利用回應曲面法尋求苔蘚桿菌生產聚麩胺酸之培養基最適化

呂文凱、張耀南、洪淑嫻

E-mail: 9300259@mail.dyu.edu.tw

摘 要

本研究以苔蘚桿菌Bacillus licheniformis CCRC 12826 為培養菌株，並以搖瓶培養方式，進行回應曲面法實驗設計探討培養基主要組成分 (麩胺酸、甘油、檸檬酸及氯化銨) 對苔蘚桿菌生合成聚麩胺酸 (γ -PGA) 產量之影響。由實驗結果得知，當培養基組成分濃度為34 g/L麩胺酸、26 g/L檸檬酸、146 g/L甘油、11 g/L氯化銨時，可得到本研究目前最高 γ -PGA產量為35.33 g/L。若由回應曲面法實驗設計，分析得知，當培養基組成分濃度為34.70 g/L麩胺酸、26.97 g/L檸檬酸、145.45 g/L甘油、10.49 g/L氯化銨時，可得到理論最高 γ -PGA產量為35.51 g/L。

關鍵詞 : 聚麩胺酸、苔蘚桿菌、回應曲面實驗設計法

目錄

參考文獻

1. 李昌憲、洪哲穎、熊光賓 (1992) 利用回應曲面法進行以Streptococcus Faecalis 生產酪胺酸脫唆酵素之培養基最適化研究。中國農業化學會誌，31:28-34。 2. 李琇鈴、周正俊、吳淳美 (1993) 利用回應曲面法尋求Streptococcus Faecalis 生產 γ -decalactone之最適條件。中國農業化學會誌，31:28-34。 3. 洪哲穎，陳國誠 (1992)，回應曲面實驗設計法在微生物酵素生產上之應用，39(2):3-18。 4. 胡恆達、陳建宏 (1993)，環保寵兒---分解性塑膠市場/技術現況。化工資訊，7(8):68-79。 5. 洪哲穎 (1998)，回應曲面品質工程技術。工業局八十八年度人才培訓計畫研習班，1998年11月，私立義守大學，高雄縣大樹鄉。 6. 范宜琮，施英隆 (2001) 以苔蘚桿菌生產聚麩胺酸之研究。大葉大學環境工程研究所碩士論文。 7. 徐敬衡 (1994) 生物分解性微生物塑膠之開發。食品工業，26(7):30-35。 8. 陳義融譯 (1992) 日本開發---生物分解性塑膠國家計畫。化工資訊，6(2):86-96。 9. Birrer, G. A., A. M. Cromwick, and R. A. Gross (1994) γ -Poly(glutamic acid) formation by Bacillus licheniformis 9945a: physiological and biochemical studies. Int. J. Biol. Macromol., 16:265-275. 10. Bovarnick, M. (1942) The formation of extracellular D(-)-glutamic acid polypeptide by Bacillus subtilis. J. Biol. Chem., 145:415-424. 11. Buchanan, R. L., and J. G. Philips (1990) Response surface model for predicting the effects of temperature, pH, sodium chloride content, sodium nitrite concentration and atmosphere on the growth of Listeria monocutogenes. J. Food Protect., 53:370-376. 12. Cheng, C., Y. Asada, and T. Aaida (1989) Production of γ -polyglutamic acid by Bacillus subtilis A35 under denitrifying conditions. Agric. Biol. Chem., 53:2369-2375. 13. Cromwick, A. M., and R. A. Gross (1995a)

