



## REFERENCES

- Aiba, S.-I. (1992). A convenient assay for chitinase that uses partially N-acetylated chitosans as substrates. Carbohydrate Research, 230, 373-376.
- Aiba, S.-I. (1993). Studies on chitosan : 6. Relationship between N-acetyl group distribution pattern and chitinase digestibility of partially N-acetylated chitosans. International Journal of Biological Macromolecules, 15, 241-245.
- Aiba, S.-I. (1994). Preparation of N-acetylchitooligosaccharides by hydrolysis of chitosan with chitinase followed by N-acetylation. Carbohydrate Research, 265, 323-328.
- Allan, G. G., and Peyron, M. (1997). Depolymerization of chitosan by means of nitrous acid. In R. A. A. Muzzarelli, & M. G. Peter (Eds.), Chitin Handbooks (pp 175-179). European Chitin Society.
- Andrade, A. L., Torikai, A., Kobatake, T. (1996). Spectral sensitivity of chitosan photodegradation. Journal of Applied Polymer Science, 62, 1465-1471.
- Belemie, E., Domard, A., Giraud-Guille, M.-M. (1997). Journal of Polymer Science: part A: Polymer chemistry, 35, 3181-3191.
- Biagini, G., Muzzarelli, R. A. A., Giardino, R., and Castaldini C. (1992). Biological materials for wound healing. In C. J. Brine, P. A. Sandford, & J. P. Zikakis (Eds.), Advances in Chitin and Chitosan (pp. 16-24). London: Elsevier Science Publishers Ltd.
- Blackwell, J. (1988). Physical methods for the determination of chitin structure and conformation. Methods in Enzymology, 161, 435-442.

- Bonvin, M. M., and de Bertorello, M. M. (1994). In vitro drug release from chitosan membranes. Polymer Bulletin, 37(2), 69-75.
- Brameld, K. A., Shrader, W. D., Imperiali, B., and Goddard III, W. A. (1998). Substrate assistance in the mechanism of family 18 chitinase : Theoretical studies of potential intermediates and inhibitors. Journal of Molecular Biology, 280, 913-923.
- Chandy, T., and Sharma, C. P. (1992). Chitosan beads and granules for oral sustained delivery of nifedipine: in vitro studies. Biomaterials, 13(13), 949-952.
- Chen, X., Li, W., Zhong, W., Lu, Y., and Yu, T. (1997). pH sensitivity and ion sensitivity of hydrogels based on complex-forming chitosan/silk fibroin interpenetrating polymer network. Journal of Applied Polymer Science, 65, 2257-2262.
- Deans, J. R., and Dixon, B. G. (1992). Bioabsorbents for wastewater treatment. In C. J. Brine, P. A. Sandford, & J. P. Zikakis (Eds.), Advances in Chitin and Chitosan (pp. 648-656). London: Elsevier Science Publishers Ltd.
- Defaye, J., Gadelle, A., and Pederson, C. (1989). Chitin and chitosan oligosaccharides. In G. Skjåk-bræk, T. Anthonsen, & P. Sandford (Eds.), Chitin and Chitosan (Sources, Chemistry, Biochemistry, Physical Properties and Applications) (pp.415-429). London: Elsevier Science Publishers Ltd.
- Desbrieres, J., and Rinaudo, M. (1997). Hydrophobic derivatives of chitin; Synthesis, characterization and properties. In A. Domard, G. A. F. Roberts, & K. M. Vårum (Eds.), Advances in Chitin Science Volume II (pp. 339-347). Lyon: Jacques André Publisher.
- Deuchi, K., Kanauchi, O., Imasato, Y., and Kobayashi, E, (1994). Decreasing effect of chitosan on the apparent fat digestibility by rats fed on a high-fat diet. Bioscience and Biochemistry, 589, 1613-1616.

