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Comparative study on the effects of isochoric cryopreservation and liquid nitrogen flash freezing on the quality of fish

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Freezing and cryopreservation are critical for maintaining the quality of organism, which has been widely used in food and medical industries. However, the generation of ice crystal during cryopreservation process can inevitably induce tissue injures and consequently damages the organism quality. Lowering the freezing point and accelerating the freezing rate are helpful to suppression the ice crystal damage. Therefore, isochoric cryopreservation and liquid nitrogen flash freezing are conducted to investigate the different effects of these two freezing methods on fish body in this work. The influence of different packaging methods, freezing pressures/temperatures, freezing rates and cryopreservation time on the quality of the quality of fish body including volume, water holding capacity, color, and taste are systematically tested and analyzed in this work. Furthermore, an in-situ investigation is also conducted to reveal the evolution mechanism of cellular activity of fish body under different freezing methods by optical microscopy and scanning electron microscopy. In addition, the heat transfer processes under different freezing system are also calculated and analyzed to evaluate the energy consumption. Finally, an optimized freezing and cryopreservation process is proposed to keep the quality of fish products with lower storage-transportation costs and carbon emission.

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