Biosynthesis of PHBV by Burkholderia sp. Yu-4 under a Phosphorus-limited condition

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ABSTRACT

In this study, Burkholderia sp. Yu-4 was cultured under phosphorus limitation, and sodium valerate was added as a PHBV precursor. The purpose of this study is to explore the effects on the microbial growth and PHBV production. In a flask culture, as the phosphorus concentration decreased, all of the biomass, final pH, and nutrient consumption decreased. The reason for this is that disodium hydrogen phosphate and potassium dihydrogen phosphate in the medium play a role of buffer solution, thus providing a more stable pH environment for microbial growth. First thought was to elevate the initial medium pH to extend the microbial growth period. However, when the initial pH was elevated to 9.0, the strain didn’t grow well and hence didn’t completely consume phosphorus in the medium. Burkholderia sp. Yu-4 was cultured under phosphorus limitation in a batch fermenter with a pH controlled at 7.0. Results showed that, when the strain was cultured for 32 hours, the highest yields of the biomass and PHB were 10.1 and 3.89 g/L, respectively, and PHB accounted for about 38.5% of the biomass. The phosphorus in the culture was depleted at 48 h, and the system attained a status of phosphorus limitation. However, the residual nitrogen still existed at 120 h.To culture Burkholderia sp. Yu-4 in a batch fermenter, sodium valerate (2.0 g/L) was added at 12 h, the strain grew steadily, and the HV content reached the highest. Strain began to grow rapidly at 6 h, HB started to accumulate at 8 h, HV started to accumulate at 20 h, phosphorus in the medium was exhausted at 64 h, and the system attained a status of phosphorus limitation. The highest yields of HB and HV were 2.29 and 0.42 g/L, respectively, at 84 h, and HB was about 33.8% of the biomass, HV about 6.19% of the biomass, HV was 15.5% of the total PHBV. To culture Burkholderia sp. Yu-4 in a batch fermenter, if sodium valerate (4.0 g/L) was added at 6 h, the strain grew very slowly due to the inhibition of the high sodium valerate concentration. If sodium valerate (4.0 g/L) was added at 20 h, the strain still didn’t grow well and started to decease gradually. This fact may be attributed to the aging of bacteria cells, and the strain could not tolerate the high concentration of the organic salt. Therefore, the timing of adding the organic salt and its concentration need to be examined in order to optimize the microbial growth.

Keywords : Burkholderia sp. Yu-4、phosphorus limitation、batch fermenter、PHA、PHB、PHBV

Table of Contents

封面內頁 簽名頁 授權書 iii 中文摘要 iv 英文摘要 vi
誌謝 viii 目錄 ix 圖目錄 xiii
表目錄 xvi 1. 緒論 1 2. 文獻回顧 3
2.1 前言 3 2.2 塑膠簡介 3 2.3 生物可分解塑膠 5
2.4 PHAs 6 2.4.1 PHAs種類 10
2.4.2 PHBV之生合成 12
2.4.3 PHAs之工業生產與市場價格 14 2.5 磷源的代謝 18 2.5.1 細菌攝入磷源的途徑 18
2.5.2 能量儲存與代謝路徑 21 3. 材料與方法 24 3.1 實驗藥品 24 3.2 儀器設備 25
3.3 菌株 27 3.4 培養基 27
3.4.1 培養基組成 27 3.4.2 培養基配製 27 3.5 菌株培養 37
3.5.1 篩菌 37 3.5.2 篩菌方法 37
3.5.3 菌株活化 38 3.5.4 繼代培養 38
3.5.5 預培養 39 3.5.6 菌種保存 39
3.5.7批次發酵槽培養 39 3.6 營養源之影響 40
3.6.1 氮源 40 3.6.2 碳源 41 3.7 溶氧量 41

3.8 磷源濃度與pH值之影響 42
3.8.1 磷源濃度 42 3.8.2 起始pH值培養 42
3.8.3 不同磷源濃度起始pH 9.0之培養 42
3.9 分析方法 43 3.9.1 生質量 43
3.9.2 PHB/PHBV 43
3.9.3 氮源 46 3.9.4 磷源 47 3.9.5 葡萄糖 48
3.9.6 代謝酸 49
4. 結果與討論 50 4.1 篩菌結果 50
4.2 Burkholderia sp. Yu-4之生長曲線 54 4.3 營養源之影響 54
4.3.1 氮源 54 4.3.2 碳源 57 4.4 溶氧量對Burkholderia sp. Yu-4之影響 57 4.5 磷源濃度與pH值之影響 60 4.5.1 磷源濃度 60
4.5.2 起始pH值對Burkholderia sp. Yu-4之影響 63
4.5.3 不同磷源濃度對培養基起始pH 9.0之Burkholderia sp. Yu-4的影響 63 4.6 批次發酵槽培養 66
4.6.1 基礎培養基批次發酵槽培養Burkholderia sp.Yu-4 68
4.6.2 限磷培養基批次發酵槽培養Burkholderia sp.Yu-4 71 4.6.3 限磷培養基批次發酵槽培養Burkholderia sp. Yu-4並於培養6小時添加戊酸鈉 (4.0 g/L) 77
4.6.4 限磷培養基批次發酵槽培養Burkholderia sp. Yu-4並於培養20小時添加戊酸鈉 (4.0 g/L) 80
4.6.5 限磷培養基批次發酵槽培養Burkholderia sp. Yu-4並於培養12小時添加戊酸鈉 (2.0 g/L) 86 4.6.6 不同條件下批次發酵槽培養Burkholderia sp.之比較 91 5. 結論 96
5.1 結論 96 5.2 未來展望 97
參考文獻 99
附錄 109

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