

IV Sustainable Energy Supply and Consumption

Oral presentation

Combination of Biological Processes and Fuel Cells to Harvest Solar Energy

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Biomass production by micro-algae is by a factor of 10 more efficient than by plants, which renders possible to establish an economic process of solar energy harvesting. Owing to the very low dry mass content of algal suspensions, the most promising way of their conversion to a high exoergic and transportable form of energy is the anaerobic production of biogas. Such a system will be a sustainable source of hydrogen to form a hydrogen economy.

We are developing such processes including especially micro-algal reactors at work, methods for micro-algal cell separation and biomass treatment, and a subsequent two stage anaerobic process. The conduct of feeding the anaerobic process over several weeks using micro-algal biomass is discussed in detail. Results will be presented in August 2008. [1] Fig. 1 shows the principle of work of such a system.

After steam reforming biogas, a mixing of methane and carbon dioxide, can be converted to a mixing of carbon dioxide and hydrogen. This gases could be separated using membrane separation technologies. It will be possible to form a closed carbon loop recycling the carbon dioxide to the micro algal process. The mean result is hydrogen as a transportable and storable energy supplier. Hydrogen can be converted to electrical energy and heat using fuel cells. The simulation of such a process will be shown. Looking to prices of fossil energy in 2004 the energy supply will become by a factor of 5 to 6 more expensive. The project was funded by the German Federal Ministry for Education and Research (BMBF). FKZ 170 02 01

[1] D. F. Ihrig, H. M. Heise, U. Brunert, M. Poschmann, R. Kuckuk, K. Stadtlander: Combination of Biological Processes and Fuel Cells to Harvest Solar Energy; J. Fuel Cell Science and Technology, Vol. 5 (August 2008)

