

Sustainable electrochemical synthesis of regenerative transportation fuels

Waldemar Sauter¹, Uwe Schröder^{*,1}

¹ Institute for Environmental and Sustainable Chemistry, Technical University of Braunschweig,
Hagenring 30, 38106 Braunschweig

* Author of correspondence; Email: u.schroeder@tu-bs.de, Tel.: +49 531 391 8425

Abstract:

In times of declining fossil fuel resources, new pathways to sustainable transportation fuels are more important than ever. Research on methods like Power-to-liquid are a necessity for the establishment of a new generation of liquid fuels. Electro organic synthesis is one possible way to produce these new fuels, but to fully utilize the potential of the method, it is most important that precursor molecules and the energy used for the process, are renewable sources.

Photovoltaic and wind energy are weather depended sources of energy. The fluctuation of electricity is difficult to compensate in conventional methods of fuel generation. A fully electrified one-pot process is a lot more flexible and simplifies maintenance as well as leads to easier scalability.

We have demonstrated the principal feasibility of the *ElectroFuels* approach by means of the electrochemical conversion of levulinic acid to octane, the electrocatalytic hydrogenation of 5-HMF and furfural to dimethylfuran and methylfuran, respectively, and the conversion of fatty acids and oils to alkanes/alkenes. [1-4]

Literature:

- (1) Nilges, P.; dos Santos, T.; Harnisch, F.; Schröder, U.: Electrochemistry for biofuel generation: Electrochemical conversion of levulinic acid to octane. *Energy and Environmental Science* 2012, 5 5231-5235
- (2) Nilges, P., Schröder, U.: Electrochemistry for biofuel generation: Production of furans by electrocatalytic hydrogenation of furfurals. *Energy and Environmental Science*. 2013, 6, 2925-293
- (3) Harnisch, F.; Blei, I.; dos Santos, T.R.; Möller, M.; Nilges, P.; Eilts, P.; Schröder, U.: From the test-tube to the test-engine: Assessing the suitability of prospective liquid biofuel compounds. *RCS Advances* 2013, 3, 9594-9605
- (4) dos Santos, T.; Nilges, P.; Schröder, U.: Electrochemistry for biofuel generation: Transformation of fatty acids and triglycerides to "diesel-like" olefin/ether mixture and olefins. *ChemSusChem*, 2015, 8 886-893