

论文

负载蛋白质的胶原/聚两性电解质IPN角膜替代物

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摘要:

以碳二亚胺/*N*-羟基琥珀酰亚胺(EDC/NHS)和聚乙二醇二丙烯酸酯(PEGDA)为交联剂分别对猪皮去端肽 I 型胶原和3-(甲基丙烯酰胺)丙基-二甲基(3-磺丙)胺(MPDSAH)进行交联, 制备了具有互穿聚合物网络(IPN)结构的角膜替代物. 胶原基IPN角膜替代物的折光指数和白光透过率与天然人角膜相似. IPN水凝胶具有优于纯胶原凝胶的力学性能, 同时PMPDSAH网络的引入明显提高了IPN凝胶在胶原酶中的稳定性. 体外细胞培养实验结果表明, IPN角膜替代物支持人角膜上皮细胞生长. 通过冷冻干燥-溶胀后包覆技术可将牛血清白蛋白(BSA)和神经生长因子(NGF)装载到角膜替代物中, 负载药物的冻干凝胶可干态保存, 避免了湿态下蛋白质等活性因子的失活和漏泄; 再吸水恢复原状的特性可使角膜替代物完好地移植病灶部位, NGF具有良好的缓释效果. 此负载NGF的复合角膜替代物有望促进角膜组织和神经的再生.

关键词: 去端肽胶原; 角膜替代物; 互穿聚合物网络; 水凝胶; 神经生长因子

Corneal Substitutes of Protein-loaded Collagen/Polyzwitterion IPN

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Abstract:

Collagen/polyzwitterion IPN based corneal substitutes were fabricated by crosslinking porcine type I atelocollagen and *N*-[3-(methacryloylamino)propyl]-*N,N*-dimethyl-*N*-(3-sulfopropyl) ammonium hydroxide (MPDSAH) with 1-ethyl-3-(3-dimethyl aminopropyl) carbodiimide/*N*-hydroxysuccinimide and poly(ethylene glycol) diacrylate (PEGDA), respectively. The white light transmission and refractive indices of IPN corneal substitutes were similar to those of natural human cornea. IPN hydrogels had superior mechanical properties and collagenase resistance compared to pristine collagen hydrogels. Human corneal epithelia grew well on the surface of IPN hydrogel. Bovine serum albumin(BSA) and nerve growth factor(NGF) were efficiently encapsulated in corneal substitute by freeze-drying and re-swelling, and drug-embedded xerogels could be stored in dry state, avoiding the denaturation and leakage of active factors in wet state. It is expected that the completely shape-recovered corneal substitutes after re-swelling can be implanted into diseased site. BSA and NGF were found to release from IPN hydrogel in a sustainable manner. NGF-loaded composite corneal substitute shows promise in promoting the regeneration of corneal tissue as well as nerve.

Keywords: Atelocollagen; Corneal substitute; Interpenetrating polymer network; Hydrogel; Nerve growth factor

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参考文献:

[1]Duan X. D., McLaughlin C., Griffith M., et al.. Biomaterials[J], 2007, 28(1): 78—88

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- [2]Zhong S. P., Teo W. E., Zhu X., et al.. Biomacromolecules[J], 2005, 6(6): 2998—3004
- [3]Newsome D. A., Foidart J. M., Hassell J. R., et al.. Invest. Ophthalmol. Vis. Sci.[J], 1981, 20(6): 738—750
- [4]Liu Y., Gan L., Carlsson D. J., et al.. Invest. Ophthalmol. Vis. Sci.[J], 2006, 47(5): 1869—1875
- [5]Liu Y., Griffith M., Watsky M. A., et al.. Biomacromolecules[J], 2006, 7: 1819—1828
- [6]Liu W., Merrett K., Griffith M., et al.. Biomaterials[J], 2008, 29: 1147—1158
- [7]Garrana R. M., Zieske J. D., Assouline M., et al.. Invest. Ophthalmol. Vis. Sci.[J], 1999, 40(6): 1266—1270
- [8]Liu W., Deng C., McLaughlin C. R., et al.. Biomaterials[J], 2009, 30(8): 1551—1559
- [9]Wang D. A., Williams C. G., Li Q. A., et al.. Biomaterials[J], 2003, 24(22): 3969—3980
- [10]CHEN Lie-Huan(陈列欢), LIU Wan-Shun(刘万顺), HAN Bao-Qin(韩宝芹), et al.. Chem. J. Chinese Universities(高等学校化学学报)[J], 2006, 27(5): 880—884
- [11]Zhang Y. Q., Zhang W. J., Liu W., et al.. Tissue Eng.: Part A[J], 2008, 14: 295—303
- [12]Lawrence B. D., Marchant J. K., Pindrus M. A., et al.. Biomaterials[J], 2009, 30(7): 1299—1308
- [13]Rezende R. A., Uchoa U. B. C., Raber I. M., et al.. Am. J. Ophthalmol.[J], 2004, 137(3): 415—419
- [14]Lynn A. K., Yannas I. V., Bonfield W.. J. Biomed. Mater. Res. Part B: Appl. Biomater.[J], 2004, 71(2): 343—354
- [15]Dai F. Y., Wang P. F., Liu W. G., et al.. Polymer[J], 2008, 49: 5322—5328
- [16]Ladd J., Zhang Z., Chen S. F., et al.. Biomacromolecules[J], 2008, 9(5): 1357—1361
- [17]Chang Y., Chen S. F., Zhang Z., et al.. Langmuir[J], 2006, 22 (5): 2222—2226
- [18]Cho W. K., Kong B.Y., Choi I. S.. Langmuir[J], 2007, 23 (10): 5678—5682
- [19]Bhang S. H., Lee T. J., Lim J. M., et al.. Biomaterials[J], 2009, 30(1): 126—132
- [20]Lambiase A., Manni L., Bonini S., et al.. Invest. Ophthalmol. Vis. Sci.[J], 2000, 41(5): 1063—1069
- [21]Jhaveri S. J., Hynd M. R., Dowell-Mesfin N., et al.. Biomacromolecules[J], 2009, 10(1): 174—183
- [22]Mandal B. B., Kapoor S., Kundu S. C.. Biomaterials[J], 2009, 30(4): 2826—2836
- [23]Zhao Y., Kang J., Tan T. W.. Polymer[J], 2006, 47: 7702—7710
- [24]Patel S., Marshall J., Fitzke F. W.. J. Refract. Surg.[J], 1995, 11(2): 100—105
- [25]Kourosh K., Sara F. D.. Polym. Adv. Technol.[J], 2005, 16: 659—666
- [26]Mary P., Bendejacq D. D., Labeau M. P., et al.. J. Phys. Chem. B[J], 2007, 111(27): 7767—7777
- [27]Han Y. A., Lee E. M., Ji B. C.. Fibers and Polymers[J], 2008, 9(4): 393—399
- [28]Myung D., Waters D., Wiseman M., et al.. Polym. Adv. Technol.[J], 2008, 19(6): 647—657
- [29]Kong B., Choi J. S., Jeon S., et al.. Biomaterials[J], 2009, 30(29): 5514—5522
- [30]Zhang Y., Zhu W., Wang B. B., et al.. J. Controlled Release[J], 2005, 105(3): 260—268
- [31]Kourosh K., Sara F. D.. Polym. Adv. Technol.[J], 2005, 16: 659—666

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