Research on the Synthesis of Super Absorbent Polymer Materials From Tapioca Starch and the Applicational Production of Flame-Retardant Hydrogel

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Fire has always been a significant concern, causing substantial damage annually. An effective approach to address this issue is to conduct research and develop effective flame-retardant materials, including flame-retardant hydrogels. However, previous generations of hydrogels still have certain disadvantages. In this project, our main purpose is to synthesize a super water-absorbent polymer material from tapioca starch (a natural compound) and then fabricate flame retardant hydrogels that can prevent and extinguish fires effectively. The synthesis of super absorbent polymer material through free radical copolymerization was conducted, followed by an evaluation of its characteristic properties using various measurements such as Scanning Electron Microscope, Thermal Gravimetric Analysis, FTIR spectroscopy, and the tea bag method which is used for assessing water absorption. Subsequently, hydrogels were manufactured using the oil-in-water emulsification method. The adhesion on different materials and the ability to prevent and extinguish fires of hydrogels were evaluated through small-scale and large-scale experiments conducted both in the laboratory and the field. In summary, a super absorbent polymer material with a network structure, a porous surface with many micro-capillaries which is suitable for water absorption, and has thermal stability has been synthesized, and hydrogel from the material is capable of preventing and extinguishing fires well.

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