Relationship between 3D printing characteristics and rheological properties on potato, rice, and corn starches

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Outline

1. Introduction
2. Effect of rheological properties of potato, rice and corn starches on their hot extrusion 3D printing behaviors.
3. Impact of rheological properties of mashed potatoes on 3D printing.
4. Conclusion

Abstract

Rheological properties of the mashed potatoes (MP) with addition of potato starch (PS) and their 3D printing behavior were established. MP with 0% PS possessed low yield stress (τ_0) (195.90 Pa) and printed objects deformed in sagged afterwards. Whereas, addition of 2% PS displayed excellent extrudability and printability, i.e., shear-thinning behavior, consistency index (K) of 118.44 ($Pa \cdot s^n$), τ_0 of 312.16 Pa and proper elastic modulus (G′). This study also investigate the relationship between rheological properties and printability of three types of starch (potato, rice and corn starch) for hot-extrusion 3D printing (HE-3DP). Each starch sample showed a shear-thinning behavior, self-supporting property, as well as the feature of a substantial decrease at higher strains and a recovery at lower strains in storage modulus (G′), which indicated the suitability of starch for HE-3DP. Besides, the flow stress (τf), yield stress (τy), and G′ increased with a higher starch concentration. Overall, the results provided useful information to produce individualized starch-based food by HE-3DP.

References

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