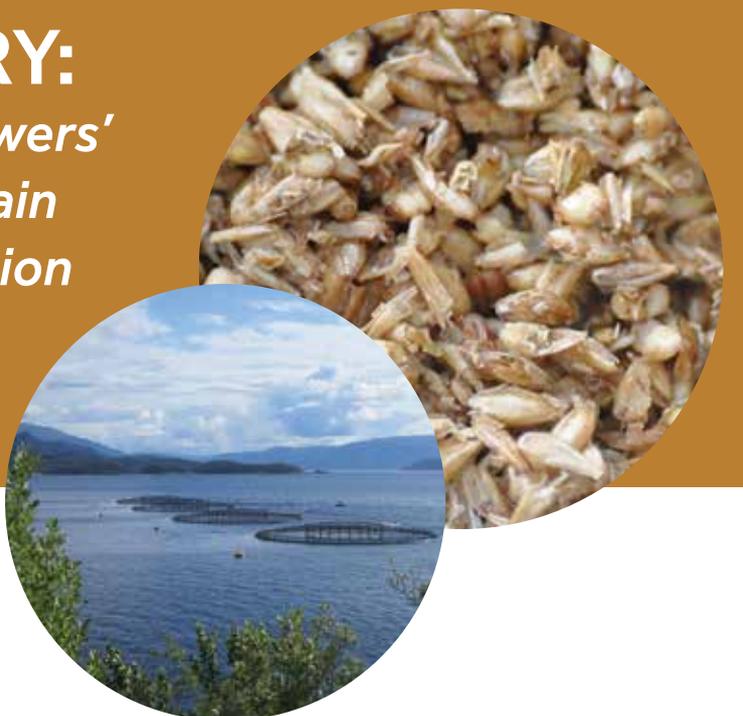




# Life BREWERY: Valorisation of brewers' yeast and spent grain as second-generation feedstuff for aquaculture feed



DAVID SAN MARTÍN<sup>1</sup>, MIKEL ORIVE<sup>1</sup>,  
BRUNO IÑARRA<sup>1</sup>, RICARD FENOLLOSA<sup>2</sup>,  
ALICIA ESTEVEZ<sup>3</sup>, JOSE MIGUEL MARTINEZ<sup>4</sup>,  
ANNA-MARIA DE SMET<sup>5</sup> AND JAIME ZUFÍA<sup>1</sup>

In the food industry, the brewing sector holds a strategic economic position with annual beer production exceeding 1.34 billion Hl. The brewing industry employs different batch type operations in processing raw materials to the final beer product that produce large quantities of wastewaters and solid wastes. The effluent to beer ratio has been estimated to be approximately 3-10 L of waste effluent per litre of beer produced. Regarding solid wastes, the main solid by-products are spent grain (SG) followed by spent yeast (SY), representing the 80 % and 10 % of total waste solids, respectively. The remaining 10 % are residues similar to urban residues such as glass, plastic, wood, etc. (Beer statistics, 2017).

Europe is the second most important beer producer worldwide with an annual beer production in 2017 above the 40 billion litre mark for the first time since the economic crisis. According to the Brewers of Europe statistics (2017 edition), the European Union now counts around 8,500 active breweries, with an estimated twenty new breweries starting up each week. Thus, the annual generation of SG and SY is expected to be above 7 million tons. The inherent characteristics of these by-products give them a great potential to be recovered for human nutrition, pharmaceutical, cosmetic applications and animal feed.

However, although all these options are technically and economically feasible, most of these sectors are only able to absorb a small part of the by-products that are annually

generated worldwide. Therefore, a global solution to deal with greater volumes needs to be found.

On the other hand, the continuous increasing demand of aquaculture derived products (25 % for 2020) is making the aquafeed valorisation route one of the most promising alternative for the massive recovery of brewers' by-products. Additional advantage of this valorisation alternative is the higher efficiency of SG and SY proteins conversion comparing to other animal (ruminants, poultry, etc.) protein sources.

**lifebrewery**  
from brewery to fish feed



Within this framework, Life BREWERY project (LIFE16ENV/ES/000160) aims to find a comprehensive solution for reusing brewery by-products as new feed ingredients for aquaculture. This project is co-funded by LIFE European Environment Programme, 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.

The project is developing low-moisture meal prototypes from brewer's spent grain and yeast, through the application of an innovative drying process. This process consists of a first highly efficient and low energy consuming mechanical dewatering that reduces the energy needed for the drying before the thermal drying in the second step. This second drying applies a highly efficient drying technology to achieve the desired moisture content of less than 10 %. In addition, with the aim of increasing the digestibility of these new ingredients, a process of hydrolysis is under development as a pre-processing prior to dehydration.

