MTBE與BTEX分解菌之篩選及生物分解之動力學研究

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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： μm=0.0658±0.04 hr-1，KS=14.386±12.04 mg/l，Ki=72.47±3.10 mg/l，Y=0.68±0.22 mg-biomass/mg-MTBE； Ralstonia sp. YABE411降解苯之動力學參數值： μm=0.2927±0.230 hr-1，Ki=341.04±15.40 mg/l，Y=0.20±0.40 mg-biomass/mg-benzene，當苯濃度範圍為9.91~94.87 mg/l時，其Ks=1.988±0.665 mg/l，而當苯濃度範圍為115.66~178.97 mg/l時，Ks則提高至8.712±1.369 mg/l； Pseudomonas sp. YATO411對甲苯之動力參數值： μm=0.4598±0.0915 hr-1，KS=1.788±0.924 mg/l，Ki=122.04±5.49 mg/l，Y=0.68±0.07 mg-biomass/mg-toluene；及 Pseudomonas putida YAEB411對乙苯之動力參數值： μm=0.7870±0.0875 hr-1，KS=15.631±1.612 mg/l，Ki=158.14±3.53 mg/l，Y=0.842±0.159 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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