Effects of manganese(II) on Bacillus licheniformis ATCC 9945a physiology and γ-poly(glutamic acid) formation. Int. J. Biol. Macromol., 17:259-267. 14. Cromwick, A. M., and R. A. Gross (1995b) Investigation by NMR of metabolic routes to bacterial γ-poly(glutamic acid) using 13C-labeled citrate and glutamate as media carbon sources. Can. J. Microbiol., 41:902-909. 15. Cromwick, A. M., G. A. Birrer, and R. A. Gross (1996) Effects of pH and aeration on γ-poly(glutamic acid) fermentation by Bacillus licheniformis in controlled batch fermentor cultures. Biotechnol. Bioeng., 50:222-227. 16. Fujii, H. (1963) On the formation of mucilage by bacillus natto. Part III chemical constitutions of mucilage in natto (1). Nippon Nogeikagaku Kaishi, 37:407-411. 17. Goto, A., and M. Kunioka (1992) Biosynthesis and hydrolysis of Poly(γ-glutamic acid) from Bacillus subtilis IFO3335. Biosci. Biotechnol. Biochem., 56:1031-1035. 18. Haltrich, D., M. Press, and W. Steiner (1993) Optimization of a culture medium for increased xylanase production by a wild strain of Schizophyllum commune. Enzyme Microb. Technol., 15:854-860. 19. Ito, Y., T. Tanaka, T. Ohmachi, and Y. Asada (1996) Glutamic acid independent production of poly(γ-glutamic acid) by Bacillus subtilis TAM-4. Biosci. Biotechnol. Biochem., 60:1239-1242. 20. Ko, Y. H., and A. R. Gross (1998) Effects of glucose and glycerol on γ-poly(glutamic acid) formation Bacillus licheniformis ATCC 9945. Biotechnol. Bioeng., 57:430-437. 21. Krupp, L. R. (1992) Biodegradability of modified plastic films in controlled biological environments. Environ. Sci. Technol., 26: 193-198. 22. Kubota, H., T. Matsunobu, K. Uotani, H. Takebe, A. Satoh, T. Tanaka, and M. Taniguchi (1993a) Production of poly(γ-glutamic acid) by Bacillus subtilis F-2-01. Biosci. Biotechnol. Biochem., 57:1212-1213. 23. Kubota, H., Y. Nambu, and T. Endo (1993b) Convenient and quantitative esterification of poly(γ-glutamic acid) produced by microorganism. J. Polym. Sci. A: Polym. Chem., 31:2877-2878. 24. Kunioka, M., and M. Taniguchi (1993) Production of poly(γ-glutamic acid) from L-glutamic acid, citric acid, and ammonium sulfate in Bacillus subtilis IFO3335. Appl. Microbiol. Biotechnol., 40:867-872. 25. Kunioka, M. and A. Goto (1994) Biosynthesis of poly(γ-glutamic acid) from L-glutamic acid, citric acid, and ammonium sulfate in Bacillus subtilis IFO3335. Appl. Microbiol. Biotechnol., 40:867-872. 26. 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. 27. Kunioka, M. (1997) Biosynthesis and chemical reactions of poly(amino acid)s from microorganisms. Appl. Microbiol. Biotechnol., 47:469-475. 28. Lemoigne, M. et. al. (1926) Products dehydration polymerization acid beta-oxybutyrique. Bull. Soc. Chem. Biol., 8:770-782. 29. Leonard, C. G., R. D. Housewright, and C. B. Thorne. (1958a) Effects of metal ions on glutamyl polypeptide synthesis by Bacillus subtilis. J. Bacteriol., 76:499-503. 30. Leonard, C.G., R.D. Housewright, and C.B. Thorne. (1958b) Effects of metal ions on the optical specificity of glutamine synthetase and glutamyl transferase of Bacillus licheniformis. Biochem. Biophys. Acta., 62:432-434. 31. 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. 32. Murao, S. (1969) On the polyglutamic acid fermentation. Kobunshi., 16:1204-1212. 33. Perez-Camero, G., F. Congregado, J. J. Bou, and S. Munoz-Cuerra (1999) Biosynthesis and Ultrsonic degradation bacterial poly(γ-glutamic acid). Biotechnol. Bioeng. 63:110-115. 34. Prapulla, S. G., S. Jacob, N. Chand, D. Rajalakchmi, and N. G. Karanth (1992) Maximization of lipid production by Rhodotroula gracilis CFR-A using response surface methodology. Biotechnol. Bioeng., 40:965-969. 35. Sawamura S (1913) On Bacillus natto. J. Coll. Agric. 5:189-19. 36. Shih, I. L., and Y. T. Van (2001) The production of poly(γ-glutamic acid) from the microorganisms and its various applications. Bioresour. Technol., 79:207-225. 37. Shima, S., Y. Fakuhara, and H. Sakai (1982) Inactivation of bacteriophages by ε-poly-L-lysine produced by Streptomyces. Agric. Biol. Chem., 46:1917-1919. 38. Thorne, C. B., C. G. Gomez, H. E. Noyes, and R. D. Housewright (1954) Production of glutamyl polypeptide by Bacillus subtilis. J. Bacteriol., 68:307-315. 39. Troy, F. A. (1973a) Chemistry and biosynthesis of the poly(γ-D-glutamyl) capsule in Bacillus licheniformis. I. Properties of the membrane-mediated biosynthetic reaction. J. Biol. Chem., 248:305-315. 40. Troy, F. A. (1973b) Chemistry and biosynthesis of the poly(γ-D-glutamyl) capsule in Bacillus licheniformis. II. Characterization and structural properties of the enzymatically synthesized polymer. J. Biol. Chem., 248:316-324. 41. Ward, R. M., R. F. Anderson, and F. K. Dean (1963) Polyglutamic acid production by Bacillus subtilis NRRLB-2612 grown on wheat gluten. Biotechnol. Bioeng., 5:41-48. 42. YoKoi, H., O. Natsuda, J. Hirose, S. Hayashi, and Y. Takasaki (1995) Characteristics of a biopolymer flocculant produced by Bacillus sp. PY-90. J. Ferment. Bioeng. 79:378-380. 43. YoKoi, H., T. Arima, J. Hirose, S. Hayashi, and Y. Takasaki (1996) Flocculation properties of poly(gamma-glutamic acid) produced by Bacillus subtilis. J. Ferment. Bioeng. 82:84-87. 44. Yoon, S.Y. (2000) Production of poly-γ-glutamic acid by fed-batch culture of Bacillus licheniformis. Biotechnol. Lett., 22:585-588.