Copolymerization studies of methyl methacrylate-styrene and acrylonitrile-styrene.

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ABSTRACT

The synthesis of methyl methacrylate-styrene (MMA-ST) copolymers has been carried out using three different types of initiating system. The first type, leading to free radical copolymerization, involved the use of benzoyl peroxide as the initiator at 60°C, whilst the second, resulting in anionic copolymerization, employed butyl lithium in benzene as the catalyst at -50°C; finally, the third type, that of cationic copolymerization, utilized aluminium trichloride in nitrobenzene as the catalyst at 25°C. Subsequently, the relative compositions of copolymers prepared via these three routes were studied by infrared (IR) and nuclear magnetic resonance (NMR) spectroscopy.

Experimentally, the composition of a copolymer chain, in terms of the mole fractions of MMA and ST which comprise
it, depends on the concentration ratio of the initial monomer feed and also on the monomer reactivity ratios. IR spectra of the copolymers, exhibiting, as they do, a carbonyl stretching vibration (from MMA) at 5.76 μm and an aromatic band (from ST) at 6.15 μm, indicate that a linear relationship exists between the absorbance ratio of these two peaks and the copolymer (MMA:ST) composition. Furthermore, IR analysis has also been able to demonstrate that whereas equimolar monomer concentrations of MMA and ST do, in actual fact, lead to roughly 50:50 free radical copolymer compositions, equimolar MMA:ST anionic and cationic reactions yield copolymers into which are incorporated much more and much less MMA respectively than would have been expected. The reasons for this are clearly associated with the electronic structures of the two monomers which, on the one hand, sees MMA strongly activated towards anionic initiation, by virtue of its electron-withdrawing methacrylate group, yet correspondingly deactivated when it comes to cationic initiation - and vice versa, although to a lesser extent, for styrene.

At the same time, NMR analysis of the copolymers was able to confirm these findings through resonance area ratioing of the methoxy proton resonance (from MMA) at 3.6 ppm and the aryl proton resonance (from ST) at 6.3-7.3 ppm.
Finally, this copolymerization study was extended to include acrylonitrile-styrene (ACN-ST) copolymers, prepared most easily by benzoyl peroxide initiated free radical means. However, the ACN-ST copolymers prepared in this and other ways proved to be less amenable to compositional analysis due to their generally lower solubility in common IR film-forming and NMR solvents.
ทำการเตรียมอนิลิน methyl methacrylate-styrenes (MMA-ST) copolymers โดยใช้ initiators บางตัว แบบ แบบ格尔เรก free radical copolymerization โดยใช้ benzoyl peroxide เป็น initiator ที่ 60°C แบบสองลีก anionic copolymerization ใช้ butyl lithium ใน benzene เป็น catalyst ที่ -50°C ดูทำให้เป็นแบบที่กล่าวถึง cationic copolymerization ใช้ aluminium trichloride ใน nitrobenzene เป็น catalyst ที่ 25°C ทำ องค์ประกอบหลักของ copolymers ได้เรียบง่าย ๆ แบบนี้นำมาทำให้ infrared (IR) และ nuclear magnetic resonance (NMR) spectroscopy จากการกระจายอยู่ของ copolymer chains ประกอบด้วย molecule fraction ของ MMA และ ST อาจจะ ๆ ทำให้ปริมาณที่มีความคงที่เป็นน้อย monomers บางตัวที่เกี่ยวข้อง และ monomer reactivity ratios. IR spectra ของ copolymers ปรากฏเฉพาะที่ง่าย caronyl stretching vibration (จา MMA) ที่ 5.78 μm และ aromatic band (จาก ST) ที่ 6.25 μm เพาะที่ผ่าน
The copolymer (MMA:ST) composition and its effects on the absorbance were studied. The monomers were polymerized using free radical, anionic, and cationic polymerization. In the copolymer composition, MMA- ST was 30:70, with equal amounts of MMA and ST units. The resulting copolymer chain consists of a methoxy and methacrylate group.

Infrared spectroscopy and NMR spectroscopy were used to determine the methoxy proton resonance (MMA) at 3.6 ppm and the aryl proton resonance (ST) at 6.3-7.3 ppm.

Copolymerization was carried out with acrylonitrile-styrene (ACN-ST) copolymers using benzoyl peroxide as the initiator. The resulting copolymers were analyzed using IR spectroscopy and NMR spectroscopy. The results showed that the properties of the copolymers were influenced by the composition and structure.