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SFP SUSTAINABLE FOOD PROCESSING

Refining of pea and rapeseed protein using Natural Deep Eutectic Solvents

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1 Motivation & Method

Animal husbandry contributes about 11-17% of total human-driven greenhouse gas emissions. Plant-based diets have been shown to emit significantly less greenhouse gas per gram of protein as compared to animal protein. To date, the sensory properties of protein-rich plant-based foods do not appeal as much to consumers due to the off-taste and off-flavor of protein-rich plant-based foods. Therefore, the objective of this project is to extract off-taste and off-flavor components like polyphenols from pea or pea protein concentrate as well as rapeseed to recover plant proteins. A novel class of food grade solvents, Natural Deep Eutectic Solvents (NADES) have been investigated to extract these compounds from plant-based protein-rich agricultural raw materials. A circular process has been researched to recover all solvents (Figure 1).

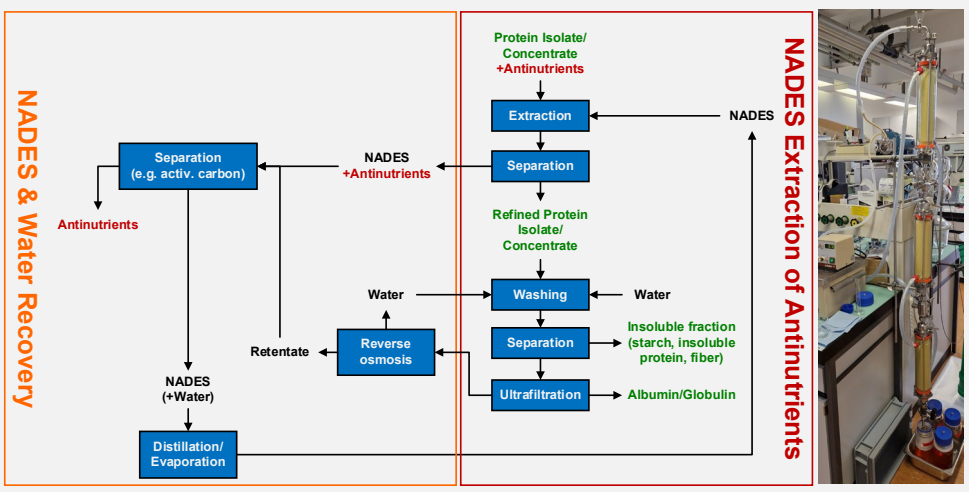

Figure 1. Process flow chart for refining of pea protein concentrate consisting of the extraction of antinutrients (middle) and the recovery of the solvent (left) to achieve a circular process with minimal amounts of effluent. The there-stage extraction column for granular material is shown in the image to the right.

2 Results

The main objective of this project is to explore the solubility difference of polyphenols and protein in NADES for protein refining from pea protein concentrate (Figure 2) and dehulled rapeseed to selectively extract polyphenols as the bitter, astringent, and staining compounds in current protein isolates.

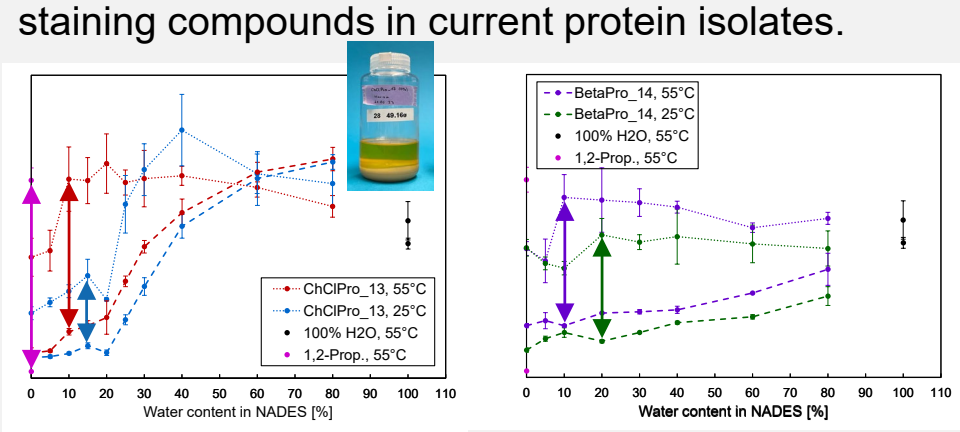

Figure 2. Relative comparison of the amount of extracted polyphenols (dotted lines) and proteins (dashed lines) extracted from pea protein concentrate depending on the water content in NADES consisting of choline chloride and 1,2-propanediol (left) and betaine and 1,2-propanediol (right).

The results show that the highest solubility difference could be observed at 55°C extraction temperature and 10% water in NADES. The solubility difference was higher in choline chloride (left) as compared to betain (right) containing NADES.

3 Conclusion

A transfer of this technology to other protein-rich legumes such as soy, lentils, fava beans, lupins to yield a broader range of functionality of plain tasting proteins as ingredient will even further enhance consumer acceptance for plant-based foods for more sustainable food production and consumption.

4 Contribution to Sustainable Food Systems

The aim of this project is to eliminate antinutrients and sensory defects of plant-based protein-rich agricultural raw materials like yellow pea and rapeseed (shown on the right) to enhance consumer acceptance and provide a more sustainable alternative to animal-based proteins. The project thereby directly addresses SDGs 2, 3, 12, 13, and 15.

Partner/Sponsor: Nestlé, BÜHLER, Givaudan

World Food System Center