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Optimization of growth and electrosynthesis of PolyHydroxyAlkanoates by the thermophilic bacterium *Kyrpidia spormannii*

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Abstract:

The recent discovery of the Knallgas bacterium *Kyrpidia spormannii* EA-1, able to produce PolyHydroxyAlkanoates (PHA) on a cathode, is of great interest to sustainably produce bioplastics from electricity and CO2. In this study, we investigated the effect of cathode properties on PHA synthesis, focusing on the choice of cathode material, the surface modification of a graphite cathode with different treatments or by electrodeposition of metal catalysts, and the distance between anode and cathode. The results show a particular high performance of iron-based electrodes with increased biofilm density and PHA production. Also, a simple treatment of the graphite cathode with isopropanol and sonication showed the best performance compared to more elaborate surface modifications treatments. Finally, the shorter the distance between anode and cathode was, the better the PHA production was obtained. These optimizations allow to increase by 5-fold the PHA production compared to initial conditions, reaching a production of 117 $mg \cdot day^{-1} \cdot m^{-2}$.

Keywords: microbial electrosynthesis, PolyHydroxyAlkanoates, thermophilic Knallgas bacteria, biofilm optimization, growth optimization