Preparation and characterization of nano silver/chitosan composite membranes

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ABSTRACT

Chitosan salts were prepared by reacting chitosan with hydrochloride, nitric acid, and acetic acid, respectively. Chitosan salt aqueous solutions with concentration 0.5, 0.75, and 1.0 % (w/v) were further prepared and reacted with silver nitrate as well as glutaraldehyde. Solution casting method was used to prepare films. These films showed moisture absorptivity in a range between 16 and 29 %. The FESEM indicated that the size of a majority of the silver compound particles which were dispersed in the films ranged between 6 and 74 nm. Silver compound particles which dispersed in chitosan nitrate salt films had smaller average size than that which dispersed in chitosan hydrochloride salt films. The FTIR spectroscopy revealed that chitosan was crosslinked by glutaraldehyde. In contact angle measurement results, crosslined films had larger contact angle than that whitout crosslinked. Evaluation of tensile strength of films these were conducted using an rheometer. It was found that films with glutaraldehyde had higher tensile strength than that without glutaraldehyde. Elongation was increased with increasing the salt concentration, but decreased with increasing the glutaraldehyde content. From the impedance analysis results, it was found that the conductivity of membranes can be up to 1.2×10-3 S/cm.

Keywords : chitosan ; membranes ; conductivity ; tensile strength

Table of Contents

REFERENCES

1.白春禮。2002。納米科技現在與未來。頁28-37。凡異出版社。新竹，台灣。 2.吳建忠。2002。羧酸改質幾丁聚醣溶液物理性質:頁6-9。私立元智大學化學工程學系碩士論文。桃園。 3.李賢學。2004。化學還原法製備奈米銀及其應用:頁15-20。國立清華大學化學工程學系碩士論文。新竹。 4.李勳宜。1998。草蝦幾丁聚醣之製備及其應用研究:頁11-14。國立台灣大學食品科技研究所碩士論文。台北。 5.林景正、賴宏仁。1999。奈米材料技術與發展趨勢。工業材料 153:95-101。 6.徐世昌。2001。生物性高分子-幾丁質與幾丁聚醣之介紹與應用。化工資訊 15(2):36-45。 7.郭文正、曾添文。1991。薄膜分離。頁5-14。高立圖書有限公司。台北，台灣。 8.張立德。2002。奈米材料。頁5-10。五南圖書出版社。台北，台灣。 9.張立德、牟季美。2002。奈米材料和奈米結構。頁50-55。滄海書局。台中，台灣。 10.陳光華、鄧金祥。2005。奈米薄膜技術與應用。頁16-24。五南圖書出版社。台北，台灣。 11.黃德歡。2002。改變世界的納米技術。頁19-29。瀛舟出版社。台北，台灣。 12.鄭宗田、張憲彰、溫添進。1995。固態高分子電解質之研發與應用。化學 53(4):359-368。 13.羅吉宗。2004。薄膜科技與應用。頁4-7~4-11。全華科技圖書股份有限公司。台北，台灣。 14.顧寧、付德剛、張海黔。2003。奈米技術

與應用。頁26-28。滄海書局。台中，台灣。 15.龔建華。2002。影響世界、改變未來你不可不知的奈米科技。頁35-41。世茂出版社。台北，台灣。 16.Bough, W. A., Salter, W. L., Wu, A. C. M. and Perkins, B. E. 1978. Influence of manufacturing variables on the characteristics and effectiveness of chitosan products. I. Chemical composition, viscosity, and molecular-weight distribution of chitosan products. Biotechnology and Bioengineering. 20:1931-1943. 17.Cho, Y. I., No, H. K. and Meyers, S. P. 1998. Physicochemical characteristics and functional properties of various commercial chitin and chitosan products. Journal of Agricultural and Food Chemistry. 46:3839-3843. 18.Hornyak, G. L., Peschel, St., Sawitowski, Th. and Schmid, G. 1998. TEM, STM and AFM as tools to study clusters and colloids. Micron. 29(2-3):183-190. 19.Majid, S. R. and Arof, A. K. 2005. Proton-conducting polymer electrolyte films based on chitosan acetate complexed with NH4NO3 salt. Physica B. 355:78-82. 20.Mi, F. L., Huang, C. T., Liang, H. F., Chen, M. C., Chiu, Y. L., Chen, C. H. and Sung, H. W. 2006. Physicochemical, antimicrobial, and cytotoxic characteristics of a chitosan film cross-linked by a naturally occurring cross-linking agent, aglycone geniposidic acid. Journal of Agricultural and Food Chemistry. 54 (9):3290-3296. 21.Mima, S., Miya, M., Iwamoto, R. and Yoshikawa, S. 1983. Highly deacetylated chitosan and its properties. Journal of Applied Polymer Sciences. 28:1909-1917. 22.Mohamed, N. S., Subban, R. H. Y. and Arof, A. K. 1995. Polymer batteries fabricated from lithium complexed acetylated chitosan. Journal of Power Sources. 56:153-156. 23.Morni, N. M. and Arof, A. K. 1999. Chitosan-lithium triflate electrolyte in secondary lithium cells. Journal of Power Sources. 77:42-48. 24.Morni, N. M., Mohamed, N. S. and Arof, A. K. 1997. Silver nitrate doped chitosan acetate films and electrochemical cell performance. Materials Science and Engineering B. 45:140-146. 25.Osman, Z., Ibrahim, Z. A. and Arof, A. K. 2001. Conductivity enhancement due to ion dissociation in plasticized chitosan based polymer electrolytes. Carbohydrate Polymers. 44:167-173. 26.Percot, A., Viton, C. and Domard, A. 2003. Optimization of chitin extraction from shrimp shells. Biomacromolecules. 4:12-18. 27.Rockenberger, J., Scher, E. C. and Alivisatos, A.P. 1999. A new nonhydrolytic single-precursor approach to surfactant-capped nanocrystals of transition metal oxides. Journal of the American Chemical Society. 121:11595-11596. 28.Strathmann, H. and Kock, K. 1977. The formation mechanism of phase inversion membranes. Desalination 21 (3):241-255. 29.Thanpitcha, T., Sirivat, A., Jamieson, A. M. and Rujiravanit R. 2006. Preparation and characterization of polyaniline/chitosan blend film. Carbohydrate Polymers. 64:560-568. 30.Varum, K. M., Egelandsdal, B. and Ellekjar, M. R. 1995. Characterization of partially N-acetylated chitosans by near infra-red spectroscopy. Carbohydrate Polymers. 28:187-193. 31.Wan, Y., Creber, K. A. M., Peppley, B. and Bui, V.T. 2003. Ionic conductivity of chitosan membranes. Polymer. 44:1057-1065. 32.Yahya, M. Z. A. amd Arof, A. K. 2004. Conductivity and X-ray photoelectron studies on lithium acetate doped chitosan films. Carbohydrate Polymers. 55:95-100. 33.Yahya, M. Z. A. and Arof, A. K. 2003. Effect of oleic acid plasticizer on chitosan-lithium acetate solid polymer electrolytes. European Polymer Journal. 39:897-902. 34.Yahya, M. Z. A. and Arof, A. K. 2002. Studies on lithium acetate doped chitosan conducting polymer system. European Polymer Journal. 38:1191-1197. 35.Young, T. H., Wang, D. M., Hsieh, C. C. and Chen, L. W. 1998. The effect of the second phase inversion on microstructures in phase inversion EVAL membranes. Journal of Membrane Science. 146:169-178.