

EGU2020-2989

<https://doi.org/10.5194/egusphere-egu2020-2989>

EGU General Assembly 2020

© Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.



## Towards an artificial carbohydrates supply on Earth

**Florian Dinger**<sup>1,2</sup> and Ulrich Platt<sup>1,2</sup>

<sup>1</sup>Institute of Environmental Physics, University of Heidelberg, Germany (fdinger@iup.uni-heidelberg.de)

<sup>2</sup>Max-Planck Institute for Chemistry, Satellite Remote Sensing, Mainz, Germany

How to feed a growing global population in a secure and sustainable way? The conventional, biogenic agriculture has yet failed to provide a reliable concept which circumvents its severe environmental externalities — such as the massive use of land area, water for irrigation, fertiliser, pesticides, herbicides, and fossil fuel. In contrast, the artificial synthesis of carbohydrates from atmospheric carbon dioxide, water, and renewable energy would allow not only for a highly reliable production without those externalities, but would also allow to increase the agricultural capacities of our planet by several orders of magnitude. All required technology is either commercially available or at least developed on a lab-scale. No directed research has, however, yet been conducted towards an industry-scale carbohydrate synthesis because the biogenic carbohydrate production was economically more competitive. Taking the environmental and socioeconomic externalities of the conventional sugar production into account, this economical narrative has to be questioned. We estimate the production costs of artificial sugar at ~1 €/kg. While the today's spot market price for conventional sugar is about ~0.3 €/kg, we estimate its total costs (including external costs) at >0.9 €/kg in humid regions and >2 €/kg in semi-arid regions. Accordingly, artificial sugar appears already today to be the less expensive way of production. The artificial sugar production allows in principle also for a subsequent synthesis of other carbohydrates such as starch as well as of fats. These synthetic products could be used as a feedstock to microorganisms, fungi, insects, or livestock in order to enhance also the sustainability of the biogenic production of, e.g., proteins.