Isolation of the MTBE and BTEX-degrading oorganisms and their biodegrading kinetics

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ABSTRACT

The major work for the study is the testing of aromatic compound-degrading cultures and with heavy metals in batch experiments for biodegradation of MTBE, benzene, toluene, ethylbenzene, and xylene. Additionally, batch growth data of four pure cultures (i.e., Pseudomonas aeruginosa YAMT521、Ralstonia sp. YABE411、Pseudomonas sp. YATO411及Pseudomonas putida YAEB411) isolated from an industrial wastewater treatment under aerobic conditions has been assessed with nonlinear regression technique. Results of the research show that：(1) In single substrate conditions, relative magnitude of the aromatic compound-degrading rate to Pseudomonas aeruginosa YAMT521 can be MTBE＞benzene＞toluene＞p-xylene＞ethylbenzene. (2) In two substrate conditions, relative magnitude of the aromatic compound-degrading rate to Pseudomonas aeruginosa YAMT521 can be MTBE+benzene ＞MTBE+toluene＞MTBE+ethylbenzene＞MTBE+p-xylene. (3) In three substrate conditions, relative magnitude of the aromatic compound-degrading rate to Pseudomonas aeruginosa YAMT521 can be MTBE+benzene+p-xylene＞MTBE+benzene+ toluene ＞MTBE+benezene+ethylbenzene. (4) In mixed substrate conditions, the aromatic compound-degrading rate to Pseudomonas aeruginosa YAMT521 can be debased by increasing the kinds of BTEX. (5) Relative magnitude of the toxic effects of the heavy metals to Pseudomonas aeruginosa YAMT521 can be Zn2+＞Mn2+＞Ni2+. (6) μm 0.0658±0.04hr-1, KS 14.386±12.04mg/l, Ki 72.47±3.10mg/l, and Y=0.68±0.22 mg/mg for aerobic biodegradation of MTBE by Pseudomonas aeruginosa YAMT421; μm 0.2927±0.230hr-1, Ki 341.04±15.40mg/l, Y=0.20±0.40 mg/mg, Ks=1.988±0.665 mg/l under substrate concentrations ranging from 9.91 to 94.87 mg/l, and Ks=8.712±1.369 mg/l under substrate concentrations ranging from 115.66 to 178.97 mg/l for aerobic biodegradation of benzene by Ralstonia sp. YABE411; μm 0.4598±0.0915hr-1, KS 1.788±0.924mg/l, Ki 122.04 ±5.49mg/l, and Y=0.68±0.07 mg/mg for aerobic biodegradation of toluene by Pseudomonas sp. YATO411; μm 0.7870 ±0.0875hr-1, KS 15.631±1.612mg/l, Ki 158.14±3.53mg/l, and Y=0.842±0.159 mg/mg for aerobic biodegradation of ethylbenzene by Pseudomonas putida YAEB411. (7) In mixed substrate conditions, the substrate concentration coefficient, Ks, can be used as an indicator of model. (8) The kinetics of heavy metal-induced(Zn2+, Mn2+, Ni2+) repression of Pseudomonas aeruginosa YAMT521 can be mathematically described as non-competitive inhibition of a rate-determining enzymatic reaction with fitting values higher than 94%, 92%, and 85%.

Keywords : MTBE ; inhibition of substrate and heavy metal ; biodegradation ; kinetic

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