

研究论文

微波辐射增强改性三维壳聚糖棒材

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摘要: 通过微波辐射热致交联的方法增强改性三维壳聚糖棒材。结果表明, 辐射一定时间后发生的交联反应提高了壳聚糖溶液的旋转粘度; 继续增加辐射时间, 由于壳聚糖的热交联反应和热分解碳化同时并存, 壳聚糖溶液的旋转粘度反而下降了。交联和高温碳化对壳聚糖分子链产生化学和物理的固定作用, 使其吸水膨胀困难, 从而降低了壳聚糖棒材的吸水率。热交联反应使壳聚糖分子链间形成体型网络状结构, 从而有效地改善了三维壳聚糖棒材的力学性能。微波辐射4 min后, 壳聚糖棒材的弯曲强度和弯曲模量可达182.8 MPa、5.6 GPa, 比未辐射的壳聚糖棒材分别提高了97.8%、36.6%。

关键词: 有机高分子材料 生物材料 微波辐射 壳聚糖 增强改性

Three Dimensional Chitosan Rods Reinforced by Microwave Irradiation

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Abstract: The chitosan (CS) rods were reinforced by thermal cross-linking method through microwave irradiation. The results show that the rotary viscosity of CS solution was increased due to thermal cross-linking reaction, but much more irradiation time would decrease its solution viscosity because of thermal decomposition. Crystallinity of CS was reduced due to the formation of network structure. Bending strength and bending modulus of microwave irradiated CS rods maximized at 182.8 MPa and 5.6 GPa, increased by 97.8% and 36.6% respectively, compared with untreated CS rods. The improvement of mechanical properties can be attributed to the formation of network structure.

Keywords: organic polymer materials biomaterials microwave irradiation chitosan reinforcement

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参考文献:

- [1] TAO Mingtao, YU Xiangan, Research status and advances on the complex drug delivery system for the treatment of nonunion, *China Pharmacy*, 18(20), 1586(2007)
- [2] WANG Zhengmei, FAN Shuxian, XIE Xuejian, GAO Guizhi, Research progress on bone fracture internal fixation materials, *Journal of Nantong University Medical Sciences*, 25(3), 229(2005)
- [3] M. Van der elst, A.R.A. Dijkema, C.P.A.T. Klein, P. Patka, H.J.T.M. Haarman, Tissue reaction on PLLA versus stainless steel interlocking screws for fracture fixation: an animal study, *Biomaterials*, 16, 103(1995) 
- [4] C.M. Agrawal, K.A. Athanasiou, Technique to control pH in vicinity of biodegrading PLA-PGA implants, *Journal of Biomedical Materials Research*, 38(2), 105(1997)
- [5] K.S. Katti, D.R. Katti, R. Dash, Synthesis and characterization of a novel chitosan/montmorillonite/hydroxyapatite nanocomposite for bone tissue engineering, *Biomedical Materials*, 3(3), 34122(2008)
- [6] T. Honma, T. Senda, Y. Inoue, Thermal properties and crystallization behaviour of blends of poly(ϵ -caprolactone) with chitin and chitosan, *Polymer International*, 52(12), 1839(2003)
- [7] V.G. Mir, J. Heinamaki, O. Antikainen, O.B. Revoredo, A.I. Colarte, O.M. Nieto, J. Yliruusi, Direct compression properties of chitin and chitosan, *European Journal of Pharmaceutics and Biopharmaceutics*, 69(3), 964(2008)
- [8] B. Krajewska, Membrane-based processes performed with use of chitin/chitosan materials, *Separation and Purification Technology*, 41(3), 305(2005)
- [9] Y.C. Kuo, I.N. Ku, Cartilage regeneration by novel polyethylene oxide/chitin/chitosan scaffolds, *Biomacromolecules*, 9(10), 2662(2008)
- [10] HU Qiaoling, QIAN Xiuzhen, LI Baoqiang, SHEN Jiacong. Studies on chitosan rods prepared by in situ precipitation method, *Chemical Journal of Chinese Universities-Chinese*, 24(3), 528(2003)
- [11] L.Y. Lim, E. Khor, C.E. Ling, Effects of dry heat and saturated steam on the physical properties of chitosan, *Journal of Biomedical Materials Research*, 48(2), 111(1999)
- [12] J.M. Wasikiewicz, F. Yoshii, N. Nagasawa, R.A. Wach, H. Mitomo, Degradation of chitosan and sodium alginate by gamma radiation, sonochemical and ultraviolet methods, *Radiation Physics and Chemistry*, 73(5), 287(2005)
- [13] G. Cardenas, J. Diaz, M.F. Melendrez, C. Cruzat, Physicochemical properties of edible films from chitosan composites obtained by microwave heating, *Polymer Bulletin*, 61(6), 737(2008)
- [14] P. Wongpanit, N. Sanchavanakit, P. Pavasant, P. Supaphol, S. Tokura, R. Rujiravanit, Preparation and characterization of microwave-treated carboxymethyl chitin and carboxymethyl
- [15] chitosan films for potential use in wound care application, *Macromolecular Bioscience*, 5(10), 1001(2005)
- [16] JIANG Tingda, Chitosan, (Beijing, Chemical Industry Press, 2006) p.103
- [17] Q.L. Hu, B.Q. Li, M. Wang, J.C. Shen, Preparation and characterization of biodegradable chitosan/ hydroxyapatite nanocomposite rods via in situ hybridization: a potential material as internal fixation of bone fracture, *Biomaterials*, 25, 779(2004) 
- [18] Z.K. Wang, Q.L. Hu, L. Cai, Chitin fiber and chitosan 3D composite rods, *International*