<sup>1</sup>AZTI, ASTONDO BIDEA, EDIF. 609, E-48160 DERIO (BIZKAIA, SPAIN)

<sup>2</sup>RIERA NADEU, POLÍGONO INDUSTRIAL COLL DE LA MANYA CAL ROS DELS OCELLS, 1-3, PARCELA 8, NAVE 1 Y 2, E-08403 GRANOLLERS (BARCELONA, SPAIN)

<sup>3</sup>IRTA, CTRA. DE POBLE NOU, 5, E-43540 SANT CARLES DE LA RÀPITA (TARRAGONA, SPAIN)

<sup>4</sup>LKS, ZUATZU 1, EDIF. ULIA, PLANTA 1, E-20018 SAN SEBASTIÁN (GIPUZKOA, SPAIN)

<sup>5</sup>THE BREWERS OF EUROPE, RUE CAROLY 23-25, B-1050 (BRUSSELS, BELGIUM)



The overall goal is to show that these meal types can be used to feed three fish species in aquaculture systems: Sea bream, as a model of a Mediterranean aquaculture specie; Senegalese sole, as a model of Atlantic specie; and Trout, as a model of a freshwater specie. The result is an increase of the sustainability of aquaculture by providing two new, economically advantageous, protein sources that could replace fish meal. Thus, the reduction of aquaculture production costs will contribute to achieve the objectives established by the new European Common Fisheries Policy. In addition, the replacement of marine origin ingredients (fishmeal) will contribute to reduce significantly wild catches, contributing to achieve the goals defined in the Marine Strategy Framework Directive.

Thanks to all these tasks, apart from validating the new aquafeed prototypes, the existing uncertainties regarding the technical and economic issues will be reduced. Thus, the main barriers for the final transferability and replication of the project in other European region (mainly in the Atlantic and Mediterranean arcs) are expected to be overcome.

The consortium of the project is formed by AZTI (marine and food research centre from the Basque Country), IRTA (Catalan Institute of Agri-food Research and Technology), Riera Nadeu (a Catalan company specialized in dehydrating solutions) and LKS (a Basque engineering company) and, finally, by the 'The Brewers of Europe' (European brewers' association). This consortium brings together the main actors of the value chain to achieve successfully the final implementation of the solution.

AZTI ([www.azti.es](http://www.azti.es)), apart from coordinating the project, will oversee sensorial analysis of the final products and will oversee the demonstration trial under real operation conditions. Riera Nadeu is responsible for brewery by-products stabilization through an innovative drying process. IRTA is in charge of developing and testing the new aquafeed prototypes in the fish growing trials and, LKS will perform the integrated eco-design of a recovery plant model. Finally, The Brewers of Europe is responsible for fostering the transference and replicability of the solution in any other EU region with similar environmental problem.

In order to facilitate the take up of the fish feeds, the project has set up a stakeholder group that comprises at least two representatives of the main sectors of the value chain for the recovery of brewery by-products. The aim is to identify and meet the requirements of the different industrial sectors. The first meeting of the stakeholder group was held last March in Brussels. The ideas and strategies raised in this meeting are expected to be key to accomplish successfully the final implementation of the project's results.

The main conclusions from this first stakeholders' meeting table were that the key issues in any valorisation activity for aquafeed production are to find the most appropriate sources of protein and to control the preservation of digestibility. In addition, apart from large scale solution, the potential extraction of high-value compounds (i.e. peptides) might contribute to increase the value of the by-product. However; it is necessary to check the legislation of each EU country in terms of by-products valorisation. Finally, it is necessary to find potential investors interested in implementing the final designed process both in Spain and at European level. Easily marketable ingredients and a good business model are key for searching potential investors. Apart from in the Nordic coun-



tries and Mediterranean area, the main interest for project replication could become from the United Kingdom for salmon growth. As the ingredients are tested in three different fish models (fresh and marine water), the developed ingredients should be also suitable for other species.

The main advances of the project to date are being focused on the optimization of both SG and SY treatment, both hydrolysis and drying, with the aim of ensuring the feasibility, profitability and sustainability of the proposed Valorisation scheme. Thus, AZTI is already designing the valorisation scheme including all stages of the value chain. The inclusion of all actors will facilitate the replication of the project in other European regions. IRTA, at the same time, has also defined the methodology for digestibility tests and growth trials and has formulated the aquafeeds including both SG and SY as protein substitutes of marine origin proteins.

Next steps will include a demonstration trial of the hydrolysis and dehydration processes for each by-product at semi-industrial scale during the first part of 2019. In the second part, digestibility tests will be taken place to determine the optimum level of inclusion of each ingredient for each fish species object of study. Finally, growth trials will be carried out to quantify the nutritional efficiency of the experimental aqua feeds including the optimum inclusion level of new ingredients for each fish species. This demonstration trial will also allow assessing the feasibility of the recovery scheme as tool to increase the long-term economic and environmental sustainability of brewing and aquaculture sectors. It will be carried out in the northeast area of Spain.

More information about the project in the following website: <http://lifebrewery.azti.es/>; twitter: @life\_brewery or e-mail: [dsanmartin@azti.es](mailto:dsanmartin@azti.es).

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