FREEZING UNDER PRESSURE: LOW TEMPERATURE AND HIGH HYDROSTATIC PRESSURE IN FOOD TECHNOLOGY

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Pressure is a thermodynamic property, as essential to determine the state and evolution of physical systems (including “biological systems”), as temperature is. However, while variations in temperature are evidently having an effect on anything surrounding us, and specially on living systems, pressure tends to be forgotten, taken for granted at its widespread “atmospheric pressure” level. However, by controlling this parameter, we can induce dramatic effects on many systems. A significant part of the influence of temperature on biological systems surges in relation to its aqueous content, and for low temperature, as a consequence of water anomalous phase behavior, when both thermodynamic and kinetic aspects of water turning into ice (or glass...) are so relevant to Cryobiology. Pressure has a direct route to come into this play through the different possibilities offered by the complex water pressure-temperature phase diagram. Solid water, only available at atmospheric pressure as ice I (and amorphous forms), can occur in an increasing number of phases with different temperature-pressure existence regions and distinct properties. Pressure can be used in combination with temperature to act on aqueous systems to obtain novel effects. Food frequently can be considered as a high water content system, with properties and structure derived from its natural origin and the different technological manipulations suffered. Several uses of the combination high pressure-low temperature are either under study or in application and they may give rise to new products and technological possibilities. In several cases, the ability of high pressure to avoid ice formation at normally freezing temperatures, is exploited: to reduce the size and homogenize the distribution of ice crystals in tissues, with reduced ice damage; to store at low temperature without ice formation, and as effective and mild thawing processes. In other cases, alternative ice forms to ice I are employed.

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