Synthesis of Some Polyimides by Different Methods

Firyal AL-Salami*

Date of acceptance 5/7/2005

Abstract

In this work the polyimides were prepared as thermally stable polymers by different ways. In order to perform the above mentioned project the following outlines are classified:

1. A- Preparation of a number of new N-substituted maleamic acids.
   B- Dehydration of above maleamic acids to their corresponding N-substituted maleimides.
   C- Polymerization of all the new maleimide monomers.
2. A- Preparation of N-substituted maleimides from reaction of maleimide with alkyl halides.
   B- Polymerization of N-alkyl substituted maleimide monomers.
3. A- Polymerization of maleimide compound free radically by using AIBN as initiator.
   B- Substitution of polyimide by using different alkyl halides.

All the prepared monomers and polymers were characterized by IR, UV spectra, elemental analysis, thermal analysis and chemical reaction. Physical properties and the viscosities for all polyimides were determined by using DMF as a solvent.

We concluded from all the results of different ways that the 3rd method gave the best result than the 2nd and the 1st methods, it gave higher molecular weight and higher softening point.

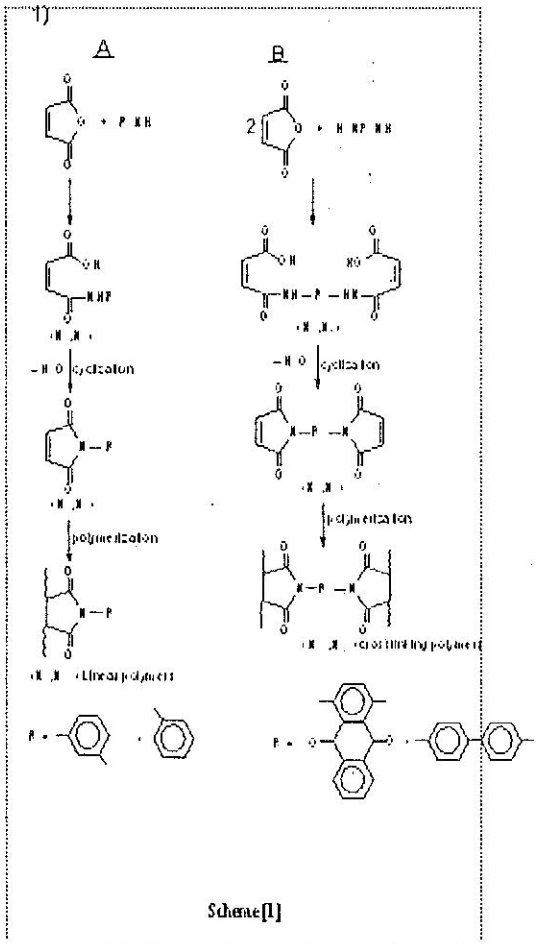
Introduction

Imides are organic compounds containing two carbonyl groups and one nitrogen atom. These compounds can be written by the general formula and could be as an open chain molecule or cyclic forms [1,2].

In 1901, Kuhara and Fukui [3] obtained n-phenyl phthalimide from reaction of acetyl chloride with n-phenyl phthalamic acid [2].

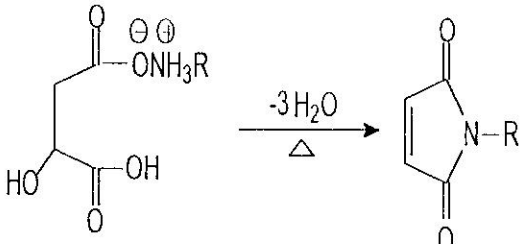
In 1959, Bender and Neven [3] isomerized the isoimides to maleimides by using acetate ion through nucleophilic attack by acetate ion.

Department of Chemistry , College of Science , Al. - Mustansiriya University , Baghdad,Iraq



Scheme[1]

N-Substituted maleimides [4] were prepared from ammonium salt of malic acid at high temperature.



General methods [5-14] for preparation of N-substituted cyclic imide include: -

A. Dehydration of Amic Acids Using Proper Dehydrating Agent such as:

1. Phosphorus pentoxide [7].
2. Phosphorus trichloride [7].
3. Acetic anhydride – sodium acetate [8,9].
4. Acetyl chloride [3,10,11].
5. Acetyl chloride with triethylamine [12].
6. Thionyl chloride [13,14].

B. Thermal Dehydration:

Thermal dehydration of N-substituted amic acids [15] produce low yields of corresponding imides.

C. Via Diels Alder Adducts [16]:

Frill prepared maleimides from heating maleic anhydride with cyclopentadiene to form the Diels Alder adduct which converted to the imide and heated with excess maleic anhydride at 400 °C. Hedaya and coworkers [17] used a similar method in preparing bis maleimide.

D. By Gabriel Type Synthesis:

N-Cinnamyl phthalimide [18] was prepared in high yield.

Polyimides prepared two types of polymers:

1. Chain growth-addition polymerization [19,20].
2. Chain growth-condensation polymerization [21].

Pyriadi and Fraih [22] prepared N-phenyl, N-p-tolyl, N-p-methoxy phenyl, N-o-ethyl phenyl and N-p-chloro phenyl itaconimides and polymerized