UDC 664 Innovative Technologies in the Food Industry

ENHANCING THE QUALITY OF PLANT-BASED MEATS: TEXTURE, FLAVOR, AND PROCESSING INNOVATIONS

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This work investigates the impact of freezing on the quality of plant-based meat products, focusing on how freezing affects texture, flavor, and overall appeal. It examines various processing techniques, particularly freeze-structuring, and how these methods can be optimized to produce fibrous, meat-like textures in artificial meat. Additionally, it highlights current strategies, challenges, and approaches for creating high-quality, resource-efficient meat analogues that meet consumer expectations for sensory and nutritional quality.

Artificial or plant-based meat has gained significant popularity in recent years as a sustainable and ethical alternative to traditional meat. However, there are concerns about the impact of freezing on the quality of these products. Freezing can lead to changes in texture, flavour, and overall quality, which can reduce consumer appeal.

Freezing cause ice crystals to form within the meat, this can rupture cell walls and damage the protein structure. Additionally, freezing can affect the flavour and aroma of the meat, resulting in a less appetizing product. It is important to determine how freezing affects the quality of artificial meat**.**

As the demand for artificial meat alternatives continues to grow, manufacturers are developing new products to meet the needs of consumers. However, there are concerns about the impact of freezing on the quality of these products. Freezing can affect the texture, flavour, and overall quality of plant-based meat, making it less appealing to consumers.

Therefore, the problem statement is how to develop artificial meat products that can withstand freezing without compromising on quality, taste, or texture.

This require research into the composition of artificial meat, the effects of freezing on different ingredients, and the use of different processing methods to maintain quality during freezing and thawing. The effect of freezing on the quality indicators of artificial meat is not well understood [1].

Freeze-structuring process can successfully create anisotropic, layered, porous structures in soy protein-based food gels, closely mimicking the texture of traditional meat. The effectiveness of this process, however, is highly dependent on the type of soy protein used, with soybean flour at a 10% solid content yielding the most desirable texture. Higher solid contents or soy protein isolates with strong gelling properties were less effective in achieving the targeted structure. Lowering the gelling ability of soy protein is essential to achieve meat-like textures through freezing, though further investigation into protein solubility, freezing rates, and duration is necessary to optimize and scale the process [2].

The main challenge for meat analogues is achieving a fibrous, meat-like texture, which can be addressed by adjusting processing conditions or selecting suitable plant proteins. Various methods, including extrusion, freeze structuring, and

shear cell technology, are used to create fibrous structures. This study used freeze structuring, where freezing a protein emulsion and removing ice crystals creates a porous, fibrous structure resembling animal muscle. The success of this technique depends on the protein source, as different plant proteins (e.g., pea, soy, wheat) offer unique properties that impact texture and structure formation in meat analogues.

Freeze-structuring technique can successfully create a fibrous, layered texture in plant-based protein nuggets. This formulation displayed texture attributes similar to commercial meat analogues and was the preferred choice among panelists. Variations in protein ratios did not significantly affect protein or moisture content, but the inclusion of wheat protein proved critical for achieving a meat-like texture due to its role in forming a strong protein gel network. These findings indicate that plant protein composites, particularly those with wheat protein, hold strong potential for producing high-quality meat analogues in Asia through freeze-structuring techniques [3].

Strategies to mimic meat texture vary based on the type of meat product being replicated, such as ground, comminuted, or whole muscle meats.

There are different processing routes to create fibrous products, which can be classified in bottom-up and top-down approach. both bottom-up and top-down processing approaches offer unique advantages for creating fibrous, meat-like structures in plant-based products. The bottom-up approach closely replicates the structural details of meat by assembling individual components, while the top-down approach, which blends proteins and polysaccharides under shear, is more robust, scalable, and resource-efficient. Future advancements in top-down processing will benefit from the development of new in situ analytical methods, allowing more precise control over the structuring process. Together, these innovations in analysis and processing will support the creation of high-quality, resource-efficient meat analogues with desirable sensory properties [4].

References

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