

poly(N-Isopropylacrylamide)-Polyvinyl Alcohol Semi-Interpenetrating Network Hydrogel for Wound Dressing

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Abstract : Traditional wound dressings, such as gauze, bandages, etc., are easy to adhere to the tissue fluid exuded from the wound, causing secondary damage to the wound during removal. This study takes this as the idea to develop a hydrogel dressing, to explore that the dressing will not cause secondary damage to the wound when it is torn off, and at the same time, create an environment conducive to wound healing. First, the temperature-sensitive material N-isopropylacrylamide (NIPAAm) was used as the substrate. Due to its low mechanical properties, the hydrogel would break due to pulling during human activities. Polyvinyl alcohol (PVA) interpenetrates into it to enhance the mechanical properties, and a semi-interpenetration (semi-IPN) composed of poly(N-isopropylacrylamide) (PNIPAAm) and polyvinyl alcohol (PVA) was prepared by free radical polymerization. PNIPAAm was cross-linked with N,N'-methylenebisacrylamide (NMBA) in an ice bath in the presence of linear PVA, and tetramethylhexamethylenediamine (TEMED) was added as a promoter to speed up the gel formation. The polymerization stage was carried out at 16°C for 17 hours and washed with distilled water for three days after gel formation, and the water was changed several times in the middle to complete the preparation of semi-IPN hydrogel. Finally, various tests were used to analyze the effects of different ratios of PNIPAAm and PVA on semi-IPN hydrogels. In the swelling test, it was found that the maximum swelling ratio can reach about 50% under the environment of 21°C, and the higher the ratio of PVA, the more water can be absorbed. The saturated moisture content test results show that when more PVA is added, the higher saturated water content. The water vapor transmission rate test results show that the value of the semi-IPN hydrogel is about 57 g/m²/24hr, which is not much related to the proportion of PVA. It is found in the LCST test compared with the PNIPAAm hydrogel; the semi-IPN hydrogel possesses the same critical solution temperature (30-35°C). The semi-IPN hydrogel prepared in this study has a good effect on temperature response and has the characteristics of thermal sensitivity. It is expected that after improvement, it can be used in the treatment of surface wounds, replacing the traditional dressing shortcoming.

Keywords : hydrogel, N-isopropylacrylamide, polyvinyl alcohol, hydrogel wound dressing, semi-interpenetrating polymer network

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