



Synthesis and investigation of chemically modified Phthalimide based copolymers and their Antimicrobial activity

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ABSTRACT

A novel phthalimide based monomer 2-(N-phthalimido)ethyl acrylate (NPEA) was synthesized by reacting N-(2-hydroxyethyl)phthalimide (NHEP) with acryloyl chloride and was further copolymerized with styrene (STY). Copolymers of NPEA with STY at different feed composition were prepared by free radical solution polymerization at $70\pm 2^\circ\text{C}$ using 2,2'-azobisisobutyronitrile (AIBN) as an initiator and dimethylformamide (DMF) as a solvent. The monomer and copolymers thus synthesized were characterized by Fourier transform infrared spectroscopy (FT-IR) and $^1\text{H-NMR}$. Copolymer composition was obtained using FT-IR and UV spectroscopy. The reactivity ratios of the monomers were determined by Fineman-Ross ($r_1 = 0.67$, $r_2 = 0.79$) and Kelen-Tudos ($r_1 = 0.68$, $r_2 = 0.81$) methods. Gel permeation chromatography (GPC) was employed to find molecular weights and polydispersity index which increases as the NPEA content increases in the copolymer. Thermogravimetric analysis (TGA) in nitrogen atmosphere showed that thermal stability of the copolymer decreases as the NPEA content increases. The activation energy (E_a), calculated by Broido's method lies in the range 52-58 KJ/mole. As the NPEA content in the copolymer decreases the activation energy increases. Antimicrobial activity of the polymers was also investigated against various microorganisms like bacteria (*Bacillus subtilis*, *Escherichia coli* and *Staphylococcus citreus*), fungi (*Aspergillus niger*, *Sporotichum pulveruleum* and *Trichocerma lignorum*) and yeast (*Candida utilis*, *Saccharomyces cerevisiac* and *Pichia stipitis*). The antimicrobial activity of the copolymer increases as the content of NPEA increases in the copolymer. This demonstrates that phthalimide moiety plays very important role as antimicrobial agent.

Keywords: Phthalimide, Styrene, Copolymer, Reactivity ratios, Antimicrobial activity.
