溫度變化對Ralstonia eutropha在限磷條件下發酵生產PHB之探討

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摘 要

摘 要 微生物合成聚酯屬於生物分解性塑膠之一，其中以PHB作為此類型之代表，乃由於其特性與聚丙烯相似，因此可代替石化塑 膠以降低對環境之衝擊。過量的碳源與某營養源不足之條件可促 使菌體合成PHB，由於磷是ATP之能量傳遞作用有關之重要營養素，一旦缺乏無機磷即可抑制ATP之再生作用，基質將用於PHB之合成。本研究係以Ralstonia eutropha (ATCC 17699) 於5 L之發酵槽進行批次培養，限制培養基之磷源含量，於培養過程中給予 菌株足夠之氮源與碳源，R. eutropha分別在溫度26、30及35℃ 下，其菌體生質量、PHB、淨菌體生質量之生長情形，葡萄糖、氮源及磷源之消耗情形，以及菌體所分泌之代謝酸含量，作數據分析之 探討。 於26℃，菌體生質量與PHB產率於72 h達到最高，分別為 0.44與0.35 g/L · h，且產率係數YX/G、YP/X及YP/G皆於72 h達到最高，依序為0.42、0.79及0.33。最終培養至96 h，菌體分泌的代謝酸以甲酸含量最多，平均菌體生質量1 g可生成甲酸9.78 mg，琥珀酸、檸檬酸次之，反丁烯二酸的含量最為稀少，依序為6.66、4.87及0.07 mg。 於30℃，由於溫度提高，促使菌體生質量與PHB產率提前於48 h達到最高，分別為0.74與0.56 g/L · h，但產率係數YX/G、YP/X及YP/G乃於96 h達到最高，依序為0.39、0.82及0.32。最終培養至96 h，菌體分泌的代謝酸以檸檬酸含量最多，平均菌體生質量1 g可生成檸檬酸3.93 mg，琥珀酸、甲酸次之，反丁烯二酸的含量仍最稀少，依序為3.37、1.62及0.02 mg，其中甲酸之含量於培養初期時逐漸上升，但至培養中期約40 h明顯有下降之趨勢。 於35 ℃，菌體生質量與PHB產率於60 h達到最高，分別為 0.63與0.50 g/L · h，而產率係數YX/G、YP/X及YP/G於96 h依序為0.40、0.82及0.32。最終培養至96 h，菌體分泌的代謝酸以琥珀酸含量最多，平均菌體生質量1 g可生成琥珀酸8.43 mg，甲酸、檸檬酸及蘋果酸次之，反丁烯二酸的含量仍最稀少，依序為5.00、3.24、0.66及0.05 mg。 由實驗結果得知，菌體所分泌之代謝酸含量以26℃ 最高，使其菌體生質量與PHB產率最低；於30℃，菌體所分泌之代謝酸含量最低，因此菌體生質量與PHB產率最高；但菌體於35℃ 所分泌之代謝酸含量並非最低，顯示菌體分泌之代謝酸含量與培養溫度 並無絕對之關係，但代謝酸含量確實會影響菌體產率。於35℃，菌體所分泌之代謝酸於培養後期產生蘋果酸，即菌體於此溫度之 代謝路徑已有改變。 關鍵字：PHB，Ralstonia eutropha，產率，產率係數

關鍵詞 : PHB ; Ralstonia eutropha ; 產率 ; 產率係數

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