Studies on Bioflocculation Propeties of Poly(γ -glutamic acid)

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ABSTRACT

The object of this study was to investigate the effect of various suspended solids, metal-chloride salts, solution pH, poly- γ -glutamic acid (PGA) concentrations on the flocculating activity of PGA . The flocculating activity of PGA (40mg/L) was markedly good at pH 8.0 when Al2O3 and MgCl2 were used as the suspended solid and metal salt, respectively, in aqueous solution. In addition, the effect of PGA concentrations and solution pH on the heavy-metal (Cd, Cr, Cu, Pb, Zn, Ni) binding (chelating) of PGA was studied. The optimal heavy metals for 120mg/L PGA binding were Cd and Ni under the pH 8.0 and 9.0, respectively, The binding percent for Cd and Ni was around 90%. The efficiency of Zn for PGA binding was not good as the other heavy metals. The binding percent was not over 75% at the range of pH (4~10).

Keywords : poly- γ -glutamic acid, flocculating activity, heavy-metal

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REFERENCES

1. 何守、李演、陳堅。2002。蛋白聚糖類生物絮凝劑REA-11的發酵與絮凝條件。過程工程學報，62-66。 2. 胡筱敏、羅茜、劉述波。1998。微生物絮凝劑的研究與應用。國外金屬礦選礦，16-18。 3. 徐慶源。1994。用於廢水淨化與資源化的新型化學絮凝劑。化工環保，281-283。 4. 宮小燕、弈兆坤、王曙光、黎澤華。2001。微生物絮凝劑絮凝特性的研究。環境化學，550-556。 5. 陶茂林、施大林、王蕾、陳金林。1997。微生物絮凝劑的製備及絮凝條件的研究。食品與發酵工業，26-28。 6. 許世興、顏棋鑫。2003。幾丁聚糖顆粒吸附之有害重金屬之探討。國家圖書館。 7. 張添晉、郭文陽、顏士閔、李冠蓁。酸萃取、淋洗受重金屬污染土壤之研究。第十五屆廢棄物處理技術研討會論文集，2-80～2-88。 8. Bhattacharya, D., J. A. Hestekin, P. Brushaber, L. Cullen, L. G. Bachas, and S. K. Sikdar, 1998, Novel poly-glutamic acid functionalized microfiltration membranes for sorption of heavy-metals at high capacity. J. Memb. Sci. 141(1): 121-135. 9. Cardenas, G., P. Orlando, and T. Edelio, 2001, Synthesis and applications of chitosan mercaptanes as heavy metal retention agent. Intern. J. Bio. Macromol. 28: 167-174. 10. Cheng, C., Y. Asada, and T. Aida, 1989, Production of γ -polyglutamic acid by Bacillus subtilis A35 under denitrifying conditions. Agric. Biol. Chem. 53:2369-2375. 11. Daninippon Parmaceutical Co. Ltd., 1972, Ice cream stabilizer, Japanese Patent 19735/72. 12. Goto, A., and M. Kunioka (1992) Biosynthesis and hydrolysis of Poly(γ -glutamic acid) from Bacillus subtilis IFO3335. Biosci. Biotechnol. Biochem., 56:1031-1035. 13. Konno, A., T. Taguchi, and T. Yamaguchi, 1989, New use of polyglutamic acid for foods. European Patent Application EPO284386A1. 14. Kunioka. M., 1995, Biosynthesis of poly(γ -glutamic acid) from L-glutamine, citric acid and ammonium sulfate in Bacillus subtilis IFO3335. Appl. Microbiol. Biotechnol. 44:501-506. 15. Kunioka., M., 1997, Biosynthesis and chemical reactions of poly(amino acid)s from microorganisms. Appl. Microbial. Biotechnol. 47:469-475. 16. Kurane, R., and H. Matsuyama, 1994, Production of a bioflocculant by mixed culture. Biosci. Biotech. Biochem. 58:1589-1594. 17. Kurane, R. and Y. Nohata, 1991, Microbial flocculation of waste

