Protein Ingredients

Innovative processes for functional ingredients

Protein ingredients from high-quality protein seed crops (quinoa, buckwheat and amaranth) and from high protein containing legume seeds (lupin, lentil and faba bean), as well as sustainable and industrially applicable processes for their targeted processing and fractionation are missing on the European market. PROTEIN2FOOD has applied **innovative processes** for dry fractionation and aqueous extraction of these seeds, allowing for efficient protein enrichment and purification, and developed various new flours, protein concentrates and isolates with good **functional**, sensory and nutritional **properties**, for the development of protein-rich and tasty food products**.**

Main Achievements

PROTEIN2FOOD process developments provided several new high-quality **plant protein ingredients**, which are not currently available on the market. **Dry fractionation** based on impact milling combined with sieve classification or air classification was suitable for providing protein-rich flours from faba bean, quinoa, buckwheat and amaranth. Protein contents of the protein-rich flours were at least doubled compared to the raw material and ranged between 24% to 67 % depending on the raw material.

Image 1. Faba bean milling fractions: From left to right: whole seed, dehulled kernels, hulls, dehulled flour, whole seed flour.

Wet **fractionation processes** combining mild aqueous protein extraction and protein recovery by acid precipitation or ultrafiltration were successfully developed for faba bean, lentil and lupin seeds, which ensured protein concentrates and isolates had protein contents of 85-92% (2.5-3 times higher than the corresponding raw materials). The protein yields of the main fractions of 55-65% demonstrated **efficient protein enrichment** and purification. All the prospected processes were scaled-up to pilot plant or near industrial scale.

"PROTEIN2FOOD developed new plant-based functional ingredients with up to 3 times higher protein contents than the raw materials"

Image 2. Products from the protein extraction of faba beans: Functional fibres, protein isolate, protein concentrate, starch.

Aqueous processing provided protein ingredients with significantly reduced contents of antinutrients, including trypsin inhibitors, as well as improved sensory profiles. Due to good protein solubility, emulsifying and foaming properties **the protein ingredients exhibit excellent potential for a wide range of food applications.**

Go back to Infographic >>

Impacts

Reduced environmental footprint for processing
Environmentally friendly and resource efficient aqueous processing methods for the production of lentil, faba bean and lupin protein isolates were successfully implemented into a pilot plant scale. The developed technologies can potentially be used by the food industry to produce novel plant protein ingredients that can replace animal proteins in food applications, thus lowering the environmental footprint.

New market opportunities
The developed ingredients such as protein isolates and concentrates from lentil, faba bean and white lupin are not yet on the market. The knowledge for their production can be applied by ingredient producers to create new types of protein ingredients for the production of new nutritious plant-based foods. This will increase the market opportunities of both ingredient and food producers in the medium term.

Novel nutritious protein ingredients
The present work demonstrated that aqueous protein processing allows for protein ingredients with improved protein quality (i.e. improved in-vitro protein digestibility) and antioxidant potential. Their commercialisation enables food producers to create tailored plant-based food products that contribute to a nutritious diet and increase the market uptake of new proteins

Recommendations

- The analytical results demonstrate that these new plant-based protein ingredients are suitable for the production of innovative protein-rich food products.
- **Aqueous processing** is required to obtain concentrates or isolates with protein contents higher than 80% and with low contents of antinutrients.
- The best-suited **dry fractionation process** depends on the raw material; the most efficient protein-enrichment is achieved by air classification of fine flours of starch containing legumes seeds.
- Efficiency and thus sustainability of a process is depending on protein content and extractability of the raw material, protein yield and the number of side-streams. The assessment and valorisation of **side-streams** is crucial and should be part of further investigations.
- **Continuous collaboration** with food application specialists on ingredient functionality is a key issue in further developing innovative processes for the production of functional plant-based protein ingredients, since the flavour and texture are important for meeting the needs of consumers.

References

PROTEIN2FOOD (2016). **Deliverable 2.1 – Raw materials for protein fractionation**.

PROTEIN2FOOD (2016). **Deliverable 2.2 – Report on dry milling methods.**

Alonso-Miravalles, et al. (2019). **Membrane filtration and isoelectric precipitation technological approaches for the preparation of novel, functional and sustainable protein isolate from lentils**. European Food Research and Technology, In Press.

Hoehnel, et al (2019). **Comparative analysis of plant-based high-protein ingredients and their impact on quality of high-protein bread**. Journal of Cereal Science, Volume 89.

For more information visit: https://www.protein2food.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grants agreement No 635727.