

Electrocatalytic activity of starch/Fe₃O₄/zeolite bionanocomposite for oxygen reduction reaction

ABSTRACT

The present work demonstrated an eco-friendly and facile method for the preparation of starch/Fe₃O₄/zeolite-bionanocomposite (BNC) at moderate temperature. Zeolite and starch were used as solid support and stabilizer, respectively. The analysis of UV–vis showed the appearance of surface plasmon resonance. From PXRD analysis, the incorporation of magnetite nanoparticles (NPs) in zeolite substrate results in reducing of intensities and broadening of the zeolite peaks of BNC. The TEM analysis showed the formation of highly distributed Fe₃O₄-NPs with an average diameter and standard deviation of 9.24 ± 3.57 nm. The FESEM and EDX analyses imply that Fe₃O₄-NPs were homogeneously formed on the surface of the zeolite substrate. VSM analysis illustrated the as prepared BNC possessed magnetic behaviour with a saturation magnetization and coercivity of 1.84 emu g^{-1} and 17.76 G, respectively. The prepared BNC showed potential applicability in energy as low-cost electrode material. The BNC was used as a non-precious catalyst for oxygen reduction reaction (ORR) in the alkaline medium. The presence of starch and zeolite promoted long term stability up to 1000 cycles and avoid the dissolution and agglomeration of iron oxide. The ORR commences at the onset potential of 0 V follows by the two successive reduction peaks at -0.48 V and -1.00 V.

Keyword: Green synthesis; Bionanocomposite; Electrocatalytic; Oxygen reduction reaction