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Effect of α-Amylase on Instantaneous Rheological Properties of Tapioca Starch

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Oral perception of food texture is a complex mechanochemical process. Conventionally, sensory analysis with trained panels is employed to evaluate and describe the mouthfeel of food products. Development of semi-automated processes to mimic human mouthfeel is desirable to accelerate product formulation and development. It is therefore of interest to understand the oral perception of semi-solid foods with instrumental rheological assessment.

Present work aims to evaluate the effect of human salivary α-amylase (two levels of enzyme activity) on the instantaneous rheological properties of starch paste. Commercial native and modified tapioca starch (5%) are suspended separately in salted buffer (pH 6.5) and heated at 95 C while stirring for 6 min. Subsequently, heating is continued without stirring for another 20 min, followed by cooling down to room temperature before subjecting to rheological measurements.

Viscosity of the starches is monitored for 300 s immediately after the addition of α-amylase, at constant shear rate of 50 /s. For samples added with 0.25 U α-amylase, native starch shows a rapid viscosity reduction (more than 10 times) compared to modified starch, for the first 20 s. Starches added with 2.5 U α-amylase show similar reduction profiles, with native starches degraded more.

Oscillatory measurement is performed with constant strain (1%) and angular frequency (1 rad/s) applied to the samples for 300 s. Native starch exhibits a noticeable reduction in complex viscosity, storage and loss modulus around 20 s after the addition of 0.25 U α-amylase. For modified starch, reduction in complex viscosity and loss modulus is negligible. It is interesting to observe that 0.25 U amylase causes a noticeable reduction in storage modulus for both samples, with the effect more profound in native starch. This suggests that amylase is causing a structural breakdown in starch, but with less effect on the viscous component. All rheological results shows acceptable repeatability. In conclusion, present work demonstrates an effective test to explore the possibility of projecting oral textural mouthfeel perception with rheological properties. This work lays a foundation for future work to further correlate instrumental results with sensory evaluation.