



Thermal Degradation Studies of High-Performance Copolymer Resin Derived From 8-Hydroxyquinoline, Acrylamide and Furfural

Megha Rangari^a, S S Rahangdale^b, Seema Shrivastava^c, Yashpal Rathod^d, Prajкта U Waghe^e & Wasudeo B Gurnule^{*}

^aDepartment of Chemistry, Kamla Nehru Mahavidyalaya, Nagpur 440 024, India

^bDepartment of Chemistry, Jagat Arts, Commerce and Indiraben Hariharbhai Patel Science College, Gondia 441 614, India

^cDepartment of Chemistry, Priyadarshini College of Engineering, Hingna Road, Nagpur 440 019, India

^dDepartment of Chemistry, J M Patel College, Bhandara 441 904, India

^eDepartment of Chemistry, Yashwantrao Chavan College of Engineering, Nagpur 441 110, India

Received: 8 June 2023; Accepted: 21 September 2023

Using the polycondensation process with acid medium as the catalyst, the monomers 8-hydroxyquinoline, acrylamide, and furfural were combined to form the copolymer 8-HQAF in a molar ratio of 1:1:2. Elemental analysis method were used to evaluate the molecular weight and composition of the organic copolymer. The structure was clarified through analysis of the FTIR, proton nuclear magnetic resonance (¹H NMR), and UV-visible spectra. SEM analysis was done on the copolymer's crystalline behaviour and surface characteristics (SEM). For the purpose of determining their method of disintegration and relative thermal stability, non-isothermal thermogravimetric analysis The Sharp-Wentworth (SW) and Freeman-Carroll (FC) approaches have been used to compute activation energy, frequency factor, and order of response. Both the Sharp-Wentworth and Freeman-Carroll approaches for calculating activation energy agree with one another.

Keywords: Activation energy, Copolymer, Morphology, Polycondensation, Resin Thermal degradation

1 Introduction

The synthesis of polymers using renewable resources has caught the interest of numerous researchers recently.¹ Numerous laboratory investigations on the synthesis, characterisation, structure, and thermal analysis of various polymers have been published.² Many kinetic parameters for the copolymer have been evaluated using the Freeman-Carroll and Sharp-Wentworth methods. The Arrhenius equation's assumptions that the thermal and diffusion barriers are minimal are particularly the foundation of the TGA study methodologies.³

Copolymers are a unique class of polymers noted for their many applications. These polymers can have crystalline, amorphous, or resinous structures in their natural state.⁴ Since copolymers hold a unique place in the field of polymer science, their utilisation for the current generation has significantly increased in recent years.⁵ Gupta and Co-workers have investigated the kinetics of the heat degradation of the polymers 2-amino-6-nitrobenzothiazole, melamine, and formaldehyde.⁶ The heat degradation of 8-hydroxyquinoline, formaldehyde, and acrylamide

terpolymer was studied by Michael *et al.*⁷ Thermal degradation of polymer made from formaldehyde, dithioamide, and 2,4-dihydrogen acetophenone was examined by Rahangdale and colleagues.^{8,9} It is significant to remember that the various approaches have all been developed while keeping the kinetic model in mind. As a result, it has been determined that the kinetic analysis of is a function of the reacted fraction.^{10,13} No copolymer has been synthesized utilising 8-hydroxyquinoline, acrylamide, and furfural, according to analyses of the literature. Consequently, in this study, we describe the structural characterisation, thermal degradation tests, and copolymer production.

2 Materials and Methods

2.1 Materials

Acrylamide, furfural, and 8-hydroxyquinoline acid were purchased from Central Scientific Company in Nagpur. Solvents like DMSO and HCl were purchased from Himedia. All compounds are pure grade and analytical grade.

2.2 Synthesis of 8-HQAF Copolymer Resin

8-Hydroxyquinoline-acrylamide- furfural (8-HQAF) copolymer was synthesised by polycondensation of

*Corresponding author (E-mail: wbgurnule@gmail.com)