

Title: Enhancing Ingredient Functionality in Plant-Based Cheese Production: Challenges and Potential Solutions

Abstract:

Plant-based cheese has gained significant popularity due to its potential for reduced environmental impact and growing consumer demand for plant-based alternatives. However, replicating the desirable functionality of traditional dairy-based cheese poses several challenges. This review aims to explore the challenges associated with ingredient functionality in plant-based cheese production, including ingredient interactions and the processes involved. It also proposes three potential solutions to address these challenges. Each solution is supported by relevant literature to justify its feasibility.

Challenge: Texture and Melting Properties

One of the critical challenges in plant-based cheese formulation is achieving a desirable texture and melting properties that mimic traditional cheese. The selection and interaction of ingredients play a crucial role in determining the final product's texture and meltability. Various solutions can be explored to overcome this challenge:

1.1. Solution: Ingredient Combinations and Processing Techniques

Optimizing ingredient combinations and processing techniques can enhance the texture and melting properties of plant-based cheese. Incorporating specific plant-based proteins (e.g., soy, pea, or wheat) and hydrocolloids (e.g., carrageenan, and xanthan gum) can improve the cheese's texture and meltability. Furthermore, processing techniques such as heating, homogenization,

and high-pressure treatment can modify the protein structure and improve functionality. (Wendorff et al., 2019; Zhang et al., 2020)

1.2. Solution: Incorporation of Fat Analogues and Emulsifiers

The addition of fat analogs and emulsifiers can enhance the texture and mouthfeel of plant-based cheese. Plant-based fats, such as coconut oil or shea butter, can be used to mimic the creamy texture of dairy fats. Emulsifiers, such as lecithin or mono- and diglycerides, aid in the dispersion and stabilization of fats, improving the cheese's overall texture and melting behavior. (McCarthy et al., 2020; Sánchez-Macías et al., 2021)

Challenge: Flavor Development and Enhancement

The flavor is a crucial factor influencing consumer acceptance of plant-based cheese. However, replicating the complex flavor profile of traditional cheese using plant-based ingredients presents a challenge. To address this challenge, the following solution can be considered:

2.1. Solution: Fermentation and Cultures

Incorporating fermentation techniques and cultures can help develop complex and desirable flavors in plant-based cheese. The use of specific strains of lactic acid bacteria and yeast can contribute to the production of flavor compounds, such as diacetyl and various esters, which enhance cheese flavor. Controlled fermentation conditions and precise starter culture selection can play a pivotal role in achieving the desired flavor profile. (Bonaïti et al., 2017; Xu et al., 2021)

Challenge: Shelf Stability and Molding Properties

Ensuring the shelf stability and molding properties of plant-based cheese products is critical for commercial success. The following solution addresses this challenge:

3.1. Solution: Hydrocolloids and Gelling Agents

Incorporating hydrocolloids and gelling agents can improve the texture, stability, and molding properties of plant-based cheese. Ingredients such as agar, carrageenan, or pectin can provide gelation and firmness, ensuring the cheese retains its shape and structure. Moreover, these hydrocolloids can contribute to water binding, preventing syneresis and enhancing shelf stability. (Campbell et al., 2019; Scharff et al., 2020)

Conclusion:

The challenges associated with ingredient functionality in plant-based cheese production are significant but can be overcome through strategic ingredient selection, processing techniques, and the incorporation of additives.

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1. Challenge: Texture and Melting Properties

1.1. Solution: Ingredient Combinations and Processing Techniques

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