



THERMAL DEGRADATION STUDIES OF COPOLYMER DERIVED FROM 2-HYDROXY, 4-METHOXYBENZOPHENONE, 1,5-DIAMINONAPHTHALENE AND FORMALDEHYDE

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ABSTRACT

Copolymer 2-H, 4-MBP-1,5-DANF-I has been synthesized by the condensation of 2-hydroxy, 4-methoxybenzophenone, 1,5-diaminonaphthalene and formaldehyde in 1:1:2 molar proportions. The structure of copolymer has been characterized by elemental analysis and various physico-chemical techniques i.e. UV-visible absorption spectra, Infrared spectra and proton nuclear magnetic resonance spectra. The morphology of copolymer was studied by scanning electron microscopy (SEM). The thermal decomposition behavior of 2-H, 4-MBP-1,5-DAF-I copolymer has been studied by using TGA in static nitrogen atmosphere at a heating rate of $10^{\circ}\text{C}/\text{min}$. The activation energy (E_a) and thermal stability calculated by using the Sharp-Wentworth and Freeman-Carroll methods. Thermodynamic parameters such as entropy change (ΔS), apparent entropy change (S^*), free energy change (ΔF) and frequency factor (Z) have also been evaluated on the basis of TGA curves and by using data of Freeman-Carroll method. The order of reaction (n) was found out to be 0.98.

Keywords: Thermal degradation, copolymer, condensation, thermal stability, Freeman-Carroll method, Sharp-Wentworth method.

INTRODUCTION

The synthesized copolymer showing numerous applications and properties attracting much attention of scientist [1, 2]. Copolymers resin has been become subjects of interest and are found to be amorphous, crystalline or resinous in nature [3,4]. Phenolic resin have a large number of practical applications in the electronic controls, insulating materials,

protective adhesive, aerospace industries etc. because of their high thermal stability, heat and chemical resistance and electrical insulation properties [5-7]. A considerable attention has been paid in the past two decades to the synthesis of copolymer resin due to their exciting features such as high thermal stability. The properties may be profoundly affected by the presence of particular sequence of comonomers as well as of quite small proportion of additives and have been expensively studied, employing the method of thermo gravimetric analysis by several authors [8, 9]. Terpolymers of 4-hydroxybenzoic acid, thiourea with formaldehyde and 8-hydroxyquinoline, formaldehyde with pyrogallol have been reported in the literature [10, 11]. Jadhao et al. studied the thermal degradation of terpolymer resins derived from 2, 2-dihydroxy biphenyl, urea and formaldehyde [12].

Michael and coworker studied the synthesis, characterization and thermal degradation of 8-hydroxyquinoline, guanidine with formaldehyde terpolymer [13]. Thermal degradation of salicylic acid, ethylenediamine and formaldehyde has been studied by Masram et al. [14]. Belsare et al. studied the thermal degradation of terpolymer derived from 2-aminophenol, hexamethylenediamine with formaldehyde [15]. Hung et al. synthesized and studied the kinetics of thermal degradation of thermotropic (p-oxybenzoate-co-ethylene terephthalate) [16]. M. Karunakaran and C. Mangesh, synthesized copolymer by condensation of o-cresol and biuret with formaldehyde and TGA analysis was employed to study the thermal stability and kinetic data like activation energy of the copolymer resins [17].