

**THERMAL DEGRADATION STUDIES OF COPOLYMER OBTAINED FROM 2, 4-DIHYDROXYACETOPHENONE-GUANIDINE-FORMALDEHYDE.**

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**ABSTRACT**

Copolymer (DAPGF) has been synthesized utilizing the monomers 2,4-Dihydroxyacetophenone, guanidine and formaldehyde by the condensation polymerization reaction in the presence of 2M HCl as a catalyst using 1:1:2 molar ratios of reacting monomers. The structure of DAPGF copolymer has been elucidated on the basis of elemental analysis, and various physicochemical techniques, i.e., UV-Visible, FT-IR and <sup>1</sup>H-NMR spectroscopy. Detailed thermal degradation study of the new copolymer has been carried out to determine its thermal stability. Thermal degradation curve is discussed which shows various decomposition steps. The activation energy (*E<sub>a</sub>*) and thermal stability calculated by using the Sharp-Wentworth and Freeman-Carroll methods. Thermodynamic parameters such as entropy change ( $\Delta S$ ), apparent entropy change (*S\**) and frequency factor (*z*) have also been evaluated on the basis of the data of Freeman-Carroll method. The order of reaction (*n*) is found out to be 0.8.

**Keywords -** Synthesis; Polycondensation; Thermal; Kinetic parameter; Spectral methods.

**INTRODUCTION**

For the progression in the field of material science, copolymers found by numerous scientists have amazingly extraordinary applications. A large number of copolymers have been synthesized by various chemists in large amounts and discover huge applications like cement, bundling, covering in electrically stable materials, impetus, thermally stable materials [1,2], ion-exchangers [3,4], high dielectric constant for energy storage capacitors [5] and semiconductors which have many applications.[6]. A remarkable effort has been made to work on the nature of copolymer either by monomers or by changing different strategies. The thermal properties of various copolymers have been studied by utilizing the method of thermogravimetric analysis (TGA) by a wide range of scientists. S. Ullah et al had studied the Synthesis and thermal degradation studies of melamine-formaldehyde resin [7]. The thermal properties and behavior of newly synthesized copolymer derived from salicylic acid and thiosemicarbazone have been investigated by Kamlakar *et al* [8]. The thermal degradation and kinetics of terpolymer resin derived from p-hydroxybenzaldehyde, succinic acid with ethylene glycol were examined by A. Gupta and co-workers [9]. Thermogravimetric analysis of terpolymer resin derived from salicylic acid, hexamethylenediamine with formaldehyde was studied by D.T. Masram [10] and thermal analysis of 8-hydroxyquinoline and formaldehyde was done by P. E.P. Michael *et al* [11]. The thermal decomposition reaction of salicylic acid, diamionaphthalene with formaldehyde was investigated by D.T. Masram [12]. S. Butoliya *et al* have taken interest in the study of non-isothermal decomposition and kinetic analysis of 2,4-dihydroxybenzoic acid, the melamine-formaldehyde copolymer [13]. A thorough study of literature survey reveals that copolymer derived from substituted hydroxyl or acetyl group, propionyl group, and methoxy group with formaldehyde shows improved thermal resistance, electrical property, antimicrobial property, light-emitting property, and morphology.

The current study deals with the preparation of 2,4-dihydroxyacetophenone-Guanidine hydrochloride-formaldehyde copolymer in 1:1:2 molar extents. The structure of 2,4-DAPGF copolymer has been drawn based on elemental analysis and various physicochemical techniques, such as ultraviolet-visible spectroscopy, Fourier transforms infrared spectroscopy, <sup>1</sup>H-NMR spectroscopy. To study the thermal stability of DAPGF copolymer, detailed thermal degradation analysis has been carried out. The thermal degradation curve is discussed, which shows four decomposition steps. By using Freeman-Carroll method and Sharp-Wentworth methods, the activation energy (*E<sub>a</sub>*) and thermal stability are calculated.

**Materials:**

Entire synthetic substances such as 2,4-Dihydroxyacetophenone and guanidine hydrochloride were purchased from Central Scientific Company, Dharampeth, Nagpur, was of A.R. grade. The chemicals like Hydrochloride, formaldehyde, and dimethyl sulphoxide were used from the Post Graduate Department of chemistry, Kamla Nehru Mahavidyalaya, Nagpur, India.

**Synthesis of DAPGF Copolymer Resin**

2,4-Dihydroxyacetophenone[0.1mol], and Guanidine hydrochloride [0.1mol], were weighed properly using the