- [19] WANG Zhengke, HU Qiaoling, LV Jia, WANG Youxiang, SHEN Jiacong, Chitosan rod reinforced with absorbent cotton fibers, Journal of Zhejiang University(Engineering Science), 43(7), 1312(2009)
- [20] HU Wenjie, HE Xueyin, DENG Yujie, XIE Feng, LIU Xiangyan, CHEN Mingjun. A clinical study on Dikfix absorbable internal fixation screws, Chinese Journal of Orthopaedic Trauma, 4(4), 258(2002)
- [21] G.O.Hofmann, F.D. Wagner, New implant designs for bioresorbable devices in orthopaedic surgery, Clinical Materials, 14(3), 207(1993)

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2. 赵名艳 李立华 周长忍 李贤.多级开孔壳聚糖海绵的细胞行为分析[J]. 材料研究学报, 2011,25(3): 243-248
3. 金剑 王雪 肖长发.用聚合--溶解--析出法制备强疏水性聚酯[J]. 材料研究学报, 2011,25(2): 165-171
4. 洪春双 李明春 辛梅华 谢峰 毛扬帆.壳聚糖固载环糊精--海藻酸钠凝胶球的制备和载药性能[J]. 材料研究学报, 2011,25(2): 135-140
5. 刘成龙,王猛,张春艳,王玥霖,曾荣昌,黄伟九.蛋白质作用下医用金属材料的腐蚀行为研究进展[J]. 材料研究学报, 2011,31(1): 10-17
6. 胡剑青 郑智贤 朱海军 涂伟萍 王锋.W/O/W复相乳液法合成多元氮丙啶/聚酯微胶囊的研究及表征[J]. 材料研究学报, 2010,24(6): 619-624
7. 解林坤 叶喜 吴章康 邓启平 柴希娟 梁艳君.低温等离子体对低密度聚乙烯(LDPE)薄膜表面改性的研究[J]. 材料研究学报, 2010,24(6): 661-666
8. 宋波 傅倩 刘小云 庄启昕 韩哲文.环境因素对PBO纤维老化的影响和储存寿命预测[J]. 材料研究学报, 2010,24(5): 487-492
9. 张治红 豆君 牛晓霞 闫福丰 彭东来 郑先君.等离子体聚对二甲苯的制备及其应用[J]. 材料研究学报, 2010,24(4): 353-357
10. 毛丽贺 王玉林 万怡灶 何芳 黄远.钛离子注入镁钙锌合金在SBF中的耐腐蚀性[J]. 材料研究学报, 2010,24(4): 383-388