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A New Approach for Preparation of Super Absorbent Polymers: In-Situ Surface Cross-Linking

Authors : Reyhan Özdoğan, Mithat Çelebi, Özgür Ceylan, Mehmet Arif Kaya

Abstract : Super absorbent polymers (SAPs) are defined as materials that can absorb huge amount of water or aqueous solution in comparison to their own mass and retain in their lightly cross-linked structure. SAPs were produced from water soluble monomers via polymerization subsequently controlled crosslinking. SAPs are generally used for water absorbing applications such as baby diapers, patient or elder pads and other hygienic product industries. Crosslinking density (CD) of SAP structure is an essential factor for water absortion capacity (WAC). Low internal CD leads to high WAC values and vice versa. However, SAPs have low CD and high swelling capacities and tend to disintegrate when pressure is applied upon them, so SAPs under load cannot absorb liquids effectively. In order to prevent this undesired situation and to obtain suitable SAP structures having high swelling capacity and ability to work under load, surface crosslinking can be the answer. In industry, these superabsorbent gels are mostly produced via solution polymerization and then they need to be dried, grinded, sized, post polymerized and finally surface croslinked (involves spraying of a crosslinking solution onto dried and grinded SAP particles, and then curing by heat). It can easily be seen that these steps are time consuming and should be handled carefully for the desired final product. If we could synthesize desired final SAPs using less processes it will help reducing time and production costs which are very important for any industries. In this study, synthesis of SAPs were achieved successfully by inverse suspension (Pickering type) polymerization and subsequently in-situ surface cross-linking via using proper surfactants in high boiling point solvents. Our one-pot synthesis of surface cross-linked SAPs invovles only one-step for preparation, thus it can be said that this technique exhibits more preferable characteristic for the industry in comparison to conventional methods due to its one-step easy process. Effects of different surface crosslinking agents onto properties of poly(acrylic acid-co-sodium acrylate) based SAPs are investigated. Surface crosslink degrees are evaluated by swelling under load (SUL) test. It was determined water absorption capacities of obtained SAPs decrease with the increasing surface crosslink density while their mechanic properties are improved.

Keywords : inverse suspension polymerization, polyacrylic acid, super absorbent polymers (SAPs), surface crosslinking, sodium polyacrylate
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