Advancing Kappa-Carrageenan Hydrogels: Novel Exopolysaccharide Integration for Superior Mechanical Properties

Cho, Inu (School: Palos Verdes Peninsula High School)

Algae-derived Kappa-carrageenan (?CG) hydrogels show potential as renewable, biocompatible, and versatile materials for application in tissue engineering. It also gels easily with hydrogen bonds, but is limited due to its lack of mechanical durability. This project presents the mechanical improvement when exopolysaccharides (EPS), extracted from Chlorella vulgaris, are added to ?CG hydrogels. First, EPS was extracted from Chlorella vulgaris through a precipitation reaction with 75% ethanol alcohol and this was added to solutions of 2.5% ?CG. These gels were heated, stirred, and cast into identical molds. Four primary sections of data were collected throughout the experimental period. Tensile and compression tests were performed, measuring newtons (N), cross sectional area, change in distance, and change in diameter. Additionally, a creep test of stress compliance was performed, measuring change in force (N) over time, as well as a frictional test, measuring the initial and kinetic coefficient of friction. It was discovered that compared to the control group, the 2% EPS caused a 121% increase in maximum stress. =2% EPS caused a 120% increase in stress compliance and the 1% EPS had a 1.89% increase in elasticity. Finally, the 3% EPS caused a 16.16% decrease in coefficient of friction. These results show valuable insight on the potential of algal extracts in hydrogels for tissue engineering. The improvement on durability while reducing friction and retaining elasticity make ?CG hydrogels better suited for application in a variety of tissue engineering disciplines, from cartilage and joint repair to scaffolds.

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