VALACTICAT: pilot project for the valorisation of whey in Catalan food industries

Summary

Almost 85% of the milk used to make cheese is discarded in the form of whey – liquid rich in salts and lactose, which still contains 20% of milk proteins. As a result, companies in the sector are interested in the valorisation of this whey as a by-product in the food industry, as to date it has been considered waste with treatment that entails additional costs, given that its disposal without treatment is prohibited due to its high environmental impact. In addition, there is the potential for bringing new products obtained from this recovery to market without increasing the raw materials used, and minimising the external compounds currently used to produce existing products.

This project aims to contribute to enhancing the efficient management of the participating companies by means of solutions that make them more competitive (in terms of reducing costs), which enable them to diversify their activities (if this means that they can market ingredients that are surplus to their requirements) and which allow them to show consumers that their work is more sustainable and environmentally friendly, and firmly committed to the principles of the circular economy.

The VALACTICAT Project aims to recover whey by applying new technologies in order to increase the competitiveness of the participating companies, to save resources in their management and enhance the sustainability of their work.

Objectives

The following technical objectives are established to achieve this general objective:

- Characterise the nutritional composition of the whey from various sources produced on the premises of the companies in the consortium.
- Study and optimise the basic operations for managing whey, and recover the fractions of interest to the food industry.
- Evaluate the nutritional, structural and sensory properties of the fractions obtained from the whey fractionation processes.
- Study how the fractions recovered from the whey can be integrated into food products currently on the market or into the production of innovative new products.
- Evaluate the technical and economic feasibility of implementing optimised processes on an industrial scale.

Description of the actions carried out in the project

The following specific actions were taken to achieve these goals:

- Study the variability in the composition of whey.
- Assess the viability of the recovery process of the various recoverable fractions.
- Study the feasibility of the incorporation and valorisation of the fractions obtained from the company's own products.
- Evaluate the use of combinations of the different fractions obtained with other ingredients, to attempt to undertake a complete valorisation of the fractions which could help to find the appropriate dosage that maintains the characteristic properties of the product currently sold in the market.
- Study of the valorisation of whey by fermentation processes, and its impact.

Final results and conclusions

VALACTICAT has enabled BETARA I CASA AMETLLER ORIGEN OBRADORS to find a potential system of valorisation for whey in order to reduce costs and simplify treatment procedure, while retaining the latest technological innovations.

Based upon the performed characterisation, we have found that whey is basically composed of sugars, among which the most important are lactose and galactose. A relatively high proportion of fat to be processed by several planned systems of fractionation (membranes and/or reverse osmosis), has been observed. Therefore, skimming is considered the first unitary operation to apply to valorise whey. The concentration processes that have been studied during VALACTICAT in order to obtain different fractions are presented below: ultrafiltration (UF), nanofiltration (NF) and reversed osmosis (RO).

The UF selected membrane does not reach the separation of sugars and ions (mono or multivalent) between permeated and concentrated, because of its high cut-off. The same concentrations of these compounds have been found within the permeated and the concentrated. Nevertheless, this technology is ideal for separating proteins, thus resulting in a concentrate with the same characteristics of the initial whey, in terms of sugar and ions concentration and with a higher protein concentration, depending on the level of water recovery.

The NF allows the volume reduction and the partial demineralisation to take place at the same process stage. Moreover, multivalent ions waste (Ca^{2+}, Mg^{2+}, SO_4^{2-}, PO_4^{3-}) was high because of the membrane's cut-off. At the same time, the NF achieved a very high level of sugar waste (lactose), while small remains of galactose were found in the permeated. Proteins were completely rejected by the application of NF and RO membranes with concentrations following the tendency of the theoretic concentration factor curve.

Skimmed whey's applicability and the different fractions obtained by the concentration procedures (UF, NF, and RO) have been studied in several alimentary matrixes (dairy desserts). These applications reveal the possibility of using pasteurized skimmed whey, as well as concentrated whey, without impacting technological or sensorial attributes. At the same time, it has allowed to develop food products using fermentation as a unitary operation, which paves the way to the development of a range of new products.

Finally, a life cycle assessment (LCA), which allows to calculate the environmental impact of a product considering its whole life cycle, was conducted and standardised to the ISO regulations 14040 and 14044. This study proved that the valorisation of whey is environmentally and economically beneficial. However, the environmental and economic performance depends on the product that is being replaced or developed. It is important to take into account that the present study does not consider reusing the fat that is generated as a waste in the process of whey valorisation, which would improve the environmental and economic performance.

VALACTICAT aims to be a driving force for the valorisation of whey by other cheese production companies, and as such the aim is for the results of this pilot project to impact on innovation, productivity and sustainability at the territorial and sectoral level in Catalonia's cheese production industry.

Leader of the Operational Group

ORGANISATION: BETARA, SL
CONTACT E-MAIL: info@betara.cat

Coordinator of the Operational Group

ORGANISATION: THE FOODSERVICE CLUSTER ASSOCIATION OF CATALONIA
CONTACT E-MAIL: info@clusterfoodservice.org

Other members of the Operational Group (grant recipients)

ORGANISATION: AMETLLER ORIGEN OBRADORS, SL
CONTACT E-MAIL: aprat@casaametller.net

Other members of the Operational Group (not recipients of the grant)

ORGANISATION: EURECAT
CONTACT E-MAIL: nadia.ortega@eurecat.org

Subject area(s) of application

- ☒ Agricultural production system
- ☒ Waste and by-product management
- ☒ Food quality/processing and nutrition
- ☒ Supply chain, marketing and consumption
- ☒ Competitiveness and agriculture and forestry diversification

Geographical area(s) of application

PROVINCE(S): BARCELONA
REGION(S): L'ALT PENEDÈS, OSONA

Project website

https://foodnutritioncluster.com/casos-d-exit/?lang=en

https://www.clusterfoodservice.org/projectes-al-cluster-foodservice/

More information on the project

PROJECT DATES	TOTAL BUDGET
Start date: July 2019	Total budget: €170,617.14
Completion date: September 2021	DARP funding: €69,727.68
Current status: Executed	EU funding: €52,601.59
	Own funding: €48,287.87

With funding from:

Project funded through Operation 16.01.01 (Cooperation for Innovation) through the Catalan Rural Development Programme 2014-2020.

Order ARP/133/2017 of 21 June, approving the regulatory bases for grants for cooperation for innovation by promoting the creation of European Association for Innovation operational groups in the areas of agricultural productivity and sustainability and the execution of innovative pilot projects by those groups, and Resolution ARP/1282/2018, of 8 June, announcing the call for the grant.