



In situ Catalytic Bulk Copolymerization of Maleate Surfmer-Methyl Methacrylate Using TiO₂ and V₂O₅ at Different Conditions

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ABSTRACT

A remarkable number of studies were undertaken on the polymerization of surfmers. Surfmers have the advantage of combining the physical behavior of surfactants with the reactivity of monomers. A huge kind of surfmer structures that vary in terms of polar functional groups (lipophilic and hydrophilic balance) and the location of the polymerizable moiety have been identified. Examples include cationic, anionic, nonionic and zwitterionic surfactants. The conventional polymerizable compounds that have been used include acrylic, styrene, acrylamides and methacrylic. The polymerizable surfactants are interesting in diverse fields. Several investigations were carried out on maleic anhydride copolymers to be used as polymeric surfactants. It was declared for many years that maleic anhydride shows only a small tendency for radical polymerization, while 1,2-disubstituted ethylene does not polymerized. We used different radical initiators in order to polymerize the maleic anhydride and obtained a polymer which consists mainly of cyclopentanone derivatives by partial decarboxylation. Schneider and Heseding prepared homopolymer of maleic anhydride by γ -irradiation. The polymer acquired by initiation through irradiation showed the structure of anhydride without discoloration and decarboxylation. Catalytic methods enable the production of many materials inclusive of

polymers, pharmaceuticals, detergents, plastics and many others.

Nonionised Maleate surfmer (M1) is prepared by using ring opening method of maleic anhydride followed by esterfaction of polyethylene glycol. Surfmer was copolymerized and homopolymerized with methyl methacrylate (M2) at different conditions using V₂O₅ and TiO₂ as catalysts in presence of N₂ or O₂. The chemical shape of the prepared surfmer was established by ¹³C, FTIR and ¹HNMR. After cleaning polymers, the copolymers which are produced was also characterized and confirmed by Gel Permeation Chromatography (GPC). Additionally, thermal gravimetric analysis (TGA) indicated lower thermal stability for pure PMMA relative to M1M2TN and M1M2VO composites. Transmission electron microscope and Scanning electron microscope (TEM and SEM) for M1M2TN and PMMA may confirm homogeneous and controlled enchainment of M1-M2 copolymer at the optimum conditions using TiO₂. The % of polymer conversion was calculated and discussed. The ideal conditions resulted in 64.2% and 63.8% conversion using 10% of V₂O₅ in O₂ and 20% of TiO₂ in N₂ respectively at 80°C after 4h with M1/M2 molar ratio of 1:1. The properties of interfacial tension for the prepared surfmer and its copolymer were evaluated.

Keywords: Catalytic copolymerization; Maleate surfmer; Methyl methacrylate; Interfacial Tension; HNMR