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## **Microstructural analysis of frozen raspberries using X-ray microtomography: a comparative study with quality changes.**

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Quality properties of frozen foods are strongly related to the product microstructural organization such as ice crystal structures. Ice crystals characteristics are defined both by the freezing process and the frozen storage conditions. For example, fluctuating storage temperatures cause ice crystals growth by recrystallization, leading to tissue damages and subsequent quality losses. Microstructure imaging techniques such as X-ray microtomography could be useful for a better understanding of the complex mechanisms that take place at the microscopic level in order to reduce macroscopic quality changes during frozen storage. Raspberries are known for their health benefits but they are difficult to preserve for a long time. Freezing process is usually used to increase their shelf life, but these fruits are highly sensitive and encountered freeze damages.

In this work, X-Ray microtomography was used to investigate microstructural changes occurring during freezing and storage of raspberries under different conditions. The fruits were imaged directly at the frozen state thanks to a cooling stage (-20°C). The analysis of X-ray images showed ice crystal growth with storage temperature, temperature fluctuations and storage duration. Quality parameters, such as texture and drip loss, were also measured. Raspberries texture, along with drip loss, was altered by freezing and during storage, probably due to cell perforation caused by ice crystals formation and growth. These results taken together, show how microstructural changes can affect macroscopical quality parameters.