

Plenary Lecture

Dreamful Processes in Chitin and Chitosan Technology

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Chitin and chitosan are used for various purposes including feed for livestock industry and fishery, pesticide, germicide, a variety of membranes, waste water treatment agents, sewage treatment agents, solvents in cosmetics, artificial skin for medical treatment, and suture as well as health-supplementary food. Chitin or chitosan is not a material which exists in nature as it is. Chitin is produced in a way of deproteinizing shells of crab and shrimp under alkaline conditions and de-ashing them under acid conditions. Sequentially then, chitosan is obtained from chitin by deacetylation process of chemical treatment with thick NaOH on a heat tank. However, this chemical way for producing chitosan has an environmental problem that generates vast energy and a large amount of waste alkaline solutions and a demerit that is difficult to produce particular molecular weight and deacetylated chitosan.

The goal in this laboratory is to produce chitin and chitosan from crab shells by using biological methods rather than the chemical method. It offers an applicability of biological treatments in all the process, for example, by optimizing culture condition of strain *Lactobacillus Paracasei Subsp.* KCTC-3074 for the demineralization and strain *Serratia marcescens* FS-3 for the successful removal of protein. For the biological process, strain *Mortierella* sp. DY-52 was

screened for the generation of chitin deacetylase, strain *Bacillus cereus* D-11 for chitosanase and strain *Aeromonas* sp. GJ-18 for chitinase. Also, these bio-materials were applicable to agricultural field, for example, *Auxarthron reticulatum* DY-2 and *Trichoderma harzianum* DY-16, chitin/chitosan breakdown enzymes producers, showed a promising applicability for biological control of plant-parasitic nematode.

Recent Publication

1. Kuk, Ju-Hee, Woo-Jin Jung, Joon-Seob Ahn, Gyung-Hyun Jo, Kil-Yong Kim, Ro-Dong Park. Selective preparation of N-acetyl- β -D-glucosamine and N, N'-diacetylchitobiose from chitin using a crude enzyme preparation from *Aeromonas* sp. *Biotechnology Letters*. 27: 7-11 (2005).
2. Jung, Woo-Jin, Gyung-Hyun Jo, Ju-Hee Kuk, Kil-Yong Kim, Ro-Dong Park. Demineralization of crab shells by chemical and biological treatments. *Biotechnology and Bioprocess Engineering*. 10: 67-72 (2005).
3. Jung, Woo-Jin, Ju-Hee Kuk, Kil-Yong Kim, Tae-Hwan Kim, Ro-Dong Park. Purification and Characterization of Chitinase from *Paenibacillus illinoisensis* KJA-424. *J. Microbiol. Biotechnol.* 15(2): 274-280 (2005).
4. Jung, Woo-Jin, Ju-Hee Kuk, Kil-Yong Kim, Ro-Dong Park. Demineralization of Red Crab Shell Waste by Lactic acid Fermentation. *Applied Microbiology and Biotechnology*. 67(6): 851-854 (2005).
5. Kuk, Ju-Hee, Woo-Jin Jung, Gyung-Hyun Jo, Young-Cheol Kim, Kil-Yong Kim, Ro-Dong Park. Production of N-acetyl- β -D-glucosamine from chitin by *Aeromonas* sp. GJ-18. *Applied Microbiology and Biotechnology*. 68: 384-389 (2005).
6. Jin, Rong-de, Joo-Won Suh, Ro-Dong Park, Yong-Woong Kim, Hari B. Krishnan and Kil-Yong Kim. Effect of chitin compost and broth on biological control of *Meloidogyne incognita* in Tomato (*Lycopersicon esculentum* Mill). *Nematology*. (2005).
7. Jung Woo-Jin, Ju-Hee Kuk, Kil-Yong Kim, Ki-Chul Jung, Ro-Dong Park. Purification and characterization of exo- β -D-glucosaminidase from *Aspergillus fumigatus* S-26. *Protein Expression and Purification*. 45: 125-131 (2006).
8. Kuk Ju-Hee, Woo-Jin Jung, Gyung-Hyun Jo, Kil-Yong Kim and Ro-Dong Park.

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9. Jung Woo-Jin, Gyung-Hyun Jo, Ju-Hee Kuk, Young-Ju Kim, Kyung-Taek Oh, Ro-Dong Park. Production of chitin from red crab shell waste by successive fermentation with *Lactobacillus paracasei* KCTC-3074 and *Serratia marcescens* FS-3. *Carbohydrate Polymers*. Doi:10.1016/j.carbpol.2006.08.011(2006).
 10. Jung Woo-Jin, Gyung-Hyun Jo, Ju-Hee Kuk, Kil-Yong Kim, Ro-Dong Park. Extraction of chitin from red crab shell waste by co-fermentation with *Lactobacillus paracasei* subsp. *tolerans* KCTC-3074 and *Serratia marcescens* FS-3. *Applied Microbiology and Biotechnology*. 71:234-237 (2006. 6).
 11. Dong-Hyun Chae, Rong-De Jin, Hoon Hwangbo, Yong-Woong Kim, Yong Cheol Kim, Ro-Dong Park, Hari B. Krishnan and Kil-Yong Kim. Control of late blight (*Phytophthora capsici*) in pepper plant with a compost containing multitude of chitinase-producing bacteria. *Biocontrol*. 51:339-351 (2006).
 12. Woo-Jin Jung, Alfred Souleimanov, Ro-Dong Park, Donald L. Smith. Enzymatic production of N-acetyl chitooligosaccharides by crude enzyme derived from *Paenibacillus illioisensis* KJA-424. *Carbohydrate Polymers*. (2006) (in press).
 13. Gyung-Hyun Jo, Jung Woo-Jin, Ju-Hee Kuk, Kyung-Taek Oh, Young-Ju Kim and Ro-Dong Park. Screening of a protease-producing *Serratia marcescens* FS-3 and its application to deproteinization of crab shell waste for chitin extraction. AMB-06-13589 (2006. 6. 9) (Submitted).
 14. Young-Ju Kim, Yong Zhao, Kyung-Taek Oh, Van-Nam Nguyen, Ro-Dong Park. Enzymatic deacetylation of chitin by crude enzyme obtained from a newly screened *Mortierella* sp. DY-52. *Applied Microbiology and Biotechnology*. AMB-06-13863 (2006. 8. 18) (Submitted).
 15. Kyung-Taek Oh, Young-Ju Kim, Van-Nam Nguyen, Woo-Jin Jung, and Ro-Dong Park. Demineralization of crab shell waste by *Pseudomonas aeruginosa* F722. *Process Biochemistry*. (2006. 9. 5) (submitted).
 16. Van-Nam Nguyen, Young-Ju Kim, Kyung-Taek Oh, Woo-Jin Jung, Ro-Dong Park. The role of chitinase from two nematophagous fungi A-1 and B-3 in biological control of plant-parasitic nematode *Meloidogyne* sp. *Biological Control*. (2006. 10. 16.) (submitted).