

MTBE與BTEX分解菌之篩選及生物分解之動力學研究

鄭雅文、林啟文

E-mail: 9417450@mail.dyu.edu.tw

摘要

本研究之目的為以批次試驗方式測試各單一菌株之降解效率，並探討複合基質與重金屬存在之降解抑制效應，再探討文獻中各模式之適用性，並以非線性迴歸分析建立各菌株之動力學參數值。研究結果顯示：(1) 所篩得可分解MTBE、苯、甲苯及乙苯之四種微生物：Pseudomonas aeruginosa YAMT521、Ralstonia sp. YABE411、Pseudomonas sp. YATO411及Pseudomonas putida YAEB411；(2) Pseudomonas aeruginosa YAMT521於分別代謝單一MTBE與BTEX時，其最大降解率排序為MTBE > 苯 > 甲苯 > 對-二甲苯 > 乙苯；(3) Pseudomonas aeruginosa YAMT521於雙基質共存時，對MTBE之降解率依序為MTBE與苯共存 > MTBE與甲苯共存 > MTBE與乙苯共存 > MTBE與對-二甲苯共存；(4) 當Pseudomonas aeruginosa YAMT521於MTBE與BTEX其中二個基質共存(即三基質)時，其降解率與產率依序為MTBE、苯、對-二甲苯共存 > MTBE、苯、甲苯共存 > MTBE、苯、乙苯共存；(5) Pseudomonas aeruginosa YAMT521對MTBE之降解率將因共存之BTEX種類越多而明顯降低；(6) 添加重金屬鋅具有提高Pseudomonas aeruginosa YAMT521降解MTBE之能力；添加低濃度錳時有助於Pseudomonas aeruginosa YAMT521降解MTBE，但濃度過高時將造成微生物之降解抑制；添加鎳濃度高於3 mg/l時，Pseudomonas aeruginosa YAMT521對MTBE同化為生質量之能力有降低的情形；(7) Pseudomonas aeruginosa YAMT521降解MTBE之動力學參數值： $\mu_m=0.0658 \pm 0.04 \text{ hr}^{-1}$ ， $KS=14.386 \pm 12.04 \text{ mg/l}$ ， $K_i=72.47 \pm 3.10 \text{ mg/l}$ ， $Y=0.68 \pm 0.22 \text{ mg-biomass/mg-MTBE}$ ；Ralstonia sp. YABE411降解苯之動力學參數值： $\mu_m=0.2927 \pm 0.230 \text{ hr}^{-1}$ ， $K_i=341.04 \pm 15.40 \text{ mg/l}$ ， $Y=0.20 \pm 0.40 \text{ mg-biomass/mg-benzene}$ ，當苯濃度範圍為9.91~94.87 mg/l時，其 $K_s=1.988 \pm 0.665 \text{ mg/l}$ ，而當苯濃度範圍為115.66~178.97 mg/l時， K_s 則提高至 $8.712 \pm 1.369 \text{ mg/l}$ ；Pseudomonas sp. YATO411對甲苯之動力參數值： $\mu_m=0.4598 \pm 0.0915 \text{ hr}^{-1}$ ， $KS=1.788 \pm 0.924 \text{ mg/l}$ ， $K_i=122.04 \pm 5.49 \text{ mg/l}$ ， $Y=0.68 \pm 0.07 \text{ mg-biomass/mg-toluene}$ ；及Pseudomonas putida YAEB411對乙苯之動力參數值： $\mu_m=0.7870 \pm 0.0875 \text{ hr}^{-1}$ ， $KS=15.631 \pm 1.612 \text{ mg/l}$ ， $K_i=158.14 \pm 3.53 \text{ mg/l}$ ， $Y=0.842 \pm 0.159 \text{ mg-biomass/mg-ethylbenzene}$ ；(8) Pseudomonas aeruginosa YAMT521於MTBE與BTEX中任一個基質共存下(即雙基質)，以非競爭型抑制模式較為適用；Pseudomonas aeruginosa YAMT521於MTBE、苯及甲苯共存下，以競爭型抑制模式較為適用；而Pseudomonas aeruginosa YAMT521於MTBE、苯與乙苯共存下，則競爭型與非競爭型抑制模式皆適用；(9) Pseudomonas aeruginosa YAMT521與鋅、錳及鎳共存下模式對MTBE之降解擬合能力平均分別可達94%、92%及85%。

關鍵詞：基質與重金屬抑制；甲基第三丁基醚；生物降解；重金屬；動力學模式

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