



# Interest of functional starches in 3D printing applications

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3D printing applied to food addresses specific challenges in terms of ink development [1]. The ink's specification should cover a low viscosity and rapid stiffening following deposition in order to facilitate stacking and object formation. Dry Heat Treatment of starch (DHT starch) yields in functional starches with limited starch disruption during gelatinization (patent-EP2022/058028 "Method of additive manufacturing by hot-extrusion"); such "inhibited starches" have also a high water holding capacity. One of the challenge of such systems lies in the correct dosage of the functional starches. For 3D printing application, a mother gel hosts the DHT starch. A focus is proposed on the impact of the viscosity of the mother gel and on the volumic occupation ratio of the dispersed starch on the firmness of the deposited gel which is a colloidal system containing a primary starch based gel with dispersed gelatinized and inhibited starch granules. The occupation ratio of the dispersed inhibited starch grains act on the final firmness of the deposited gel. Adjustments of the model of Mendoza [2] is proposed with experimental results covering 2 different starches (DHT and chemically modified) with 3 different concentrations using experimental design. The temperature is also considered as a parameter. Viscosity of the initial ink and  $G'-G''$  of the final gel have been considered as responses and were linked to the swelling power [3]. The obtained results permit to visualize the key parameters and to propose an optimization of the ink composition. Printability criteria will be proposed to validate the envisaged dosage.

## References

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