Microbial electrosynthesis of methane for biogas upgrading

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Microbial electrosynthesis (MES) provides a highly attractive perspective for the future generation of chemical products from electricity. Thereby electroactive microorganisms take up electrons from a cathode and convert CO_2 into chemical compounds. To establish this electron transfer several mechanisms as direct (DET), mediated (MET) or indirect electron transfer (IET) are known. Especially MES of methane, also called electromethanogenesis, offers the chance to store electrical energy or excess current as chemical energy (biofuel). A possible application of MES, we are working on at the moment, might be the upgrading of biogas in its methane content. Therefore a robust, electroactive biocatalyst is very important. So we screened several methanogenic strains from the orders *Methanococcales*, *Methanosarcinales*, *Methanobacteriales* and *Methanomicrobiales* for its hydrogenotrophic growth and its ability for MES of methane. One strain from the order *Methanococcales*, not described so far to take up electrons, produced methane by MES between potentials of -850 and -1000 mV (vs. Ag/AgCl). The coulombic efficiency was more than 80 %. Surprisingly gas analysis revealed unusual results dealing with a possible new mechanism of electron transfer in this strain. Additionally real-time qPCR analyses under MES conditions identified a gene/protein which might be responsible for the unusual electron transfer in this methanogenic strain. Finally we will give an outlook in the development of a prototype reactor for biogas upgrading with the MES technology.