Thawing equipment for the food industry

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8.1 Introduction

From ancient times, freezing has always been a common method for the long-term food preservation, owing to its ability to retain the quality and extend the shelf-life of foods (Backi, 2022). Quality of frozen food products is firmly associated with freezing and thawing conditions. The formation of tiny ice crystals during freezing lowers the drip loss and tissue damage during thawing. Thawing is more complicated than freezing, behind which there are many reasons. In the first place, the thermal conductivity of water is lower than ice, and the thawing rate decreases as defrosting keeps on. This is in contrast with what occurs during freezing, where the outer layers of the product start to freeze and create a conductive surface for the heat to transfer through. In the second place, thawing cannot be done at all temperatures; i.e., the difference between the initial temperature of the frozen product and that of the thawing medium could only be within a specific interval to prevent the damage of food products (Bozzato et al., 2021; Xu et al., 2021). This is particularly critical in processes where the product is exposed to heat through its surface (Cai et al., 2020; Backi, 2022).

Frozen foods are typically stored at −18 °C; as a result, tempering or thawing is required for further. At the same cooking or processing time, the physical, chemical, and microbiological changes taking place during long periods of tempering or thawing lead to undesirable changes in the quality of the product. Consequently, the selection of techniques that reduce the duration of tempering or thawing and, therefore, extending the food's quality retention period and safety are vital for the frozen food industry (Xu et al., 2021). Thawing can occur by two different concepts, which differ in how the frozen food is exposed to heat (Cai et al., 2019a). Heat transfer through the frozen food surface is the first and most common thawing method (Uyar et al., 2015). This can be carried out by conduction, convection, and radiation (Cai et al., 2019a). Heat generation inside the product is the other thawing technique, which is a more uniform process (Cai et al., 2019a; Singla and Sit, 2021; Svendsen et al., 2022). These innovative techniques can reduce the processing time, thus lowering drip loss and enhancing the quality of the product (Dalvi-Isfahan et al., 2016; Backi, 2018; Cai et al., 2020;

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