KNOWLEDGE INTEGRATION FOR EFFICIENT DECISION-MAKING: A CASE STUDY FROM FISH CANNING WASTEWATER VALORISATION

- Almudena Hospido, almudena.hospido@usc.es, Spain
- Thelmo Lú-Chau thelmo.lu@usc.es, Spain
  Miguel Mauricio-Iglesias, miguel.mauricio@usc.es, Spain
  Mateo Saavedra del Oso, msaavedra.deloso@usc.es, Spain

- **Poster**
- TOPIC: Novel trends & developments
- SUBTOPIC: Novel trends / developments in food production systems (https://lcafood2020.com/conference-topics/)

Problem and aim: The recovery of resources from food industries wastewater and further transformation into high performance biodegradable plastics is an ambitious objective which fulfils the objectives of circular economy and SDGs 6 and 14: i) a potentially harmful water pollutant if discharged is converted instead into an added-value product; ii) ensuring biodegradability in marine conditions, the plastic pollution is greatly minimised. In the framework of H2020 project USABLE-PACKAGING (www.usable-packaging.eu), we are carrying out a comprehensive analysis of a selection of representative value chains, from the industrial effluent to the final bioplastic product and potential by-products to ensure its economic and environmental sustainability. In particular, we are integrating knowledge from different sources, namely from deliberately designed experiments, mathematical models and literature reviews, for the holistic assessment of the environmental performance of several scenarios, with different wastewater characteristics (i.e. substrate) and a diverse range of bioplastic applications (i.e. final product).

Methods: The challenges inherent to the production of bioplastic from a residual source are multiple. The development of a new value-chain unavoidably faces the coexistence of technologies with different levels of maturity, as some conventional technologies are being complemented by lab- and pilot-scale developments or adapted to the new process. Likewise, the sources of knowledge available to design or optimise a whole novel process are scattered and have different levels of detail, validity, robustness, etc. [1]. In this work we are developing a knowledge integration framework (Kalakul et al. 2014) composed by:

- Experimental data from novel bacterial cultures with a potentially higher productivity into PHA and lower production cost.
- Literature meta analysis of PHA extraction and purification methods, including solvent selection and yield, mechanical treatments, enzymatic digestion, etc.
- Mathematical models describing PHA production bottlenecks: the production of VFA and the posterior accumulation of PHA.
- Life-cycle assessment of the whole value chain fed, leading to a preliminary evaluation of the process sustainability that provides the tools, in an early-stage of development, for selecting the right technology when different options are available.

Results: The project is still on its early stage and therefore only preliminary results will be presented at the conference, although the structure itself and the integration building process is considered already a result of the activities done.

Discussion: Focusing on the LCA role within USABLE, we have followed the guidelines of the ambitious Plastic Strategy [3]. This Strategy involves the development of different measures to decrease the impact of plastic on the environment, being one of them the search for alternative feedstocks for plastic production if they result in genuine environmental benefits compared to the non-renewable alternatives under a life cycle perspective. So, the LCA methodology has already been used to assess the environmental performance of PHA production against competing materials [4], raising the fact that different methodological choices, such as the selection of the impact categories considered or the definition of the system boundaries, have to be done and there is still room for improvement and consensus.

Literature:

[1] Prat et al. 2012. Model-based knowledge acquisition in environmental DSS system for wastewater integrated management. WS&T 65(6): 1123-9

[2] Kalakul et al. 2014. Integration of LCA software with tools for economic and sustainability analyses and process simulation for sustainable process design. JCP 71:98-109

[3] EC 2018. A European strategy for plastics in a circular economy (COM/2018/028 final).

[4] Yates & Barlow 2013. LCA of biodegradable, commercial biopolymers—A critical review. RC&R 78: 54-66.

Keywords:

Bioplastics, circular-economy, food-industry, valorisation, wastewater