Investigation of γ-poly(glutamic acid) production by batch reactor and antifreeze activity by Differential Scanning Cal

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ABSTRACT

In this study we investigated the effects of pH, aeration and agitation on γ-polyglutamic acid(γ-PGA) productivity in a 10-L fermenter . In addition, the changes of carbon source (citric acid, glutamic acid, glycerol), dissolved oxygen, cell density, and γ-PGA production were monitored during fermentation process. The results showed that the cell growth is most suitable at pH=6.0, but the highest yield of γ-PGA is at pH=6.5. Because of low mass-transfer rate and low cell growth at 100rpm , the γ-PGA yield is low. Although mass-transfer rate is high at 300rpm, the γ-PGA yield at 300rpm is very low as well. Good yield of γ-PGA was obtained when the agitation was at 200rpm. In addition, it was found that the γ-PGA yield is highest at aeration rate of 3L/min. In conclusion, when B.licheniformis CCRC 12826 was cultivated in medium F (NH4Cl 7.0(g/L) , K2HPO4 0.5(g/L) , MgSO4・7H2O 0.5(g/L) , FeCl3 ・6H2O 0.04(g/L) , CaCl2・2H2O 0.15(g/L) , MnSO4・4~6H2O 0.104(g/L), Citric acid 22(g/L), Glutamic acid 65(g/L), Glycerol 170(g/L)), pH 6.5, 200rpm, 3L/min, the highest yield of γ-PGA was obtained ；it was 25.93g/L. The yield increased 23% from 21g/L in shake flask culture to 25.93g/L in 10-L fermenter. In addition to investigation of γ-PGA production in fermenter, we also investigated the antifreeze activity of γ-PGA. Various enatiomeric isomers, metals salts and molecular weights of γ-PGA, produced by B.licheniformis CCRC 12826 were prepared and their antifreeze activities were studied by differential scanning calorimetry(DSC). The antifreeze activity of γ-PGA was significant；it increased as its molecular weight decreased. However, the antifreeze activity of γ-PGA was indifferent to its enatiomeric content. The antifreeze activity was cation dependent；it decreased in the order Mg salt > Ca salt ? Na salt >K salt. This trend agrees with that for inorganic chlorides；that is high ionic charge leads to high antifreeze activity. The mechanism by which the cryoprotective effects of γ-PGA can be explained is still yet to be determined.

Keywords : γ-poly(glutamic acid) ; antifreeze activity

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