Pengaruh konsentrasi elektron akseptor H2O2 pada proses biobarrier campuran benzena-toluena dengan konsorsium bakteri = The effect of H2O2 concentration as electron acceptor on biobarrier process of benzene-toluene mixture using bacterial consortium

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Abstrak

Benzena dan toluena merupakan komponen utama dalam fraksi minyak bumi yang bersifat racun dan karsinogenik serta sulit didegradasi oleh lingkungan. Setelah adsorben jenuh dengan kontaminan pada proses adsorpsi, karbon aktif harus direaktivasi atau diganti. Mikroorganisme digunakan untuk reaktivasi adsorben dengan proses biodegradasi kontaminan. Pada penelitian ini akan dilakukan pengujian pengaruh variasi konsentrasi H2O2 sebagai elektron akseptor yang mensuplay oksigen pada proses biobarrier campuran benzena dan toluena dengan memanfaatkan aktivitas konsorsium Pseudomonas aeruginosa, Pseudomonas fluorescens, Aeromonas hydrophilla, Bacillus coagulans dan Bacillus substilis dalam bioreaktor fixed bed. Enrichment dilakukan terhadap konsorsium bakteri untuk adaptasi dengan benzena dan toluena. Konsorsium bakteri hasil enrichment diinjeksikan 2 ml ke dalam kolom bioreaktor yang berisi Granular Activated Carbon (GAC) yang jenuh akan benzena dan toluena pada tahap penjenuhan GAC. Dilakukan variasi konsentrasi H2O2 10 mg/l, 30 mg/l, 40 mg/l, dan 50 mg/l untuk biodegradasi yang optimum. Campuran kontaminan yang ditambah L°Ckhead and Chase (LC) dan H2O2 dialirkan secara kontinyu dengan laju alir masing-masing 18.2 ml/menit dan 1 ml/menit. Sampel outlet kolom bioregenerator dianalisa dengan Gas Chromatograph-Flame Ionization Detector (GC FID). Konsorsium bakteri akan mereaktivasi GAC dengan biodegradasi benzena toluena yang menempel di permukaan dan teradsorp dalam pori GAC. Inokulasi awal enrichment 3,5 x 105 CFU/ml mencapai fasa stationer jam ke-120 dengan jumlah bakteri 1.37 x 1011 CFU/ml. Proses biodegradasi optimum pada konsentrasi H2O2 30 mg/l dengan konsentrasi benzena dan toluena outlet kolom II masing-masing 25 ppm dan 40.5 ppm.
<hr><i>Benzene and toluene are the main component found in crude oil fraction. Both are toxic and barely degradable by nature and become hazardous contaminant. The concentration of benzene or toluene could be reduced by adsorption using Granulated Activated Carbon (GAC). By the time the activated carbon is saturated by benzene and toluene, it needs to be regenerated or replaced. Microbacterial is the agent of adsorbent regeneration through process called biodegradation. This research is aimed to observe the effect of electron acceptor, H2O2, concentration that act as oxygen supplier on biobarrrier process of benzenetoluene mixture utilizing the activity of bacterial consortium of Pseudomonas aeruginosa, Pseudomonas fluorescens, Aeromonas hydrophilla, Bacillus coagulans, and Bacillus subtilis in fixed bed reactor. Enrichment is a process which bacterial consortium is adapted to benzene and toluene environment. After some certain times, 2 ml of the enriched consortium is injected to bioreactor column that filled with GAC. This GAC already pass the loading phase, which means it is saturated with benzene and toluene. Biodegradation is carried out on 4 variations of H2O2 concentration, 10 mg/L, 30 mg/L, 40 mg/L, and 50 mg/L. Contaminant plus nutrition are flowing into column at 18.2 ml/minute while H2O2 flows at 1 ml/minute. Samples are analyzed using Gas Chromatography-Flame Ionization Detector (GC-FID). Bacterial consortium would regenerate GAC by biodegrading benzene and toluene that attach on its surface and that adsorbed inside its

pores. At t = 0, the consortium reach the number of colony 3.5 x 105 CFU/ml and get to stationery phase at t = 120 with colony 1.37 x 1011 CFU/ml. Biodegradation attain the optimum result on H2O2 concentration 30 mg/L with outlet concentration of benzene 25 ppm and toluene 40.5 ppm.</i>