HIGH STRENGTH HYDROGEL COMPOSITE PREPARED FROM POLYVINYL ALCOHOL/COTTON WOVEN FABRIC

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ABSTRACT

Hydrogels are biocompatible materials that can hold vast amount of water in their structures and exhibit a tremendous amount of swelling property without dissolving in the water. Because of the aforementioned properties, hydrogels have been used and being a promising material for different biomedical applications including drug delivery, tissue engineering, wound dressing, hygiene products, etc. Because the strength of borax crosslinked PVA based hydrogel is extremely week, its handling, processing and usage are very challenging, and it can be torn or broken easily event with an applied small amount of forces. Reinforcing the hydrogel with a biocompatible material which has a higher tensile properties provides advantages to hydrogel for handling, processing and usage. In this study, woven fabric constructed from polyvinyl alcohol (PVA) and cotton yarns were produced by using cotton as warp and cotton and PVA as weft yarns. As-produced woven fabrics were processed with a previously prepared aqueous borax solution in an ambient condition. Since PVA is a water soluble polymer and can transform into hydrogel structure when it is treated with aqueous borax, all PVA yarns in the woven fabric were converted into gel structure and stayed as matrix with cotton fabric reinforcement. Finally, cotton fabric reinforced hydrogel composite was obtained. Mechanical properties of hydrogel composites with different water content in them were investigated. Mechanical results revealed that breaking force of hydrogel composite structure were enhanced when they released water, and maximum breaking force was observed at their dried forms at both warp and weft directions. Breaking force at the hydrogel composites were 149.2 and 214.5 N at warp and weft directions when the composites contained water (100 wt. %). After releasing water from the structures and dried, breaking forces of the hydrogel composites dramatically increased up to 236.6 and 388.9 N at warp and weft directions. The produced fabric reinforced hydrogel composite can be used for biomedical applications.