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Water Dynamics in Australian Native Fruits as studied using Neutron Spectroscopy and Tomography

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Food production is being challenged by population growth and increased drought. One way to manage these challenges may lie in using native fruits, which have unique sensory and nutritional properties. Local species are inherently well-adapted to the Australian climate, and local and global interest are emerging (Richmond et al. 2019). A barrier to the industry's growth, and an ongoing research question for fruit more generally, is understanding how to maximise the retention of nutritional and quality attributes over the course of preservation. This is particularly true for those processes which manipulate food moisture, prompting the need to also understand the behaviour of water in fruits as they are being processed. In this work, neutron spectroscopy and tomography are used in a novel application to study the dynamics of water in fruit, specifically in the context of native fruits.
Measuring the drying kinetics and water sorption isotherms of native fruits and how these change with processing has revealed increased water sorption compared to what has been observed for other foods such as apple. In this work, native fruits of varying moisture contents were subjected to neutron backscattering spectroscopy (de Souza et al. 2016) and neutron time-of-flight spectroscopy (Yu 2020). This revealed slower bound water and faster free water dynamics compared to similar foods reported elsewhere.
Neutron tomography has also revealed the local moisture transport in these fruits as they were processed under different conditions (Garbe et al. 2017). This was correlated to their differences in drying kinetics and subsequent quality. From the combination of these techniques, a link is suggested between their drought tolerance and the differences in water dynamics compared to other crops. This allows for improved understanding of the preservation of native fruits and offers insight into the unique water binding of these drought-tolerant crops.

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Topics

Biological Systems and Soft Matter

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