

CYCLODEXTRINES AS AN MODIFYING AGENT FOR PROTEIN MATRICES

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Introduction

Cyclodextrins (CD) are a cyclic oligosaccharides consisting of 6, 7 or 8 glucose units. The characteristic distribution of hydroxyl groups causes that the cyclodextrins have a hydrophobic interior and a hydrophilic outer part. This makes them a useful chelating molecules that can form inclusion complexes with various compounds [1-2]. Due to the presence of polar groups on the outside of the cyclodextrin ring, they can also interact ionically with biopolymers and stabilize polymer network.

The aim of our work was to investigate the influence of β -cyclodextrins addition on protein hydrogel properties.

Materials and Methods

The collagen was extracted in our laboratory from rat tail tendons and elastin from porcine aortas. The blends containing collagen and 5% and 10% of elastin were prepared. The 5% and 10% of β -cyclodextrin (Sigma-Aldrich) was add to protein solutions. The mixtures were incubated 30 min on magnetic stirrer and then dialyzed against deionized water.

Results and Discussion

The addition of β -cyclodextrin slightly improve mechanical properties of collagen/elastin hydrogels, when 5% of CD is used (TABLE 1). It is surprising, that the temperature of the second step of thermal degradation decrease for collagen gel and increase for collagen/elastin blends with CD addition. In all cases, the weight loss is lower after modification. Moreover, there was no negative effect of CD addition on cell viability on collagen/elastin hydrogels.

TABLE 1. Young's Modulus and parameters of the second step of thermal degradation of collagen/elastin gel modified by CD addition.

Sample	E [kPa]	Thermal degradation	
		Temp [°C]	Weight loss [%]
Coll	8.04±2.93	322	62.3
Coll-5CD	9.66±2.92	319	61.0
Coll-10CD	9.48±2.88	320	54.6
95Coll-5EI	7.95±3.03	317	64.0
95Coll-5EI-5CD	10.71±3.34	323	62.5
95Coll-5EI-10CD	7.94±2.89	323	62.6
90Coll-10EI	6.99±2.22	321	64.6
90Coll-10EI-5CD	7.11±2.81	323	61.8
90Coll-10EI-10CD	5.32±1.60	314	62.2

Conclusions

The ionic interactions between CD and collagen and elastin slightly improve hydrogels mechanical properties. The gels containing 5% CD are stiffer than materials with higher CD addition. The increase of the temperature of thermal degradation of collagen/elastin blends is also observed. It would be caused by the presence of higher amount positively charged functional groups in elastin than in collagen. The materials modified by CD are well tolerated by 3T3 cells.

References

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