liquids and oil emulsion by a bioflocculant from Alcaligenes latus. Agric. Biol. Chem. 55:1127-1129. 18. Kurane, R., K. Takeda, and T. Suzuki, 1986, Screening and characteristics of microbial flocculants. Agric. Biol. Chem. 50:2301-2307. 19. Lee, S. H., S. O. Lee, K. L. Jang, and T. H. Lee, 1995, Microbial flocculant from Arcuadendron sp. TS-49. Biotech. Lett. 17: 95-100. 20. Li, C., D. F. Yu, R. A. Newman, F. Cabral, L. C. Stephens, N. Hunter, L. Milas, and S. Wallace, 1998, Complete regression of well-established tumors using a novel water-soluble poly(L-glutamic acid)-paclitaxel conjugate. Cancer Research 58:2404-2409 21. McLean, R. J. C., D. Beauchemin, L. Clapham, and T. J. Beveridge, 1990, Metal-binging characteristics of the gamma-glutamyl capsular polymer of Bacillus licheniformis ATCC 9945. Appl. Environ. Microbiol. 56(12):3671-3677. 22. Mitsuiki, M., A. Mizuno, H. Tanimoto, and M. Motoki, 1998, Relationship between the antifreeze activities and the chemical structures of oligo- and poly(glutamic acid)s. J. Agric. Food Chem. 46(3): 891-895. 23. Multani, A. S., C. Li, M. Ozen, M. Yadav, D. F. Yu, S. Wallace, and S. Pathak, 1997, Paclitaxel and water-soluble poly(L-glutamic acid)-paclitaxel, induce direct chromosomal abnormalities and cell death in a murine metastatic melanoma cell line. Anticancer Research 17:4269-4274. 24. Nestle, N., and R. Kimmich, 1996, Heavy metal uptake of alginate gels studied by NMR microscopy. Colloids & Surface 115: 141-147. 25. Ontni, Y., Y.Tabata, Y. Ikada, 1996, A new biological glue from gelatin and ploy(L-glutamic acid). J. Biomed. Meter. Res.? 31:157-1391. 26. Salehizadeh, A., and S. A. Shojaosadati, 2001, Extracellular biopolymeric flocculants: Recent trends and biotechnological importance. Biotech. Adv. 19:371-385. 27. Salehizadeh, A., M. Vossoughi, and I. Alemzadeh, 2000, Some investigations on bioflocculant producing bacteria. Biochem. Eng. J. 5: 39-44. 28. Shih, I. L., Y. T. Van, L. C. Yeh, H. G. Lin, and Y. N. Chang, 2001, Production of a biopolymer flocculant from Bacillus licheniformis and its flocculation properties. Bioresour. Tech. 78: 267-272 29. Suh, H., G. S. Kwon, C. H. Lee, H. S. Kim, H. M. Oh, and B. D. Yoon, 1997, Characterization of bioflocculant produced by Bacillus sp. DP-152. J. Ferment. Bioeng. 84(2): 108-112. 30. Takagi, H., and K. Kadowaki, 1985, Flocculant production by pacilomyces sp. Taxonomic studies and culture conditions for production. Agric. Biol. Chem. 49:3151-3157. 31. Takeda, M., J. Koizumi, H. Matsuoka, and M. Hikuma, 1992, Factors affecting the activity of a protein bioflocculant produced by Nocardia amarae. Agric. Biol. Chem. 55:2663-2664. 32. Takeda, M., J. Koizumi, H. Matsuoka, and I. Nakamura, 1991, A protein bioflocculant produced by Rhodococcus erythropolis. J. Ferment. Bioeng. 74:408-409. 33. Toeda, K., and R. Kurane, 1991, Microbial flocculant from Alcaligenes cupidus KT201. Agric. Biol. Chem. 55:2793-2799. 34. Troy, F.A., 1993, Chemistry and biosynthesis of the poly(γ -D-gluramy)capsule in Bacillus subtilis, 1. Properties of the membrane-mediated biosynthetic reaction. J. Biol. Chem. 48:305-315. 35. Wang, Z., K. Wang, and Y. Xie, 1995, Bioflocculant-producing microorganisms. Acta Microbiol. Sin. 35(2): 121-129. 36. Yokoi, H., O. Natsuda, J. Hirose, S. Hayashi, and Y. Takasaki, 1995, Characteristics of biopolymer flocculant produced by Bacillus sp. PY-90. J. Ferment. Bioeng. 79: 378-380. 37. Yokoi, H., T. Yoshida, S. Mori, J. Hirose, S. Hayashi, and Y. Takasaki, 1997, Biopolymer flocculant produced by an Enterobacter sp. Biotech. Lett. 19(6): 569-573. 38. Yokoi, H., T. Arima, J. Hirose, S. Hayashi, and Y. Takasaki, 1996, Flocculation properties of poly(γ -glutamic acid) produced by Bacillus subtilis. J. Ferment. Bioeng. 82(1): 84-87.