中和劑對乳酸菌生產乳酸之影響

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摘 要

本報告主要探討中和劑對乳酸菌發酵生產乳酸之影響，以期利用中和劑提升乳酸產量、降低乳酸對於乳酸菌之抑制作用、及減少產物之回饋抑制反應。探討不同中和劑種類對乳酸菌生產乳酸之影響，在以 NH_4OH、NaOH、及 $Ca(OH)_2$ 等中和劑對破碎米粒經 *Lactobacillus* (*Lb.*) *delbrueckii* 發酵生產 $_D$-LA 之實驗中，結果顯示 NH_4OH、NaOH、及 $Ca(OH)_2$ 組別之最大乳酸濃度分別為 63.3 g/L、64.1 g/L、及 79.0 g/L。甜高粱汁經 *Bacillus* (*B.*) *coagulans* 於 50^{o}C 下進行饋料批次發酵以比較不同中和劑對乳酸菌生產 $_L$-LA 之影響，設定 $_L$-LA 力價 ($_L$-lactic acid titer) 為 40-100 g/L，最佳 $_L$-LA 力價說明該乳酸濃度下有較佳之乳酸產率，結果顯示 NH_4OH、NaOH、與 $Ca(OH)_2$ 組別之最佳 $_L$-LA 力價為 40 g/L、60 g/L、與 80 g/L，得知 $Ca(OH)_2$ 較能提升 *B. coagulans* 生產乳酸之能力。以 *Sporolactobacillus nakayamae* 發酵生產 $_D$-LA 時比較中和劑 KOH、$Ca(OH)_2$、NaOH、5% (w/v) $CaCO_3$、6% (w/v) $CaCO_3$、及 NH_4OH 對乳酸菌生產 $_D$-LA 之影響，結果顯示 $_D$-LA 濃度分別為 84.45 g/L、88.95 g/L、103.71 g/L、91.17 g/L、37.46 g/L、和 16.05 g/L，而在 KOH 和 NaOH 組別中無殘醣現象。而不同型態之中和劑 $CaCO_3$ (Original 及 Recycled) 會影響 *Lb. lactis* 發酵生產乳酸，結果顯示最佳乳酸濃度分別為 130 g/L 與 143 g/L，推測 Recycled $CaCO_3$ 具有較多孔洞因而提升乳酸產量。因添加中和劑生成之乳酸鹽類有時會對乳酸菌之生長產生抑制作用，以 *B. coagulans* 探討乳酸鈉 (NaLA) 及乳酸鈣 ($CaLA_2$) 對於乳酸菌之生長影響，結果顯示 Non-stress、NaLA stress、及 $CaLA_2$ stress 組之最大細胞乾重分別為 1.22 g/L、0.50 g/L、及 0.63 g/L，說明 NaLA 抑制乳酸菌生長程度較 $CaLA_2$ 大，原因可能與乳酸鹽影響環境滲透壓有關。以 NH_4OH 及 $Ca(OH)_2$ 做為中和劑探討 *Lb. paracasei* 發酵生產 $_L$-LA 時環境滲透壓變化，結果顯示 NH_4OH 滲透壓變化較 $Ca(OH)_2$ 為明顯，分別造成之滲透壓變化為 837 mOsm/kg 及 222 mOsm/kg (發酵 16 hr)。綜合上述，乳酸鹽濃度愈高滲透壓上升則不利於乳酸菌生產乳酸，而含 Ca^{2+} 之中和劑影響環境滲透壓變化較小及較能提升乳酸產量，故選擇中和劑時需考量乳酸菌對滲透壓之敏感性。

五、參考文獻

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