

# Hydrogen for Human Consumption

Rait Kanarbik<sup>1,\*</sup>, Kuldar Lepiste<sup>1</sup>, Peeter Valk<sup>1</sup>, Enn Lust<sup>1</sup>

<sup>1</sup>*Institute of Chemistry, University of Tartu, Ravila 14a, 50411 Tartu, Estonia*

*\*rait.kanarbik@ut.ee*

The future of hydrogen technology is often regarded as the savior of the world where complete decarbonization is considered a must in the longevity or even continuous existence of mankind. The existence of all living depends not only on the nontoxic environment but also the availability and quality of food. Hydrogen has been used for decades in the food industry hydrogenating unsaturated fatty acids into saturated fats like margarine and butter spreads. Hydrogen itself is not edible and its applications in food production and preparation are limited, questioning the usability of hydrogen technology in the food industry.

Hydrogen technology is often seen as the solution in carbon free energy production. Most food is not consumed directly but has been processed requiring energy. Food production, processing and preparation requires substantial amounts of energy, and the source of that energy defines the carbon footprint of the final food product.

A solar powered, portable and modular hydrogen technology-based food processing system has been developed and assembled for studying the usability of hydrogen technology in the food industry. Maillard reaction is the main reaction that turns raw produce into tasty food, but it requires temperatures of at least 150 °C and therefore a substantial amount of energy. Solar power is usually limited to daytime and requires absence of overcast, but food preparation cannot be limited by these factors. Using solar power to produce hydrogen and fuel cells to use produced hydrogen as an energy source allows us to use solar power regardless of the time or weather conditions. When hydrogen is produced using surplus energy, during sunny and windy days where high amounts of solar and wind energy are generated, that energy has practically zero carbon footprint.

Hydrogen turns out to be an excellent carrier for storing solar energy and allowing portable use of solar energy regardless of time or weather and when this energy is used for Maillard reaction, it is delicious.

## **Acknowledgments**

This research was supported by the EU through the European Regional Development Fund (Centers of Excellence, TK141 “Advanced materials and high-technology devices for energy recuperation systems”), by the Estonian Research Council Grants, grant numbers PUTJD957, PSG935, and PRG676.