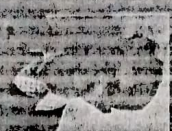




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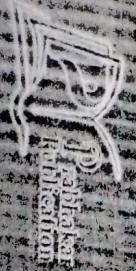


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Research Methodology Of Higher Education System In India During Covid 19 Pandemic Lockdown Situation

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Dr. Pranjit Kumar Bhuyan
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BLOCK AND GRAFT COPOLYMERS

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1. Copolymerisation :

Before we start with block or graft copolymers, it is very important to know about the copolymers and copolymerization process. Based on the type of monomer composition, polymers are classified into homopolymers and copolymers. Homopolymers are formed by polymerizing only one type of monomer. The incorporation of two different monomers, A and B, into a polymer chain in a statistical fashion leads to copolymers with properties which depend on the composition of the product and are normally intermediate between those of the parent homopolymers. The lengths of the sequences are determined by the relative reactivities of the two monomers. Copolymerization permits the synthesis of an almost unlimited range of polymers and is often used to obtain a better balance of properties for the commercial application of polymeric materials. Copolymers may be synthesized by chain growth and step growth condensation polymerization processes. In the chain growth copolymerization one or more types of monomers add to an active centre present in a growing polymer chain. Chain growth copolymerization may be done using various active centres, including free radical, ionic and Ziegler-Natta processes.

There are four basic copolymer structures- random, alternating, block and graft copolymers. Random copolymers have relatively random distributions of the two monomer units along the polymer chain. Alternating copolymers have the two monomer units, M_A and M_B , occurring in an alternating fashion. A block copolymer is a linear copolymer in which the monomers can be combined in a more regular fashion, by linking extended linear sequences of one to linear sequences of the other by end-to-end addition. A graft copolymer is a branched copolymer which consists of a main chain, with branch chains distributed in a random manner on it. Figure 1 shows the schematic structures of different types of block and graft copolymers.

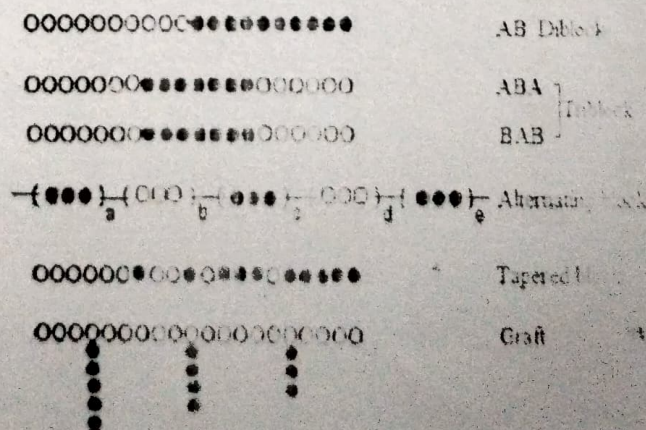


Fig.1: Types of block and graft copolymers.

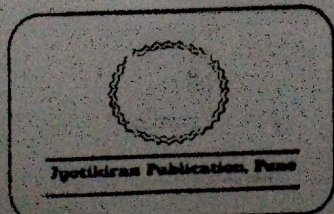
The properties of block and graft copolymers are determined by the length of

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BLOCK COPOLYMERISATION OF POLYURETHANE WITH STYRENE THROUGH LIVING RADICAL POLYMERIZATION

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Abstract :

Tetraphenyl ethane and its derivatives having a sterically hindered carbon-carbon single bond are known to act as thermal iniferters in free radical polymerization. Thus, polyurethane macroiniferters (PUMI) based on diphenyl methane-4,4'-diisocyanate (MDI), polypropylene glycol (PPG), M.W. 1000 and varying amount of 1,4-Butanediol (BD) and/ or 1,1,2,2-Tetraphenyl ethane diol (TPED) as chain extender have been synthesized using methyl ethyl ketone (MEK) as solvent. The reactions were catalysed by dibutyl tin dilaureate (DBTDL). These polyurethane macroiniferters were then used to synthesize polyurethane-block-polystyrene copolymers (PUMI-b-PS) through thermally induced living radical polymerization. The homopolymers, polystyrene (PS) were also removed by Soxhlet extraction with methanol and acetone. Polyurethane macroiniferters and the corresponding block copolymers were characterized by FTIR, SEM measurements.

Key words : Block copolymer, living radical polymerization, polyurethane, thermal iniferter, SEM.

Introduction:

Polyurethanes are a broad class of polymers having only one aspect in common, the presence of urethane linkage. But the urethane linkage may constitute only a portion of the total number of linkages in the polymer chain. By changing the nature of the diisocyanate, low molecular weight diol and macrodiol, a variety of hard and soft segments, having different compositions and chemical structures can be attained. This results in the alteration of the physical properties and morphology of the polyurethanes. It is this potential for tailoring the properties of polyurethanes to suit a specific purpose, has made it a highly versatile class of polymer. There is a good deal of current interest in the chemistry and technology of linear, branched, grafted, network polyurethanes and number of review articles have appeared (Adibi, George & Barrie, 1979; Otsu & Kuriyama, 1985)¹⁻². Linear segmented polyurethanes, which are essentially block copolymers made up of hard and soft chain segments in an alternating fashion, exhibit many of the properties of crosslinked elastomers and are of particular importance. In recent years, a number of polymeric system based on reversible termination of growing radicals were reported in order to improve the radical polymerization, such as iniferters (Otsu & Matsumoto, 1982)³

where the some species served the purpose of initiator, transfer agent and/or terminator. Iniferters may be activated both by thermal and photochemical means. When an iniferter is used as an initiator, living radical polymerization can be carried out using the same mild reaction condition as in general radical polymerization reaction. The thermally and photochemically labile iniferters (Zhu & Li, 2005; Guan et.al., 2000)⁴⁻⁵ were used for the preparation of block and graft copolymers. Recently, polymethacrylic acid and polymethyl methacrylate prepared with the polyurethane iniferter have been reported (Bhuyan & Kakati, 2009)⁶. Most of the thermal iniferters containing carbon-carbon bonds are symmetrically disubstituted tetraphenylethane derivatives which were reported in the earlier work (Chen et.al., 2000)⁷. The living radical nature of a kind of polyurethane iniferter prepared from diisocyanate and 1,1,2,2-tetraphenyl-1,2-ethanediol (TPED) was reported by some workers (Tharanikkarasu & Radhakrishnan, 1994)⁸.

In this paper, we describe the synthesis of variety of polyurethane macroiniferter (PUMI) by varying the percentage of 1,1,2,2-tetraphenyl-1,2-ethanediol (TPED) and 1,4-butanediol (BD) with 4,4'-diphenylmethanediisocyanate (MDI). Tetraphenyl ethane and its derivatives having a