Synthesis and Characterization of Poly(3-pyrrol-1-ylpropanoic acid) (PPyAA)-Fe₃O₄ Nanocomposite

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Poly(3-pyrrol-1-ylpropanoic acid)(PPyAA)–Fe₃O₄ nanocomposite was successfully synthesized by an in situ polymerization of 1-(2-carboxyethyl) pyrrole in the presence of synthesized Fe₃O₄ nanoparticles. Structural, morphological, electrical and magnetic properties evaluation of the nanocomposite were performed by XRD, FT-IR, TEM, TGA, VSM and conductivity measurements respectively. XRD analysis reveals the inorganic phase as Fe₃O₄ and TGA shows about 90 % wt loading of Fe₃O₄ in the nanocomposite. FT-IR analysis indicates a successful conjugation of Fe₃O₄ particles with polypyrrole acetic acid. Magnetization measurements show that polypyrrole acetic acid coating decreases the saturation magnetization of Fe₃O₄ significantly. This reduction has been explained by the pinning of the surface spins by the possible adsorption of non-magnetic ions during the polymerization process. The conductivity and dielectric permittivity measurements strongly depend on the thermally activated polarization mechanism and thermal transition of PPyAA in the nanocomposite structure. Large value of dielectric permittivity (ε') of the nanocomposite at lower frequency is attributed to the predominance of species like Fe²⁺ ions and grainboundary defects (interfacial polarization).

REFERENCES