- Felse, P. A., Panda, T. (1999). Regulation and cloning of microbial chitinase genes. Applied Microbiology and Biotechnology, 51, 141-151.
- Flach, J., Pilet, P.-E., and Joells, P. (1992). What's new in chitinase research. Experientia, 48, 701-716.
- Hart, P. J., Pfluger, H. D., Manzingo, A. F. , Hollis, T. , Robertos, J. D. (1995) Journal of Molecular Biology, 248, 402-413.
- Hendrickson, J., Bergeron, R. (1970). The protection and monoalkylation of amines. Tetrahedron Letters, 5, 345-348.
- Hirano, S., Ohe, Y., and Ono, H. (1976). Selective N-acetylation of chitosan. Carbohydrate Research, 47, 315-320.
- Hirano, S., Tsuchida, H., and Nagao, N. (1989). N-acetylation in chitosan and the rate of its enzymatic hydrolysis. Biomaterials, 10, 574-576.
- Hirano, S., Itakura, C., Seino, H., Akiyama, Y., Nomaka, I., Kanbara, N., and Kawakami, I. (1990). Chitosan as an Ingredient for Domestics Animal Feeds. International I. Agricultural Food and Chemistry, 38, 1214-1217
- Hirano, S., Akiyama, Y., Ogura, M., and Ayaki, Y. (1992). The regulation of serum cholesterol level by oral administration of chitosan in rabbits. In S.-I. Tokura, I. Azuma (Eds.), Chitin Derivatives in Life Science (pp. 115-120). Organizing Committee of International Symposium on Chitin Derivatives in Life Science and Japanese Society for Chitin/Chitosan..
- Hirano, S., Yamanaka, K., Tanaka, H., Watatsu, C., Inui, H., and Umemura, T. (1992). Effects of chitosan and its oligosaccharides on rabbits serum lysozyme activity in the intravenous and oral admistrations and in the in vitro blood culture. In A, Domard, G .A. F. Roberts, K. M. Varum (Eds.), Advances in Chitin Science Volume II (pp 751-758). Lyon: Jacques André Publisher
- Kaifu, K., Nishi, N., and Komai, T. (1981). Preparation of hexanoyl, decanoyl, and dodecanoylchitin. Journal of Polymer Science: Polymer Chemistry Edition, 19, 2361-2363.

- Kanke, M., Katayama, H., Tsuzuki, S., and Kuramoto, H. (1989). Application of chitin and chitosan to pharmaceutical preparations. I. Film preparation and in vitro evaluation. Chemical Pharmaceutical Bulletin, 37(2), 523-525.
- Kendra, D. F. and Hadwiger, L. A. (1984). Characterization of the smallest chitosan oligomer that is maximally antifungal to *Fusarium solani* and Elicits Pisatin Formation in *Pisum sativum* Experimental Myology, 8, 276-281.
- Kuakarun, K. (1998). Purification of chitinase enzyme TU009(I) from soil, B.S. Thesis in Biochemistry, Faculty of Science, Chulalongkorn University.
- Kurita, K., Koyama, Y., and Chikaoka, S. (1988). N-nonanoylation of chitosan for adsorption of copper (II) ion. Polymer Journal, 20(12), 1083-1089.
- Kurita, K., Yoshino, H., Yokota, K., Ando, M., Inoue, S., Ishi, S., and Nishimura, S.-I. (1992). Preparation of tosylchitins as precursors for facile chemical modifications of chitin. Macromolecules, 25, 3786-3790.
- Kurita, K. (1997). Soluble precursors for efficient chemical modifications of chitin and chitosan. In M. F. A. Goosen (Ed.), Applications of Chitin and Chitosan (pp. 103-112). Lancaster: Technomic Publishing Co., Inc.
- Mark, H.F., Bikales, N.M., Overberger, C. G., Menges, G. (1985) Encyclopedia of Polymer Science and Engineering, New York, John Wiley&Sons, 3, 430-440.
- Nishimura, S.-I, Nishi, N., and Tokura, S.-I. (1983). Bioactive chitin derivatives. Activation of mouse-peritoneal macrophages by O-(carboxymethyl) chitins. Carbohydrate Research, 146, 251-258.

