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COMMENTS

Exploring natural and artificial biofilms of Acetogenic bacteria to improve electrosynthesis rates

Microorganisms have gained considerable attention for transforming organic waste into renewable energy and value added products. We live in a microbial world , where diverse and numerous species of microorganisms have adapted to almost all kinds of surroundings, ranking from moderate to extreme conditions and have develop diverse metabolisms to cope with their environment. Electroactive (EA) and metal reducing microbes are exciting examples with diverse metabolisms, which can transfer electrons to and from extracellular soluble/insoluble substance (electrodes) or use metal salts as terminal electron acceptor, in the absence of molecular oxygen. Microbial electrosynthesis is a novel of biotechnological process for the conversion of excess renewable electricity and CO_2 into biofuels and other organic compounds. Though it is a promising strategy, but optimization of this process is required for commercialization. This process relies on acetogenic bacteria capable of reducing CO_2 to organic compounds using electrons delivered by an electrode. Cathode which enhances electrode-microbe-electron-transfer might improve rate of product formations. One major problem limiting the rate of investigates whether the production rate of microbial electrosynthesis can be improved by increasing the number of cells on the cathodes. To evaluate this possibility, biofilms of *Sporomusa ovate* which effective in acetate electrosynthesis, were grown on a range of cathode materials and acetate production was monitored overtime. Modifications of carbon cloth that result in a positive charge enhance microbial electrosynthesis. This will explore two different strategies to increase cell numbers on cathodes. First natural biofilm formation will be stimulated by condition selection and adaptation. Second artificial biofilms will be created by immobilizing cells in different polymeric matrices. These natural and artificial biofilms will allow increasing and controlling the cell numbers on cathodes and assess the effects of attached cell numbers on microbial electrosynthesis rates. Several state of art techniques, including confocal microscopy and microsensor measurements, will be applied to characterize the two types of biofilms. The possibility of providing the acetogenic microorganisms *Sporomusa ovata* with electrons delivered directly to the cells of a graphite electrode for reduction of CO_2 to organic compounds. Electrons appearing in the products accounted for over 85% electrons consumed. These results demonstrate that, microbial production of multicarbon organic compounds from CO_2 and H_2O, with electricity as the energy source is feasible. This technology also provides sustainable waste water treatment and energy production. Despite significant improvements in power output of microbial fuel cells (MFCs), this technology is still far from practical applications. Over exploitations of fossil fuel has resulted in scarcity of natural resources and environmental deterioration. Development of innovative technologies to explore sustainable and renewable energy sources is highly desirable. Extracting electrical energy and harvesting valuable products by electroactive bacteria (EAB) in bioelectrochemical systems (BESs) has emerged as an innovative approach to address energy and environmental challenges.

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