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Innovative strategies to reduce phytic acid in side streams for innovative plant-based ingredients

Aim

The aim of this thesis is to explore different processing strategies to reduce phytic acid in plant-based food ingredients while enhancing their nutritional properties. This research seeks to understand the possibility of using sustainable ingredients, to develop meat analogues. To achieve effective phytic acid reduction, the application of enzymatic treatment, membrane separation, electrodialysis, and extrusion, will be investigated.

Conclusion

This thesis will provide valuable insights into effective strategies for reducing phytic acid in plant-based food products. By evaluating different processes, the research will identify the most efficient method for improving nutrient bioavailability. The results will contribute to the development of sustainable meat analogues and other products, offering new opportunities for utilizing agricultural and industrial side-streams in plant-based food production.

Phytic Acid: What It Is and Why It's Considered an Anti-Nutrient

Phytic acid is primarily found in plants, where it is mainly stored in grains and seeds. It serves as the main storage form of inositol and phosphate, both essential for plant growth and metabolism. However, phytic acid is considered an anti-nutrient because it can bind to mineral ions such as calcium and iron, forming insoluble salts known as phytates. This interaction reduces the bioavailability of these minerals in the human digestive system.

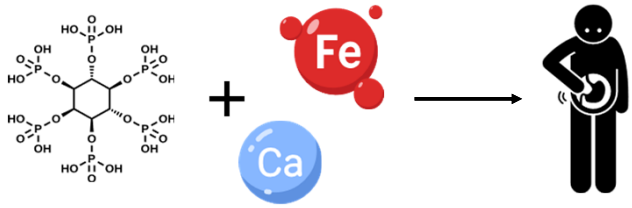

Figure 1. Phytic acid has the potential to chelate iron and calcium, thereby reducing the bioavailability of these minerals during digestion.

Materials and Methods: Processing Workflow for Phytic Acid Reduction and Meat Analogue Development

To reduce phytic acid and develop meat analogues, press cakes from hemp, rapeseed, and oat okara will be used as starting materials. The process will begin with protein extraction under alkaline conditions. Depending on the selected strategy, this will be followed by one of the following treatments: enzymatic processing, ultrafiltration or electrodialysis. Finally, the treated material will be extruded to produce structured meat analogues.

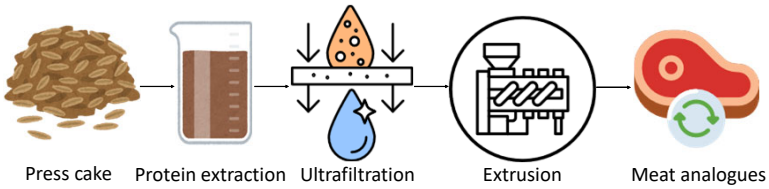

Figure 2. Example of membrane process (ultrafiltration) used for phytic acid reduction and the development of meat analogues.

The following analyses are planned to be conducted:

- Phytic acid analysis (LC-MS)
- Protein yield
- Protein concentration
- Water holding capacity
- Oil holding capacity
- Rheological properties
- Mineral analysis
- Differential Scanning Calorimetry (DSC)
- Least gelling concentration

By evaluating the analysis results, the goal is to assess:

- The most effective method for reducing phytic acid
- The changes in functional properties
- The potential applications for meat analogues

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