The Energetic Models of PHB Products by Alcaligenes eutrophus

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ABSTRACT

The Alcaligenes eutrophus were cultured at various temperatures (26 0C,30 0C, and 33 0C) to study the growth rate of the bacteria, the PHBaccumulation, the change in concentration of carbon and nitrogen duringfermentation, and pyruvic acid exhausting due to metabolism. Results showthat under 26 0C for 64 hr, the culture obtains 5.82 g microorganism/L, inwhich 3.81 g are PHB. In other words, there is a 2.01 g/L net microorganism.There is 20 g/L concentration of glucose in the beginning of fermentation,dwindling down to 6.65 g/L after 64 hr. The consumption of glucose was 13.36g/L. The nitrogen supply exhausted after 52 hr. The microorganism growthrate was 0.1282 g/hr, and the yield of PHB is 0.29 g/g glucose. Under 30 0Cfor 78 hrs, the culture obtains 9.10 g m icroorganism/L, in which 4.24 g arePHB. In other words, there is a 4.86 g/L net microorganism. There is a 25g/L glucose concentration in the beginning of fermentation, which dwindlesdown to 2.41g/L after 78 hrs. The consumption of glucose was 22.59 g/L. Thenitrogen supply exhausted after 56 hr. The microorganism growth rate was0.1027g /hr, and the yield of PHB is 0.19 g/g glucose. Under 33 0C for 62hrs, the culture obtains 10.72 g microorganism/L, in which 5.81 g are PHB.In other words, there is a 4.91 g/L net microorganism. There is 25 g/Lglucose concentration the beginning of fermentation, dwindling down to 0.13g/L after 62 hrs. The consumption of glucose was 24.87 g/L, the nitrogensupply exhausted after 33 hr. The microorganism growth rate was 0.0572g/hrand the yield of PHB is 0.22 g/g glucose. HPLC analyzing found thatincreasing the reaction time and the culture temperature during fermentationwill increase the pyruvic acid count. However, the amount of pyruvic acidwas so slight that it did not affect the growth rate of the microorganism orthe production rate of PHB. Experimental results show that the more PHBaccumulated in microorganism presents, the slower PHB accumulation rate willbe. The accumulation rate would reduce to zero, if intracellular PHB hasreduced its saturation level. Thus, the intracellular PHB may inhibit thePHB accumulation. Many kinetic models have been proposed by researchers.However, these models all have more than six parameters. In this study, amodel with five parameters has been proposed. Besides, this model is notaffected by the st arting concentration of microorganism and thenitrogen/carbon ratio, and experimental results are compared with modelvalues satisfactorily.

Keywords : 聚羥丁酸酯 ; 動力式 ; 抑制作用 ; 丙酮酸 ; 生長速率 ; 發酵

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