO_2 ($Ni_{0.05}Fe_{0.05}Ti_{0.9}O_2$) Nanoparticles for Enhanced Supercapacitor Applications

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This work reports the green synthesis of Ni and Fe co-doped TiO_2 nanocomposites *via* solution combustion using aloe vera gel as bio-fuel. The prepared $Ni_{0.05}Fe_{0.05}Ti_{0.9}O_2$ composition was confirmed by XRD and Raman spectroscopy, which showed anatase phase retention and successful substitution of Ti^{4+} by Ni^{2+} and Fe^{3+}, inducing lattice distortion and local symmetry defects. SEM revealed reduced particle size and improved dispersion due to co-doping. Electrochemical studies including cyclic voltammetry, galvanostatic charge–discharge and impedance spectroscopy demonstrated enhanced capacitance, energy density and charge transfer dynamics in $NiFeTiO_2$ compared to pure and Fe-doped TiO_2. The $NiFeTiO_2$ electrode achieved a high specific capacitance (140 F g^{-1}), energy density (280 Wh/kg) and power density (54 kW/kg), highlighting the complementary role of binary doping in improving conductivity and pseudocapacitive behaviour. Overall, green synthesis and transition metal co-doping offer a sustainable route to high-performance supercapacitor electrode materials.

Keywords: Green synthesis, Aloe Vera, Energy storage, Supercapacitor.