

## Abstract

A wide variety of thermally stable polymers containing aromatic and heterocyclic rings are increasingly in demand as performance materials for industrial and aerospace applications. However, most of these polymers are difficult to process because of their high softening temperatures and insoluble nature in most organic solvents. To render these polymers processable many attempts have been made in the past for increasing their solubility by introducing flexible bondings in the polymer back-bone and bulky pendant groups on the main chain. In view of this, a programme for synthesizing difunctional monomers incorporating the above mentioned structural features was undertaken. Cyanuric chloride- a commercially available and an inexpensive chemical- was utilized as the starting material for the synthesis of all the monomers. The choice of s-triazine nucleus is based on its high thermal stability derived from its molecular symmetry and aromaticity. The work has been presented in six chapters.

**CHAPTER 1 s-Triazine Containing Difunctional Monomers** For enhancing solubility, flexible and/or pendant groups have been incorporated in the polymer backbone by synthesizing polymers from monomer pairs containing these groups. The metaoriented structural features in the functional monomers are also responsible for enhancing the solubility of the resulting polymers. This chapter describes the synthesis of a series of new monomers such as diacids, diacid chlorides, diisocyanates and dialdehydes by condensation of 2,4-dichloro-6-methoxy-s-triazine, 2, 4-dichloro-6-phenoxy-s-triazine, 2, 4-dichloro-6-phenyl-s-triazine, and 4,6-dichloro-2-diphenylamino-s-triazine with p-/m-hydroxy benzoic acid and p-/m-hydroxy benzaldehyde. The cyanuric chloride derivatives readily underwent nucleophilic displacement of chloride ions by phenolate anion formed from p-/m-hydroxy benzoic acid and p-/m-hydroxy benzaldehyde. All these monomers were adequately characterized. These s-triazine containing monomers have been used for the synthesis of a host of polymers such as polyamides, polyimides, polyesters, polyurethanes and polyazomethines which are described in subsequent chapters.

**CHAPTER 2 Polyamides Containing ?-Triazine Rings in the Main Chain** Aromatic polyamides are in great demand as high performance fibers and plastic materials in recent years. However, they are difficult to process because of their limited solubility. A number of approaches have been tried in the past to modify aromatic polyamides in order to improve their processability with a considerable emphasis on solubility enhancement. Some success in enhancing the solubility of aromatic polyamides has been achieved by incorporation of flexible and/or pendant bulky groups in the polymer backbone with very little sacrifice in the thermal properties. In the present investigation polyamides have been synthesized by the Yamazaki. s direct phosphorylation reaction of s-triazine containing dicarboxylic acids having pendant phenyl and phenoxy groups with commercial diamines. The polyamides were characterized by elemental analysis, inherent viscosity, IR spectroscopy, solubility tests, X-ray diffraction studies and thermogravimetric analysis.

**CHAPTER 3 Polyimides Containing s-Triazine Rings in the Main Chain** Aerospace and electronic applications make polyimides very important as they possess outstanding properties like high thermal stability, high radiation resistance and excellent mechanical and electrical properties over a wide range of temperatures. This chapter details the synthesis and characterization of s-triazine containing polyimides by polycondensation of new s-triazine containing diisocyanates with pyromellitic dianhydride by solution polymerization method. The resulting polyimides were characterized by elemental analysis, IR spectroscopy, inherent viscosity, solubility tests, X-ray diffraction and thermogravimetric analysis.

**CHAPTER 4 Aromatic Polyesters Containing s-Triazine Rings in the Main Chain** Aromatic

polyesters (Polyarylates), a class of high performance engineering thermoplastics, have attracted attention as structural materials in number of industrial applications in the recent years. The structural features of polyarylates play an important role in determining their end properties. A great deal of efforts are being made to synthesize thermally stable and soluble aromatic polyesters. This chapter embodies the synthesis and characterization of polyarylates containing s-triazine rings in the main chain of the polymer by interfacial polycondensation of diacid chlorides containing s-triazine nucleus with diphenols. The polyarylates obtained were characterized by elemental analysis, inherent viscosity IR, <sup>1</sup>H-NMR spectroscopy, solubility tests, X-ray diffraction and thermogravimetric analysis.

**CHAPTER 5 Polyurethanes Containing s-Triazine Rings in the Main Chain** Polyurethanes are commercially important materials which are produced from diisocyanates and diols. The thermal stability of polyurethanes depends on the chemical structure of the monomers used during their preparation. Heterocyclic moieties have been incorporated in the polymer backbone for enhancing the service life of the polyurethanes at higher temperatures. This chapter presents the work on the synthesis of polyurethanes having s-triazine rings in the main chain derived from polyaddition of s-triazine containing diisocyanates with ethylene glycol. The resulting polyurethanes were characterized by elemental analysis, inherent viscosity, IR spectroscopy and solubility tests.

**CHAPTER 6 Polyazomethines Containing s-Triazine Rings in the Main Chain** Polyazomethines are an important class of thermally stable polymers for high performance fibers. A review of the literature reveals that polyazomethines synthesized so far are based on only a few dialdehydes and commercial diamines. This chapter describes the synthesis and characterization of polyazomethines by solution polycondensation of newly synthesized s-triazine containing dialdehydes with commercially available diamines in m-cresol. The polyazomethines obtained were characterized by elemental analysis, inherent viscosity, IR spectroscopy, solubility tests, X-ray diffraction studies and thermogravimetric analysis.