5s4a: : Waste reduction and novel resources for sustainable production of safe food or feed

MODELLING AGRI-FOOD WASTE PRODUCTION AND VALORISATION IN A CIRCULAR ECONOMY APPROACH

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The agri-food industry generates around 50 % of global waste, of which only 36 % is recycled, although the potential recovery could be as high as 60 %. These residual streams can be used as feedstock for the bio-based industry, provided that the composition, logistics and volume are carefully analysed.

The European project MODEL2BIO aims to create a Decision Support System for managing waste streams produced in agriculture-food companies. This will be an innovative concept that using predictive models, will be able to select the best ways for valorising different waste streams considering their composition, industry location and other factors. This innovative tool is based on the interconnection of three complementary elements (simulation module, optimisation algorithm and LCA module), in which the Simulation module (SM) is the focus of this abstract.

The SM is able to predict the mass fluxes for any bio-based residual stream alternatives using a set of compatible model libraries describing the agri-food production lines, the intermediate processes (storage, mixing, separation and transport) and the final valorisation in the bioprocesses. All libraries use the same Components Vector according to the Plant-Wide Modelling (PWM) methodology. The PWM methodology is a systematic and rigorous methodology for constructing mathematical models able to describe the whole systems as complex as required in each case study. This approach facilitates the mass, charge and energy continuity throughout the whole system.

The Production Line Models of the agri-food industry are a set of mathematical models for the description of the food production lines. The output of this library will be the physiochemical characteristics of waste streams based on its composition, and the flow of the residual stream generated for each kg of product, using the inputs uploaded by the user to the tool.

The Intermediate Process models describe de transformations of the waste streams to BBI feedstock and include from storage and transport, to biologic processes such as pre-fermentations or physiochemical processes such as micro-wave stabilisation.

The Bio-processes models describe of BBI processes, in which the residual streams will be valorised. In this set of models, all possible biochemical processes will be considered for valorising the agri-food residual streams, such as solid-state fermentations, anaerobic digestion and extraction processes. This library will be easily expandable for including other technologies when needed.

The next steps in the creation of the SM will be the experimentation of the valorisation routes and its consequent validation of the tool.