Changing perspectives: From waste and wastewater management to side-stream valorisation in fish cannery

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INTRODUCTION

Along with an increasing consumption of convenience seafood products such as canned fish and ready meals, the quantity of fish side-streams is increasing.
More than 30 % of the European produced edible fish and seafood weight has been lost and wasted (FAO, 2011). More specifically, it is estimated that between 45 to 70 % of tuna ends as waste (EUMOFA, 2018). Instead of considering this as a waste product it could be turned into a valuable input creating added value for the industry.
So, there is still room for improvement in different actions for the alignment with the SDG12 objectives ensuring sustainable consumption and production patterns.

The European canned seafood processing sector is mostly concentrated in Southern Europe, where Spain, Italy, France and Portugal are key players. Spain leads the production of canned food in Europe. According to data obtained from STECF from 2019, Spain produces almost 70 % of the canned tuna processed in Europe, an average of 360,000 tons of canned tuna per year.

The tuna canning industry has to face new challenges in the light of the circular economy approach that could lead to a re-thinking of the use of by-products and wastes as raw materials in line with the EU Commission focus on Blue Bioeconomy defined by the European Commission as: "the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy" (European Commission, 2012).

This work presents four different good practices examples that had been carried out in the tuna canning industry with the purpose of increase the sustainability of their processes.

- The implementation of the 3-barrier system to reduce the organic load in wastewaters and the strategies to increase the by-products for revalorisation as fish flour.
- Food loss and waste (FLW) decrease through the use of a smart IoT platform adapted for SMEs canneries
- Reuse of problematic process water as tuna cooking brines.
- High value protein recovery from tuna cooking brines for use as fertiliser ingredients.

3-barrier system – Through the ecoefficiency in the tuna canning processes

In many cases, the production side-streams ended in the wastewaters, increasing the organic matter to the point that canneries may fail to comply with the discharge limit values. This fact is especially relevant considering that the organic matter is mainly composed of useful proteins that can be used in food, feed or other valuable purposes.

In this context, LIFE VERTALIM project developed the 3-barriers system, implemented in 9 canning companies in order to reduce water consumption, pollution from spills and increase their productivity. This system described by Gutierrez et al .2020 to identify inefficiencies at source, reduce water consumption, volume and contamination of discharges. This methodology works through the implementation of improvement actions at three levels: 1st Barrier: Actions in specific production processes to avoid the loss of material, as well as to save water; 2nd Barrier: Retention of solids and fats in a hygienic way for their revaluation as by-products; 3rd Barrier: Intelligent internal management of partial discharges, for their reuse and minimization of the treatment.

As a general result of the implementation of the 3-barrier system an average reduction of the pollutant load of 30-45 % and around 30 % in the water consumption were achieved.

The use of IoT tools for Food Loss and Waste reduction

FLW in the fish processing industry is a particularly severe problem with approximately 40 – 60 % of the input raw material being lost, depending on the fish species. Given the volumes of production and the size of the market it is clear the strong impact of FLW on the efficiency and sustainability of this particular food value chain in a context of continuously growing demand.

The source of such losses is manifold and hard to address not only because of the cultural resistance of a traditional sector such as that one of the fish industries but, most importantly, because of the large diversity of the variables involved and their complex interconnections.

This is particularly true for the fish canning industry where, nowadays, most of the processing steps are performed manually. Moreover, the perception of the potential of new technologies based on data, AI and others is not very spread among those industries, missing a great opportunity to apply those methods and making their processes more efficient. With the objective of addressing all these urgent needs the iFishCan project has focused on the design, implementation and demonstration of a low-cost, flexible, transportable and scalable smart FLW monitoring system for the fish manufacturing industry with the following features: real-time detection and localization of FLW events along the chain, generation of a predictive and prescriptive action plan to avoid or mitigate such losses and control over environmental impact indicators such as carbon and water footprint.

Transforming problematic tuna cooking brines in recovered brine ready to use

One of the main streams that contribute to increasing the organic and saline load of the effluents from the canneries are the cooking brines of bonito. For this reason, the design and implementation of advanced technologies have been carried out to reduce the pollution of the company's discharges through the recovery of brines and optimization in the recovery of by-products, which currently presents some difficulties to comply with the regulations of discharges to the 100 %, and whose process efficiency has a significant margin for improvement.
The scheme of the system for the recovery of depleted brines has been developed and improved within this R & D & i project and pilot-scale tests have been carried out with real samples. The technical viability of the proposed solution and the reduction in pollution achieved have been verified, which will allow the company to comply with the requirements of the water management entities.

As a consequence, the environmental impacts of the production process will be reduced in percentages that can be estimated between 10-30 %, making the canned bonito manufacturing process more efficient and sustainable.

CONCLUSIONS

As summary, it is estimated that between 45 to 70 % of tuna ends as waste, so that, there is a great opportunity to reduce the FLW and transform it in a new secondary raw material for new activities .boosting the transition to the circular economy. In this abstract, four different good practices examples that had been shown for tuna canning industry with the purpose of increase the business sustainability, the recovery of natural resources and the fulfil of the environmental directives.

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