木質纖維素經單一菌種及共培養系統一階轉換生成乙醇之研究

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摘 要

生質乙醇為一廉價且具有發展潛力之液體燃料，可由多樣化之木 質纖維素轉換而生成。纖維素水解程序中可用專一性佳之纖維酵 素法進行，但此程序成本昂貴，無法符合需求，故後續研究以「 直接生物轉換製程法(CBP)」來進行纖維素水解及生產乙醇。本研 究以2號狼尾草(Pennisetum Alopecoider) 作為主要生質乙醇之碳 源，並以CBP製程搭配嗜中溫菌，將木質纖維素材料轉換成生質乙 醇。菌種來源主要篩選自具可將纖維素分解之狼尾草與羊糞堆肥， 包括Bacillus sp. THLA0409 、K. oxytoca THLC0109及K. pneumoniae THLB0109等三種；上述菌株均具可分解多種不同之木 質纖維素(天然竹粉、純化過之竹纖維素、玉米穗軸、狼尾草、稻 桿、avicel及α-cellulose)。以單一菌株進行狼尾草分解及乙醇 生成試驗時，可於最佳化之條件下(pH 7.0±0.2、溫度31-33°C) 獲 得乙醇最佳產率分別為：THLA0409 (0.13g/g)、 THLB0109 (0.21 g/g) 及THLC0109 (0.21 g/g)；此外， 菌株THLB0109與THLC0109可於二種不同之木聚醣(燕麥與玉米穗軸) 與多種醣類(阿拉伯糖、纖維雙糖、葡萄糖及木糖)下生長良好；但 相較下，THLA0409則適於生長於纖維雙糖與葡萄糖，較不適於木糖 、阿拉伯糖及木聚醣之條件下。在THLA0409與THLC 0109之共培養系 統可提升木質纖維素轉換成乙醇，其乙醇最大濃度與產率，依碳源 種類區分為：天然竹粉 (323.37 ppm、0.323 g/g)、稻稈 (379.28 ppm、 0.379 g/g)及狼尾草(576 ppm、0.576 g/g) 。若與 單一菌株相互比較，則於共培養下，依碳源種類分別可增加 45 – 66 % (天然竹粉)、63 – 78 % (狼尾草)及55 – 65 % (稻稈)之 乙醇產率。

關鍵詞 : 木質纖維素 ; 直接生物轉化製程 ; 共培養系統 ; 乙醇

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