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Isochoric Freezing Prospects for Food and Biomaterial Preservation

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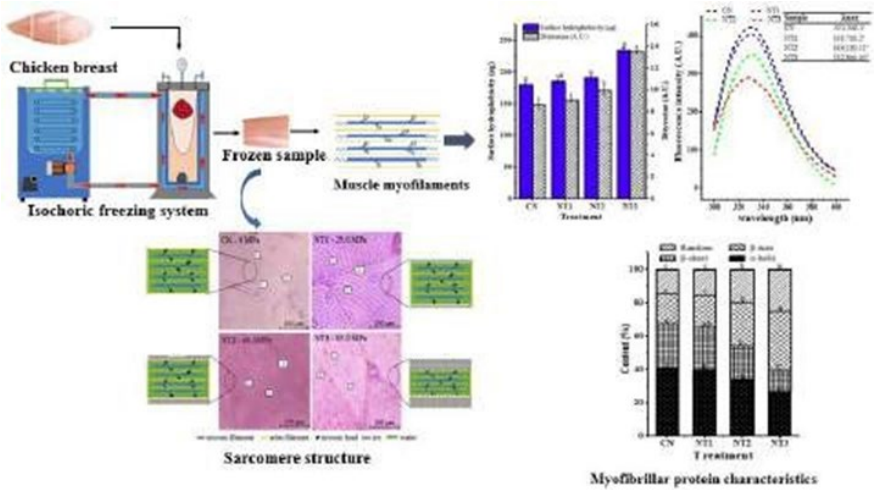
Statement of the Problem: Freezing is a widely used method for preserving food and biomaterials and can extend the shelf life of perishable items and maintain their quality. It involves lowering the temperature of the material to a level where microbial and enzymatic activities are significantly reduced, thereby slowing down deterioration processes. However, the quality of frozen food or any biomaterial is highly associated with freezing conditions, particularly the freezing rate. This is due to the significant effect of ice crystallization that occurs during freezing can have both positive and negative. Such effects have led to the development of novel freezing techniques, such as high-pressure freezing, ultrasonic freezing, electric magnetic field, and isochoric freezing, to enhance food and biomaterials preservation. Among them, isochoric freezing has demonstrated potential applications in preserving the quality and functionality of food products, improving the stability and properties of materials, and enhancing the viability and structure of biological samples. The technique involves freezing a substance under constant volume or high-pressure conditions, which can have unique effects on the freezing process and the resulting properties of the frozen material. This study aims to explore the potential of the isochoric freezing process and its prospects for preserving chicken breast meat.

Materials & Methods: Fresh chicken breast samples were immersed in 2.5% NaCl solution and frozen at -4, -8, and -12 oC. Findings: The results revealed that samples treated at -4 oC (25 MPa) showed no significant changes in the myofibrillar protein structure. In comparison, those treated at -8 oC (60 MPa) showed significant differences in protein properties, including dityrosine, solubility, and sulfhydryl, suggesting the partial recovery of the samples, whereas samples treated at -12 oC (85 MPa) indicated the destruction of the myofibrillar protein structure. Insights on the possibilities of preserving meat using isochoric freezing are envisaged to be gained from the current study.



Recent Publications:

1. Nastase, G., Lyu, C., Ukpai, G., Şerban, A., & Rubinsky, B. (2017). Isochoric and isobaric freezing of fish muscle. Biochemical and Biophysical Research Communications, 485, 279–283.

2.Preciado, J. A. & Rubinsky B. (2010). Isochoric preservation: A novel characterization method. Cryobiology, 60, 23-9.

3.Rinwi, T. G., Ma, J., & Sun, D. (2023). Effects of isochoric freezing on myofibrillar protein conformational structures of chicken breasts. LWT, 181, 114768.

4.Rinwi, T. G., Sun, D., Ma, J., & Wang, Q. (2023). Effects of isochoric freezing on freezing process and quality attributes of chicken breast meat. Food Chemistry, 405, 134732.

5.Rubinsky, B., Perez P. A. & Carlson, M. E. (2005). The thermodynamic principles of isochoric cryopreservation. Cryobiology, 50, 121–138.

Biography

Tsekwi Gracious Rinwi is a final year Ph.D. student at the School of Food Science and Engineering at the South China University of Technology. He is passionate about researching processing, quality, and preservation technologies for food and biomaterials. Over the past few years, his primary focus has been on the isochoric preservation of chicken breast meat. Isochoric freezing is a novel freezing and preservation technique that offers a superior alternative to traditional freezing methods. This innovation is considered a revolutionary approach to food preservation, offering a 'panacea' for various food freezing and storage challenges and providing a groundbreaking solution to energy and quality-related issues faced by the global frozen food industry.

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