Abstract

Aromatic polyamides (aramids) exhibit a number of interesting properties, such as high thermal stability, excellent mechanical properties, high chemical resistance and low flammability. Nevertheless, aromatic polyamides of the class are generally difficult to fabricate into fibers and films because of their high melting or softening temperatures and insolubility in most organic solvents. Therefore, much research effort has been spent to make this class of polymers soluble and/or melt processable. Pervaporation separation of closely boiling solvents is an important energy efficient method. The problems associated with the separation of hydrocarbon mixtures using polymeric membranes has been discussed extensively in recent review articles. It has been described that the separation efficiency can be increased significantly by modifying the molecular structure of the polymers. Introduction of special π electron accepting moieties are potential to form charge transfer complexes with benzene (Bz) which, in turn, change sorption and diffusion properties of the system.

The principal goal of this research was to develop new solution-processable aromatic poly(ether amide)s (PEAs) and investigation of their pervaporation performance towards Bz / Chx (50/50 wt%) mixture. In this regard, three different series of PEAs were prepared by the phosphorylation polyamidation reaction of three different dicarboxylic acids [5-*tert*-butyl-isophthalic acid (TIPA), terephthalic acid (TA) and isophthalic acid (IA)] and four structurally different semifluorinated aromatic diamines namely; bis-2,2'-[4-{2'-trifluoromethyl 4'-(4"-aminophenyl)phenoxy} phenyl] isopropylidene, bis-2,2'-[4-{2'-trifluoromethyl 4'-(4"-aminophenyl)phenoxy} phenyl] hexafluoro isopropylidene, bis-2,2'-[4-{2'-trifluoromethyl 4'-(4"-amino phenyl) phenoxy} phenyl]fluorenylidene and 3,3-bis-[4-{2'-trifluoromethyl 4'-(4"-aminophenyl) phenoxy} phenyl]-2-phenyl-2,3-dihydro-isoindole-1-one. So, total twelve new PEAs have been prepared and characterized thoroughly by different instrumental techniques. The polymers showed good solubility in many organic solvents viz. NMP, DMF, DMAc and pyridine and, were insoluble in $CHCl_3$, Bz, toluene and cyclohexane (Chx). High thermal stability, high glass transition temperature, high tensile strength and preferential solubility of these polymers made them suitable candidates for pervaporation studies. Accordingly, pervaporation study of Bz / Chx (50/50 wt%) mixture at three different temperatures have been successfully investigated using these PEA membranes. The membranes were benzene selective in nature. Membranes based on TIPA, TA and IA showed highest permeation flux (31.42 kg μm/m^2 h), selectivity (7.6) and pervaporation separation index (3782 g/m^2 h), respectively. An attempt has been taken to draw a structure-property correlationship of the chemical structures of these polymers with their pervaporation performances.

Keywords: *Poly(ether amide)s, Solubility, Thermal properties, Mechanical properties, Pervaporation, Benzene / Cyclohexane*