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Up-cycling of Plant-Based Beverage Residues (Okara) - Challenges and Opportunities

Aim – To improve the circular economy of plant-based beverages

In the production of plant-based dairy alternatives, such as soy, oat, or faba beverage, a residue rich in fiber and protein is generated. The soy residue is also known as okara. Okara from soy, oat, and faba has high water content and water activity which make them susceptible to microbiological spoilage.

Conclusions

- Drying requirements for soy, oat, and faba okara were identified.
- High-pressure pasteurization at 600 MPa reduced the microbial growth of total aerobic count and yeast and mold in both soy and oat okara.
- It was possible to co-extrude corn grits and dried oat okara into snacks.
- Native proteins in the oat okara enables texturization into meat analogues.

To contribute to a better circular economy of plant-based dairy alternatives, and to reduce food waste, this PhD project focuses on how to prolong the shelf life of okara and investigate possible food product applications where, drying, high-pressure pasteurization and extrusion processes have been explored. For each investigated process, the residues' functionalities and characteristics were studied before and after treatment to understand the properties of okara.

Drying

According to the moisture sorption isotherms (Fig 1), it would be necessary to dehydrate soy, oat, and faba okara to a moisture content of 7.6 % wb (8.2 % db), 7.5 % wb (8.1 % db), and 10.3 % wb (11.5 % db) respectively, to reach a microbiologically stable water activity below 0.7.

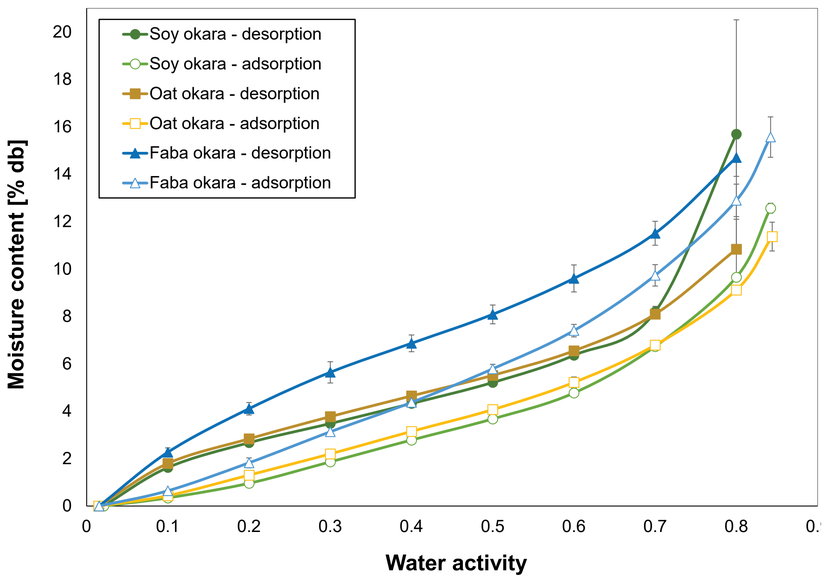

Fig 1. Moisture sorption isotherms of soy, oat, and faba okara.

High-pressure pasteurization

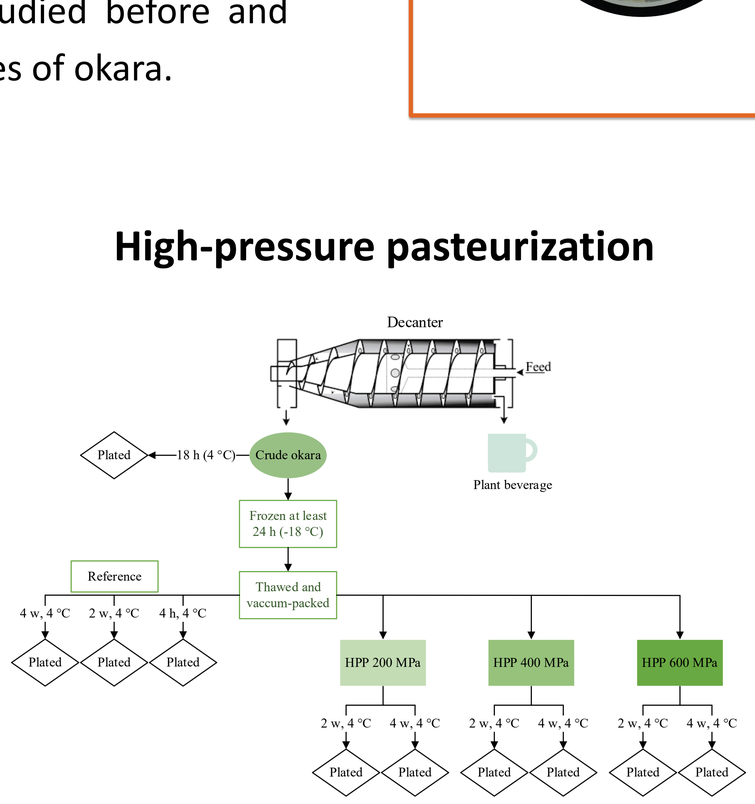

Fig 2. The storage study schedule for the high-pressure pasteurization study.

A high-pressure pasteurization study was performed on soy and oat okara (Fig. 2). A 600 MPa treatment could significantly decrease the microbial growth of total aerobic count and yeast and mold.

Extrusion

Extrusion studies will be performed to investigate the potential for oat okara to be an ingredient in snacks, high moisture meat analogues and texturized vegetable protein applications. Preliminary results for snacks made of corn grits and dried oat okara are presented in Fig. 3.

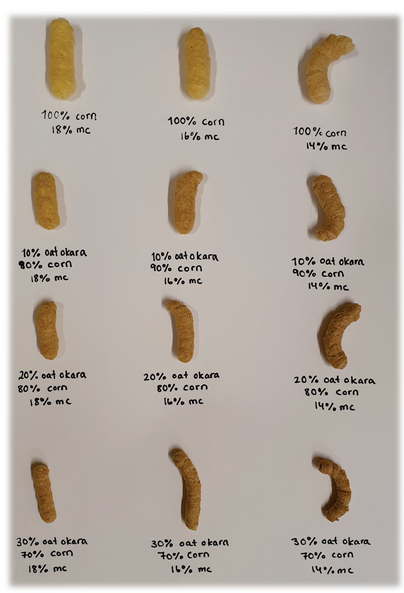

Fig 3. Preliminary results from the snacks study, co-extrusion of corn grits and dried oat okara.