Biodegradation of 1,2-Dibromoethane by *Bradyrhizobium japonicum* 273 cells in presence and absence of constant electric field

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1. Introduction

Short-chain halogenated aliphatic compounds are manufactured in bulk quantities by the chemical industry. 1,2-dibromoethane (1,2-DBE) is a synthetic organic chemical that causes enormous problems to human health. For the cleanup of polluted locations it is important to study bacteria that degrade this toxic substance. The results of the scientific research showed that *Bradyrhizobium japonicum 273* strain produces the most potent dehalogenase.

2. Experimental

Bradyrhizobium japonicum 273 was obtained from the National Bank for Industrial Microorganisms and Cell Cultures, Bulgaria (NBIMCC). Processes of dehalogenation were carried out at initial substrate concentrations of 0,05, 0,1 and 0,15 g/l 1,2-DBE in presence and absence of constant electric field. The anode potential was maintained constant by a potentiostat of values 0,1 V vs. quinquidrone electrode at 30 ^{0}C. Samples from the broth have been taken periodically and analyzed for biomass, bromoethanol and bromide ions using a spectrophotometer (VWR UV-1600 PC).

3. Results and Discussion

The best result was obtained with initial substrate concentration of 0,05 g/l 1,2-DBE. The curves have similar profiles in presence and absence of constant electric field. Processes with initial substrate concentrations of 0,1 and 0,15 g/l 1,2-DBE without field was impeded due to intermediates e.g. bromoethanol and bromo-acetaldehyde, acting as inhibitors of growth and substrate biodegradation. In presence of constant electric field of values 0,1 V vs. quinquidrone electrode at 30 ^{0}C we received good result with initial substrate concentration of 0,1 g/l 1,2-DBE. The concentration differences of bromoethanol and bromide ions are comparable with the stoichiometric ones. In Fig.1 we present the results for biodegradation of 0,1 g/l 1,2-DBE without electric field and with such a field of values 0,1 V vs. quinquidrone electrode.

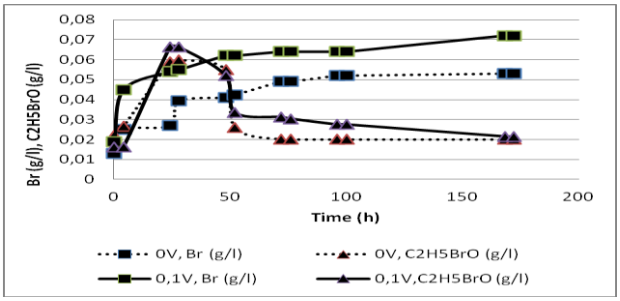

Fig. 1 Comparative processes with and without electric field with 0,1 g/l 1,2-DBE

4. Conclusions

At low initial substrate concentrations up to 0,1 g/l 1,2-DBE full dehalogenation is observed corresponding to stoichiometric values of released bromide ions. In the absence of electric field, at substrate concentrations of 0,1 g/l and 0,15 g/l only one bromide ions from 1,2–DBE is liberated. The constant electric field leads to complete degradation. Good results are obtained with bio-electrochemical potentiostatic mode at cathode potential 0,1 V vs. quinquidrone electrode.

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