1S1a Models and tools for estimating circularity of alternative food and agricultural systems

DIGESTAIR – A NOVEL ANAEROBIC DIGESTER SOLUTION IN AIR TRANSPORT FOR ON BOARD EFFICIENT WASTE MANAGEMENT. DEVELOPMENT OF A DSS TOOL

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Waste production in commercial aircrafts accounts for 0.3 – 3 kg of waste/traveller where food and packing waste of galleys represent 40% of total waste. Currently, the organic waste management of commercial flights is subjected to non-sustainable practices and restrictions.

Within the framework of Clean Sky 2.0, Digestair project (JTI-CS2-2018-CFP08-AIR-03-04) evaluates the implementation of an anaerobic digestion (AD) prototype that will enable the treatment of the waste generated on board in commercial flights, namely sewage from lavatories, food and packing waste (biodegradable plastics) in order to produce biogas. It will also use the data gathered from the experimental work to build and calibrate a Decision Support System (DSS) to simulate different scenarios and propose better configurations. The proposed system is a two-phase anaerobic digestion, with a pre-treatment process that enables the sanitisation of the waste before the AD process.

The main objective of this work is to use the DSS to simulate possible scenarios and system configuration to maximise the biogas production while keeping the system viable from the logistics point of view. Laboratory tests evaluated specific aspects related to the biodegradation of the sole waste streams, different waste stream mixtures and pre-treatment processes. Obtained data have been used to calibrate the developed mathematical model, which includes new disintegration and hydrolysis kinetics of organic wastes.

The simulation scenarios considered in the study were:

- Long flights: 13h flight, 4h technical stops, digester discharge after 2 flights and 350 passengers, 3h between feeding.

- Medium flights: 7h flight, 2.5h technical stops, digester discharge after 2 flights and 350 passengers, 3h between feeding.

-       Short flights with/without feeding: 3h flight, 45min technical stops, digester discharge after 5 flights and 200 passengers, one/zero lunches.

Results showed that long, medium and short flights with feeding working at HRT 15d are a great option to produce biogas while keeping the operation stable and viable, although the system could operate at lower HRTs without acidification problems. The ratio biogas/VS obtained was 300L/kg in the long flight scenario at 15d HRT.

Short flights without feeding have a better ratio biogas/VS but with minimum biogas production. A configuration with membranes has to be analysed in order to increase the biomass concentration in the system.

The last phase of the project comprehends the extrapolation of the aviation case to analogous scenarios, for example, in the maritime industry, providing additional case studies of co-digestion and mathematical modelling application in bio-economy.