

Sericin Ameliorates the Properties of Poly(Vinyl Alcohol) Hydrogel Prepared by Simple Repeated Freeze-Thaw Process without the Use of Chemical Crosslinking

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Abstract—Hydrogel of polyvinyl alcohol (PVA) and sericin can be easily produced using a repeated freeze-thaw process. The effects of polymer concentration (4-8 %wt), blending ratio of PVA/sericin (100/0-50/50), and the number of freeze-thawing cycle (4, 8, and 12 cycles) on chemical and physical properties of the hydrogels obtained were studied. We here showed that higher polymer concentration, higher PVA ratio, and more cycles of freeze-thawing produced the hydrogels with high gel fraction (>90), wall-like structure, and high compressive modulus (100-170 kPa). When the sericin ratio was increased, the hydrogels showed less gel fraction (60-80), more porous structure with highly interconnected pores, and better swelling ability (up to 8-9 times of its original state). The formation of the PVA/sericin hydrogels was occurred by the conformational changes of both PVA and sericin. The secondary structures of PVA and sericin turned to more stable crystalline conformation during the freeze-thawing process, as confirmed by fourier transform infrared (FTIR) spectroscopic results. Furthermore, all hydrogels were not toxic to human skin keratinocytes (HaCaT) cells while the anti-oxidant activity of sericin component in hydrogels was confirmed. We concluded that the freeze-thawing process was a simple and effective technique for fabrication of PVA and sericin, which both are water-soluble, into the stable hydrogels without the use of any chemical solvents or further crosslinking. More importantly, sericin enhances the biological activities of the hydrogels, allowing the use of this hydrogel in various medical applications such as wound dressing.

Index Terms— freeze-thaw; sericin; PVA; hydrogel; conformation; anti-oxidant.