

Isolation of the MTBE and BTEX-degrading organisms 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) μ_m 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; μ_m 0.2927 ± 0.230hr⁻¹, Ki 341.04 ± 15.40mg/l, Y=0.20 ± 0.40 mg/mg, K_s=1.988 ± 0.665 mg/l under substrate concentrations ranging from 9.91 to 94.87 mg/l, and K_s=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; μ_m 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; μ_m 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, K_s, 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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