Modelling of 1,2-dichloroethane Biodegradation, Stimulated by Constant Electric Field

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Biodegradation of 1,2-dichloroethane by the strain *Xanthobacter autotrophicus* GJ10 passes through the formation of toxic intermediates, like 2-chloroethanol and chloro-acetaldehyde. This adverse effect could be minimized by their deliberate anodic oxidation in constant electric field.
The present work presents the mathematical modelling of these processes taking into account the electric field influence on biomass growth and the effect of substrate and product inhibition. The experiments comprises control one (i.e. without application of electric field) and ones at electric field application at different anode potentials within 0.753 and 0.903 V vs. the potential of the normal hydrogen electrode. The effect of the electric field on microbial specific growth rate and on the rate of microbial decay was estimated quantitatively in terms of the corresponding rate constants. Additionally, the accumulation and the decay of the intermediates were taken into account. The results of the mathematical modelling showed that the effect of the electric field is strongly positive on the microbial growth and best kinetic parameters were observed at certain anode potential, i.e. at 0.803 V/S.H.E. The maximum specific growth rate in this case is 0.90 h^{-1}, i.e. three times higher than for the reference experiment. The rate constant of decay of the intermediates is almost four times higher than for the reference experiment.

References

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