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Chemical production by microbial electrosynthesis

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Powering microbes with electrical energy to produce valuable commodities is a new concept and a potential alternative to a petroleum-based economy. Microbial electrosynthesis (MES) is a novel bioproduction process in which microbes reduce CO₂ to multicarbon organics using electrical current. MES has tremendous potential for the storage of energy into covalent chemical bonds of commercially viable products without the need for arable land and has the flexibility to be coupled with electricity from renewable resources. In the long term, this technology will enable the European Union to cut greenhouse gas emissions, develop new energy sources and make it less dependent on imported energy. Key to the success of the MES process is effective electrical connection between bacterial cells and electrode surface. However, low electron transfer rate from electrochemical hardware to microbial platforms, unknown electron transfer mechanism, and poor adherence of microorganisms on the electrode has been the main obstacles to commercialization to date. Developing superior bioelectrochemical hardware with state-of-the-art technique like 3D printing, establishing alternative MES processes relying on multi-cultures and investigating extracellular electron transfer from the cathode to the microbes are some of the strategies that we are implementing to transform MES into a commercially viable technology.