PROWASTE

PROTEIN-FIBRE FIBRE BIOREFINERY FOR SCATTERED MATERIAL STREAMS

Photo: Fraunhofer-Institut für Verfahrenstechnik und Verpackung IVV

Protein-rich side-stream potential in EU from small-scale units (1000 tonnes)	
Apple pomace	100
Spent grain	300
Canola press cake	1.300

Potential protein and fibre yield from scall-scale units (1000 tonnes)	
Protein	500
Fibre	250

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Coordinator:	**Mr. Saska Tuomasjukka** (University of Turku, Finland) Email: sastuoma@utu.fi
Project partners:	University of Turku, **Finland**; Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V., **Germany**; Myssyfarmi Ltd, Finland; Regis Food Technology, Ltd, **Poland**; Wroclaw University of Environmental and Life Sciences, **Poland**; Center of Food and Fermentation Technologies, **Estonia**; Polarforma Ltd, **Finland**; Bayerische Staatsbrauerei Weihenstephan, **Germany**.
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FACCE SURPLUS
SUSTAINABLE AND RESILIENT AGRICULTURE FOR FOOD AND NON-FOOD SYSTEMS

BACKGROUND

Annually, over 15 million tonnes of waste is produced by canola oil and brewing industries in Europe. Current use of these side-streams as feed seriously undervalues their potential for improved economics and ecology. With simple fractionation methods, food-grade compounds could be isolated and sold to the food processing market as a valuable nutrients. The challenge is in combining existing technologies resulting in a robust, inexpensive and effective process suitable for varying and scattered material streams originating from small-scale units.

OBJECTIVE

- To develop and pilot a concept biorefinery.
- To produce food-grade protein and dietary fibre isolates from underutilized side-streams, including canola press cake, oat bran and spent barley.
- To test ingredient properties, such as bioactivity as an antioxidant (ABTS, FRAP, ORAC), antidiabetic (alfaamylase, betaglucosidase, dipeptidylo-peptidase IV), angiohypertensin activity (ACE), and antimicrobial agent.
- To screen of other potential input materials, to test of protein and dietary fibre fraction utilizability in concept produces, to monitor and develop the biorefinery fractionation process, produced fractions are utilized in concept foods (products), and evaluated for sensory and biochemical properties.

METHODOLOGY

PRETREATMENT. Enzymatic and fermentation processes are developed to improve the extractability and/or utilizability of value compounds from grain and fruit waste materials.

FRACTIONATION. Based on experience from various protein isolation procedures, fractionation process for side-streams is developed and optimized. Protein fractionation comprise of two steps: 1) solubilization and 2) concentration of protein. First, protein-rich fractions are dissolved in aqueous media with or without salt at specific pH-values according to their maximum solubility, or with buffer solutions of different ionic strengths to facilitate protein dissolution. After this they are purified by precipitation or ultrafiltration. Fibre preparations are produced from the residues of the aqueous extraction steps leading to products with a fibre content of up to 80 %.

STABILISATION. The resulting fractions need be stabilized by gentle but effective drying. Microwave drying, particularly under vacuum, is a novel, efficient method of food preservation. The puffing phenomenon, that accompanies the rapid process of dehydration, creates a porous texture of the dried material. Osmotic pre-treatment and pre-drying of the raw material by convective method followed by finishing-drying enchanced by microwaves reduce the total cost of dehydration and improve the quality of dried product. Application of heat pumps in convective method provides additional economical and environmental benefits.

RESULTS AND KEY FINDINGS

- Biorefinery concept for small and medium size farm and processing industries, with variable volumes and output material composition;
- Technological solutions for drying and fractionating side-streams gently and cost-effectively;
- New food-grade protein and fibre isolates with improved sensory characteristics and bioactivities;
- Concept food products enriched with fibre and protein, resulting substantially improved nutrient levels and a basis for development of added-value foods for special food categories.