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Nátrium-acetát koncentráció hatása a *Geobacter toluenoxydans* szaporodására, vas(III)-redukáló és elektromos áramtermelő képességére

Effects of sodium-acetate on growth, reduction of Fe^{3+} and production of exoelectrons of Geobacter toluenoxydans

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Summary

Nowadays, development of carbon-neutral renewable energy sources has become frontier research area for power systems. The production of electricity from different wastewaters would be attractive and economically desirable process because of the increase of world population. *Geobacter toluenoxydans* is known as an anaerobic iron-reducing bacterium, thus it has potential application in the bioremediation as well as in microbial fuel cell (MFC) systems. So far, only few scientific information are available in literature dealing with capability of this organism. In present study, the growth properties as well reducing power and production of exoelectrons of this microbe are focused.

Sodium-acetate was used as substrate in different concentration from 0.5 $g{\cdot}L^{-1}$ to 3 $g{\cdot}L^{-1}$ in steps of 0.5 $g{\cdot}L^{-1}$ to investigate the growth properties. To determine the microbial iron(III) reduction, ammonium-thiocyanide was used in acidic milieu to bind the iron(III) ions in complex that then be photometrically detected at 460nm. The electricity generation was measured in dual-chamber MFC. Woven graphite electrode was used as anode and cathode with 24 cm^2 of total surface. The working volume of anode chamber was 25 mL Electric voltage was measured by VC-820 multimeter with closed circuit using external resistance of 500Ω.

In the case of sodium-acetate, the growth rate of G. toluenoxydans increased proportionally with substrate concentration up to 1.5 $g{\cdot}L^{-1}$ and then decreased constantly. The maximum growth rate was 0.33 1/h. In addition, maximum reducing power of bacteria was also detected when growth on the Na-acetate concentration of 1.5 $g{\cdot}L^{-1}$. Using the equation of $\mu=\mu_{max}{\cdot}S/K_s+S{\cdot}[1-(S/S_{max})^n]$ and non-linear modelling the maximal growth rate, iron(III) reduction rate and K_s were determined.

Continuous MFC was designed and operated based on results of growth properties and iron-reduction potential. The range of the applied dilution rates was determined from the iron-reduction kinetics. After 24 hour of incubation in MFC, the optimal substrate concentrations were fed with different flow rates (from 0.5 mLh^{-1} to 2 mLh^{-1} in steps of 0.5 mLh^{-1}). Stable continuous electricity generation were reached at 0.5 and 1 mLh^{-1} flow rates, however feed rate of 1 mLh^{-1} the current production was almost the maximum. At higher feed rate the current decreased rapidly.

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