

Optimization of the Fava Bean milk

FÆRM Aps

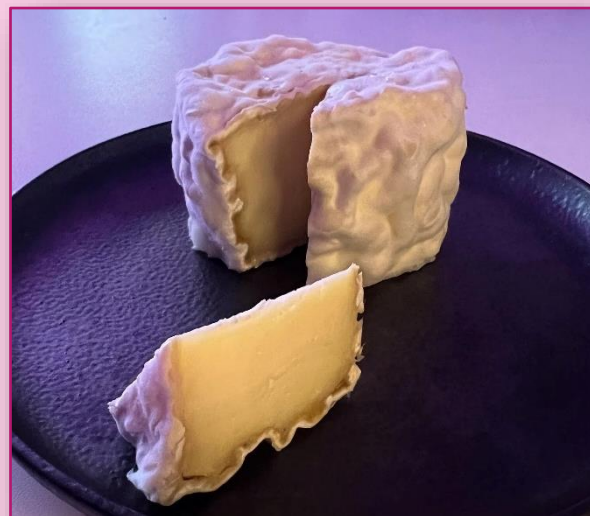
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The dairy industry can be regarded as a big contributor towards greenhouse gas emissions, as it is responsible for 30% of the total global livestock emissions [1]. This represents a hazard towards Earth's precarious climate conditions, which ultimately affects our well-being.

In this context, plant-based alternatives represent a safe choice not only to conduct a more sustainable life and reduce our individual carbon footprint, but also in the context of providing viable alternatives for lactose intolerant or allergic individuals.

In this regard, FÆRM Aps is a start-up born in 2020 that works towards building a more sustainable future in the dairy industry by producing plant-based alternatives rich in nutritional value, easily accessible and appetizing.

These products have been mainly soy-based until now, since soy represents a dominant plant-based protein well-established in the market. However, the company aims to start expanding towards other types of legumes, such as Fava beans.



https://www.instagram.com/faerm_cph/

Fava beans are a sustainable option with great nutritional and functional value. However, they also present some limitations brought mainly by the presence of *antinutritional factors*, which are specific components that can reduce the availability of food nutrients such as proteins or minerals [2].

In this framework, my project sparks from the need to optimize and neutralize issues concerning the use of Fava bean milk as a base for new plant-based dairy products. To achieve this, various pre-treatments on the raw Fava bean material have been tested, and the following success criteria have been taken into account:

- High protein content
- High protein solubility
- Emulsion stability
- Small particle size

The project was conducted both on commercial Fava beans and on specific Fava beans obtained from a breeders' collaboration, with the aim to achieve the best combination of raw material type and pre-treatment based on the success criteria mentioned above.



Raw Fava beans during the soaking period.

At first, commercial Fava beans were tested, trying soaking the raw material in water at a fixed time while testing different temperatures and pH values. These first tests were brought to different emulsions in pH and consistency, after blending the raw material into a “milk” solution.

Following the success criteria, it was important to look at the emulsion stability given by factors such as visually assessing the sedimentation of the solution over time and analyzing the solution's particle size.

In particular, lower sedimentation was observed for the alkaline pre-soaked beans at any temperature.

Moreover, having a small and even particle size in the emulsion is essential in order to achieve stability combined with the best possible “mouthfeel”, when also considering sensory perception. We considered soy as a meter of comparison with the optimal particle size, and again, we obtained the best results with alkaline emulsions.

A further analysis of the Fava bean “milk” composition, showed how alkaline pre-treatments had an overall higher proportion of protein content and, in particular,

soluble protein content, which is imperative regarding the actual availability of proteins in the emulsion. Soy milk was again used as a meter of comparison as the ideal plant-based milk alternative.

All the tests mentioned above were then repeated on specific bred Fava beans, meaning that each batch of beans had different characteristics in composition. Nonetheless, the results re-confirmed the alkaline soaking pre-treatment as the optimal and most stable one.

My specific placement at the company as a student has been mainly at the laboratories both at the company's headquarters and at the Bio Innovation Institute laboratories (BII). Here, I had the opportunity to expand my knowledge on how to move in different types of laboratories and conduct research independently.

I am currently studying agriculture with a specialization in plant science at the University of Copenhagen. Therefore, my focus had been mainly driven towards widely cultivated crops such as Fava beans themselves. This project has allowed me to expand my knowledge onto food technology, where you learn how the raw materials are processed and optimized.

The interdisciplinarity of this project was facilitated also by the support of my supervisor, Iben Lykke Petersen, from the Department of Food Science at the University of Copenhagen. Her expertise helped me approach problems during the internship with a different perspective and stimulated my overall learning experience.

Moreover, at the company, I was able to participate in all the main meetings, which sparked my interest towards problem-solving in different areas of a start-up. I had the opportunity to also participate in a meeting with an external collaborator, which gave me insight into how collaborations between companies take place and how good communication can be beneficial on multiple levels for both parties.

This experience allowed me to challenge myself overall by broadening my knowledge beyond my agricultural curriculum; practically exploring food technology led me to a deeper understanding of how the raw plant materials I've studied are actually used to obtain commercial products.

After the research conducted on Fava beans, the optimal treatment will be further investigated by FÆRM with the goal of, one day, being able to obtain a Fava bean-based cheese. This would be an important step to implement sustainability

through the use of nutritious and appetizing greener alternatives in our day-to-day menu.

References:

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[2] Sharan, S., Zanghelini, G., Zotzel, J., Bonerz, D., Aschoff, J., Saint-Eve, A., & Maillard, M. N. (2021). Fava bean (*Vicia faba* L.) for food applications: From seed to ingredient processing and its effect on functional properties, antinutritional factors, flavor, and color. *Comprehensive Reviews in Food Science and Food Safety*, 20(1), 401-428.