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Abstract
In this study, polyacrylic acid-alginate-silica (PAA-Alg-Si) hydrogel to be used as a substitute for cartilage of knee joint was prepared by UV polymerization. The physical properties of the prepared hydrogels were characterized, including mechanical strength, morphology, friction coefficient, and swelling ratio. The results of mechanical properties indicate that the stiffness and compressive strength of hydrogels increased with the increase of silica content. When 24 % (w/w) of silica was incorporated into the hydrogel, its stiffness and compressive strength reached 0.73 MPa and 12 MPa, respectively. From, SEM, porous hydrogels with more compact structure than others was observed when silica was incorporated. The compressive storage modulus (E’, (0.39～4.12)×104 Pa), shear storage modulus (G’, (0.003~0.36)×104 Pa), and crosslinking density ((0.92~4.21)×10-5 mole/cm3) were all increased with the increasing hardness of hydrogels. The surface of Silica incorporated hydrogel was smoother than others with a friction coefficient of 0.3×10-3. The prepared PAA-Alg-Si hygrogels in this study were very hydrophilic with swelling ratios ranging from 5.98 to 15.81 w/w and water content above 90%, which are accordant with the nature of cartilage. Adipose stem cells were seeded on the hydrogel to examine its bioavailability. From MTS assay and SEM observation, all indicate that cell numbers increased with the time of incubation. Cell counts prove that the PAA-Alg-Si hydrogels all accord with 25%~40% of the safe ranges. The preliminary result of cell culture indicates that the prepared PAA-Alg-Si hydrogels are good for cell attachment and growth of stem cells. Based on the above results, the PAA-Alg-Si hydrogels prepared in this study are feasible to be used as a substitute for cartilage repair.
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