Optimization of *o*-Cresol Degrading *Pseudomonas monteilii* CR13 and Kinetics of Degradation

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ABSTRACT

In the present study, Pseudomonas monteilii *CR13 isolated from petroleum contaminated soil demonstrated the highest specific* o-*cresol degradation rate at all tested* o-*cresol concentrations and also was not disturbed by the starting substrate concentration used (*o-*cresol-500 mg/L). After a serial transfer of the isolate into a series of increasing* o-*cresol level, the organism demonstrated significant improvement on degradation ability up to 3000 mg/L. The optimum condition for the cell mass increase and biodegradation of* o-*cresol by* Pseudomonas monteilii *was in the minimal mineral medium of 3 at a pH of 6.5 and temperature 30 °C, stirring velocity of 160 rpm, and the substrate concentration of 500 mg/L. The biodegradation kinetic study was carried out by bacteria in different initial substrate concentrations (500–3000 mg/L). In the present test the* μ_{max}, K_s *and the μ were found 0.332* h^{-1}, *0.166 mg/L and 0.0282 mg/L for 500 mg/L of* o-*cresol, respectively. The organism is highly promising and could be used to remove high concentrations of* o-*cresol from highly polluted aquatic and soil regions. The cells could be immobilized on a suitable matrix and the efficiency of degradation could be effectively improved.*

Keywords: *biodegradation;* o-*cresol;* Pseudomonas monteilii*; petroleum contaminated soil*

ABSTRAK

Dalam penelitian ini, Pseudomonas monteilii *CR13 yang diisolasi dari tanah yang terkontaminasi minyak bumi menunjukkan tingkat degradasi* o-*cresol spesifik tertinggi pada semua konsentrasi* o-*cresol yang diuji dan juga tidak terpengaruh oleh konsentrasi substrat awal yang digunakan (*o-*cresol-500 mg/L). Setelah transfer serial isolat menjadi serangkaian peningkatan level* o-*cresol, organisme menunjukkan peningkatan yang signifikan pada kemampuan degradasi hingga 3000 mg/L. Kondisi optimum untuk peningkatan massa sel dan biodegradasi* o-*cresol oleh* Pseudomonas monteilii *berada di medium mineral minimal 3 pada pH 6,5 dan suhu 30 °C, kecepatan pengadukan 160 rpm, dan konsentrasi substrat 500 mg/L. Studi kinetik biodegradasi dilakukan oleh bakteri dalam konsentrasi substrat awal yang berbeda (500–3000 mg/L). Dalam tes ini* μ_{max}, K_s *dan μ ditemukan masing-masing 0,332* h^{-1}, *0,166 dan 0,0282 mg/L untuk 500 mg/L* o-*cresol. Organisme ini sangat menjanjikan dan dapat digunakan untuk menghilangkan konsentrasi tinggi* o-*cresol dari daerah air dan tanah yang sangat tercemar. Sel-sel dapat diimobilisasikan pada matriks yang sesuai dan efisiensi degradasi dapat ditingkatkan secara efektif.*

Kata Kunci: *biodegradasi;* o-*cresol;* Pseudomonas monteilii*; tanah terkontaminasi minyak bumi*

INTRODUCTION

A huge amount of chemical compounds is released into the environment by different industries, of which cresols are highly toxic. *O*-cresol is an isomeric phenol with methyl substituent in the ortho position relative to the hydroxyl group. United States Environmental Protection Agency (USEPA) [1] and the Central Pollution Control Board of India (CPCB) have included cresols in the list of priori ty pollutants.

Cresol is an important commercial mixture of chemicals used as a starting material to make other chemicals including pesticides, fragrances, antioxidants, and resins. Cresol also is used as a solvent for industrial processes and certain paints and as a wood preservative. Ortho-Cresol is used as a solvent and starting material for making various resins, antioxidants, herbicides, and pesticides and they cause damage to the environment.

The in vitro toxic effect of cresol on kidney has been extensively s tudied [2] and the presence of cresols have shown to reduce the leaching capacity of the soil. [3].The huge amount of the chemical released from various industries and the extreme toxicity of o-cresol to the flora and fauna make the removal of the compound from the environment an important task.

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