Ecodesign of new circular economy scheme for Brewer's side streams

B. Iñarra[1], D. San Martin[1], M. Orive[1], S. Ramos[1], M. Cidad[1], A. Estévez[2], R. Fenollosa[3], J.M. Martinez[4], A.M. De Smet[5], J. Zufía[1]

[1]AZTI, Bizkaia, Spain
[2]IRTA, Tarragona, Spain
[3]RIERA NADEU, Barcelona, Spain
[4]LKS KREAN, Gipuzkoa, Spain
[5]The Brewers of Europe, Brussels, Belgium

Keywords: Ecodesign, Environmental assessment, brewers' by-products, aquaculture feed, second-generation feedstuff
Presenting author email: binarra@azti.es

European Union is one of the world largest beer producers with more than 400 million Hl and more than 10,000 breweries in 2019. The brewing process produces a large amounts of side streams, mainly composed by brewers' spent grains (BSG) and brewers' yeast (BY) (80 & 10 % respectively). This implies more than 6 million tons of BSG and 1 million tons of BY per year generated in Europe. The current management of these side streams implies an important environmental impact that, only regarding greenhouse gases emission, accounts for more than 500 kg CO_2 equivalent by ton of waste landfilled (BSG) and more than 80 kg CO_2 equivalent by ton of wastewater treated (BY).

LIFE BREWERY project has set up a new circular economy scheme based on a sustainable solution for valorising brewery by-products and ecodesigned the different aspects of this new value chain (https://lifebrewery.azti.es/).

The set up a successful value chain several aspects need to be analysed and ecodesigned:

- Select then an appropriate market, or ingredient, to use the valorised by-products,
- Optimize the logistics for the managements of by-products from brewery,
- Ecodesign of a valorisation process,
- Ecodesign of an efficient facility.

Results of LIFE-BREWERY project have demonstrated that brewers' by-products stand as a valuable alternative for partially substituting fishmeal in aquaculture feed, due to their accessibility in Europe, their nutritional parameters and the validation of the proposed valorisation process and products (Nazzaro *et al.* 2021). The proposed scheme (Figure 1) includes the steps to collect and transform brewer's by-products in aquaculture feed ingredients (San Martin *et al.* 2020).

The different steps of the solution have been ecodesigned to reduce the resulting environmental footprint considering the European environmental requirements and adhering to the ecodesign criteria for the whole life cycle of the plant "from cradle to grave" (San Martin *et al.* 2019).

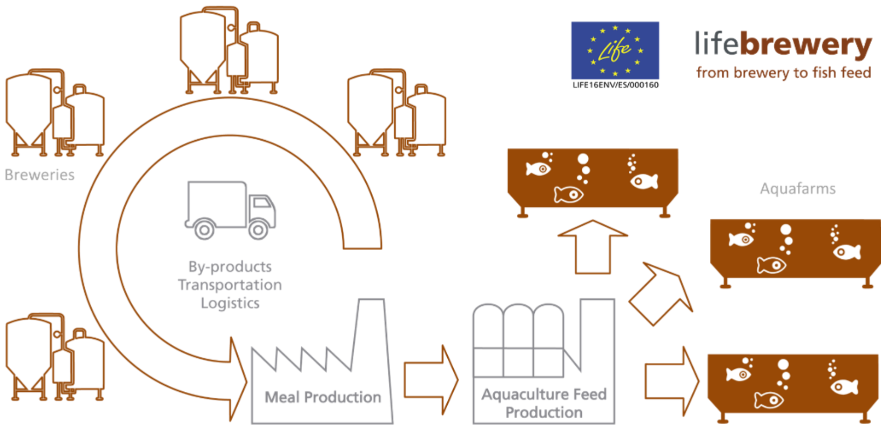

Figure 1: LIFE-BREWERY new circular economy scheme proposed.

As main conclusion this work has demonstrated that the valorisation of Brewers´ by-products as a second-generation feedstuff for the formulation of aquafeed has an important beneficial effect both in brewers and aquaculture environmental impact. The use of an Ecodesign methodology has improved the preliminary environmental advantages of the scenario leading to a more sustainable circular economy scheme surpassing initial expectations.

Acknowledgements

This project is co-funded by LIFE European Environment Programme (LIFE16 ENV/ES/000160), which is the EU's financial instrument supporting environmental, nature conservation and climate action projects throughout the EU. The implementation, updating and development of EU environmental and climate policy and legislation by co-financing projects with European added value are among its main priorities.

References

D. San Martin, C. Bald, M. Cebrian, B. Iñarra, M. Orive, S. Ramos, J. Zufía. 2019. Principles for Developing a Safe and Sustainable Valorization of Food Waste for Animal Feed: Second Generation Feedstuff. In: Preedy V., Patel V. (eds) Handbook of Famine, Starvation, and Nutrient Deprivation. Springer, Cham.

D. San Martin, M. Orive, B. Iñarra, J. Castelo, A. Estévez, J. Nazzaro, I. Iloro, F. Elortza & J. Zufía. 2020. Brewers' Spent Yeast and Grain Protein Hydrolysates as Second-Generation Feedstuff for Aquaculture Feed. Waste Biomass Valor. 11: 5307–5320

J. Nazzaro, D. San Martin, A.M. Perez-Vendrell, L. Padrell, B. Iñarra, M. Orive, A. Estévez. 2021. Apparent digestibility coefficients of brewer's by-products used in feeds for rainbow trout (Oncorhynchus mykiss) and gilthead seabream (Sparus aurata). Aquaculture 530: 735796