Brewer's spent yeast and grain as second-generation feedstuff for aquaculture feed

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Aquafeeds are formulated to contain all the essential nutrients that farmed fish need to stay healthy and maintain the benefits of their consumption in humans. Currently, such feedstuffs are highly dependent on fishmeal and fish oils. It is estimated that the aquaculture sector consumed 73% and 71% of the total global fishmeal and fish oil production (IFFO, 2013). However, the usage of these marine products in aquaculture has been steady or declining slightly in recent years as they are being used more strategically (at critical stages of the life cycle), more efficiently (the same amount of wild fish yields more farmed fish, via fishmeal and fish oil in feed), and are being increasingly substituted with vegetable protein and oil ingredients. In this regard, a study by Samuel-Fitwi *et al.* (2013) showed that replacing fishmeal with alternative ingredients, such as soybeans or rapeseed, implies a lower environmental impact: a standard trout feed based on fishmeal has an impact of 1,797 kg of CO_2 equivalent per ton, while feed based on soybean and rapeseed have 1,019.65 and 1,037.13 kg of CO_2, respectively.

Brewing industry

The brewing sector holds a strategic economic position with an annual beer production in EU-28 of about

396 million Hl. In this context, the brewing industry employs different batch type operations in processing raw materials to the final beer product that produce large quantities of wastes: above 7 million tons of spent grain (SG) and spent yeast (SY) (Beer statistics, 2018). This waste has a great potential for use as an ingredient for feed. Hence, the continuous increasing demand of aquaculture derived products (25 % for 2020) (FAO, 2013) is making the aquafeed valorization route one of the most promising alternatives for the massive recovery of brewers' by-products.

Life BREWERY project

The first challenge of the project was to develop new ingredients from brewer's spent yeast and grain by applying an innovative process. This process first consisted of mechanical dehydration to reduce the humidity as much as possible (to about 55%), which involved a low energy demand and, therefore, a reduction of the energy necessary for thermal drying in a second step. The second phase applied a flash drying to reduce the moisture content to below 10%. This flash drying involved an instantaneous drying and, therefore, a highly efficient use of thermal energy. In addition, in order to increase the digestibility of these new ingredients, a hydrolysis process was studied as a pre-treatment before dehydration.

Aquaculture trials

Once the new ingredients were produced, the second challenge was to assess the digestibility and feed efficiency of these ingredients in three species of aquaculture: sea bream (*Sparus aurata*) as a model of a Mediterranean aquaculture species; Senegal sole (*Solea senegalensis*) as a model of an Atlantic specie; and rainbow trout (*Oncorhynchus mykiss*) as a model of a freshwater species.

Four prototypes of ingredients were obtained by combining hydrolysis and drying process: brewer spent yeast; hydrolised brewer spent yeast; brewer spent grain; and hydrolised brewer spent grain.

These four prototypes have been tested in digestibility trials (isoproteic, isolipidic and isoenergetic aquafeed with 30% of inclusion of each experimental ingredient) in two species RAS aquaculture systems: sea bream and Rainbow trout. The results showed acceptable digestibility results between 71% to 90%. Hydrolised prototypes showed greater digestibility than non-hydrolised ones.

Conclusions

It can be concluded that brewer by-products stand out as a potential alternative to replace fishmeal in aquaculture food, due to its availability in Europe, nutritional characteristics and the results obtained in fish digestibility tests. Hence, their inclusion in aquafeed will contribute to increase the sustainability of aquaculture by providing new sources of sustainable and economically advantageous proteins that can replace fishmeal. Its availability will also contribute to reducing the environmental impact related to aquatic feeding based on fishmeal.

Once the digestibility trials have ensured the potential of these ingredients, the next step will be to carry out the growing trials in which the feed efficiency in fish will be assessed such as growth in weight and length, etc. In addition, the main barriers to the final transfer and replication of this solution in several European regions will be addressed.

Acknowledgements

lifebrewery
from brewery to fish feed

LIFE16ENV/ES/000160

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References available on request

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