- Nishimura, S.-I., Kohgo, O., Kurita, K., and Kuzuhara, H. (1991). Chemospecific manipulations of a rigid polysaccharide: Syntheses of novel chitosan derivatives with excellent solubility in common organic solvents by regioselective chemical modifications. Macromolecules, 24, 4747-4748.
- Ohmiya, K., Uraki, Y., Nishi, N., Tsutsumi, A., and Tokura, S. (1988). Chitin and Chitosan (sources, chemistry, biochemistry, physical properties and applications): Studies on photo-generated radicals on chitin derivatives, 439-442.
- Ohtakora, A., Mitsutomi, M., and Uchida, Y., (1979). Purification and some properties from Vibrio sp. Journal Ferment. and Techn. 57(3), 169-177.
- Ratajska, M., and Boryniec, S. (1998). Physical and chemical aspects of biodegradation of nature polymers. Reactive & Functional Polymer, 38, 35-49.
- Rathke, T. D., and Hudson, S. M. (1994). Review of chitin and chitosan as fiber and film formers. Journal of Molecular Science Review: Macromolecular Chemistry Physic, C34(3), 375-437.
- Roby, D., Gadelle, A., and Toppan, A. Chitin (1987). Oligosaccharides as elicitors of chitinase activity in melon plants. Biochemical and Biophysical Research Communications. 143(3), 885-892.
- Sannan, T., Kurita, K., Ogura, K., and Iwakura, Y. (1978). Studies on chitin : 7. I.r. spectroscopic determination of degree of deacetylation. Polymer, 19, 458-459.
- Sigh, D. K., and Ray, A. R. (1994). Graft Copolymerization of 2-Hydroxyethyl methacrylate onto chitosan films and their blood compatibility. Journal of Applied Polymer Science, 53, 1115-1121.
- Siraleartmukul, K., Limpanath, S., Udomkichecha, W., and Chandrkra-chang, S. (1999). The relationship between crystallinity and degree of

- deacetylation of chitin from crab shell. Journal of Metals, Materials and Minerals. 9(1), 33-40.
- Sugano, M., Yashida, K., Hashimoto, M., Enomoto, K., and Hirano, S., (1992). Hypocholesteromic activity of partially hydrolyzed chitosans in rats. In C. J. Brine, P. A. Sandford, J. P. Zikakis (Eds.). Advances in Chitin and Chitosan (pp 472-478) London: Elsevier Science Publishers Ltd.
- Tokura, S., Nishi, N., and Noguchi, J. (1979). Studies on chitin III: Preparation of chitin fibers. Polymer Journal, 11(10), 781-786.
- Tokura, S., Nishimura, S. I., and Nishi, N. (1983). Studies on chitin IX. Specific binding of calcium ions by carboxymethyl-chitin. Polymer Journal. 15(8), 597-602.
- Tominaga, Y., and Tsujisaka, Y. (1976). Purifications and some properties of two chitinases from. Streptomyces Orientalis which Lyse Rhizopus cell wall. Agricultural and Biological Chemistry, 40(12), 2325-2333.
- Ulanska, P., and Roslak, J. (1992). Preliminary studies on radiation-induced changes in chitosan. Radiation of Physical and Chemistry, 39(1), 53-57.
- Urasami, T., Yoshida, F., and Sugihara, M. (1983). Journal of Applied Polymer Science. 28, 1361-1370.
- Wang, W., Bo, S., Li, S., and Qin, W. (1991). Determination of the Mark-Houwink equation for chitosans with different degrees of deacetylation. International Journal of Biological Macromolecules, 13, 281-285.
- Wang, H., Li, W., Lu, Y., and Wang, Z. (1997). Studies on chitosan and poly(acrylic acid) interpolymer complex. I. Preparation, structure, pH-sensitivity, and salt sensitivity of complex-forming poly(acrylic acid): chitosan semi-interpenetrating polymer network. Journal of Applied Polymer Science. 65, 1445-1450.

Xu, J., McCarthy, S. P., Kaplan, D. L., and Gross, R. A. (1996). Chitosan film acylation and effects on biodegradability. Macromolecules, 29, 3436-3440.

Yashioka, H., Nanaka, K-I., Fukuda, K., and Kazama, S. (1995). Chitosan-derived polymer-surfactants and their micellar properties. Bioscience Biotechnological and Biochemistry, 59(10), 1901-1904.

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