Researchers develop simple method to 3-D print milk products

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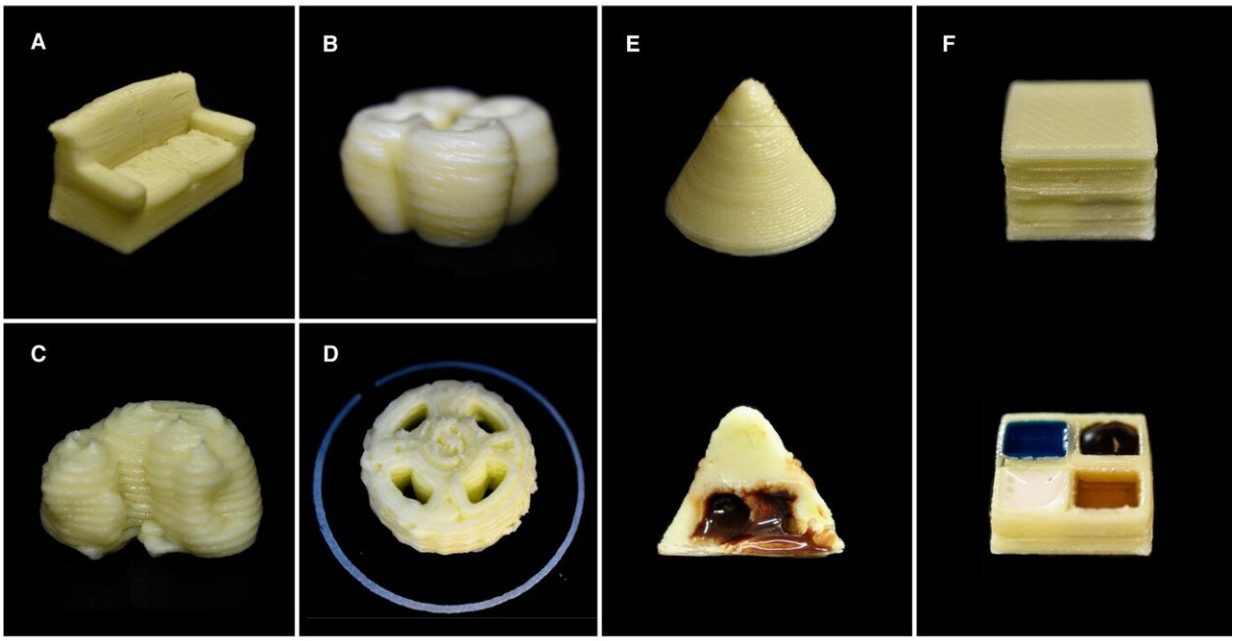

A - D: 3D printed milk structures of couch, fortress, wheel, and cloverleaf, respectively. E: 3D printed cone containing liquid chocolate syrup as an internal filling.F: 3D printed cube with four compartments containing liquid blueberry syrup, liquid chocolate syrup, milk cream, maple syrup as internal fillings. Credit: SUTD

Researchers from the Singapore University of Technology and Design

(SUTD) have developed a method to perform direct ink writing (DIW) 3-D printing of milk-based products at room temperature while maintaining its temperature-sensitive nutrients.

3-D printing of food has been achieved by different printing methods, including the widely used selective laser sintering (SLS) and hot-melt extrusion methods. However, these methods are not always compatible with temperature-sensitive nutrients found in certain types of food. For instance, milk is rich in both calcium and protein, but as these nutrients are temperature sensitive, milk is unsuitable for 3-D printing using the aforementioned printing methods which require high temperature. While the cold-extrusion is a viable alternative, it often requires rheology modifiers or additives to stabilize printed structures. Optimizing these additives is a complex and judicious task.

To tackle these limitations, the research team from SUTD's Soft Fluidics Lab changed the rheological properties of the printing ink and demonstrated DIW 3-D printing of milk (refer to image) by cold-extrusion with a single milk product—powdered milk. The team found that the concentration of milk powder allowed for the simple formulation of 3-D-printable milk inks using water to control the rheology. Extensive characterizations of the formulated milk ink were also conducted to analyze their rheological properties and ensure optimal printability.

"This novel yet simple method can be used in formulating various nutritious foods including those served to patients in hospitals for their special dietary needs," said lead author and SUTD Ph.D. candidate Mr. Lee Cheng Pau.

"Cold-extrusion does not compromise heat-sensitive nutrients and yet offers vast potential in 3-D printing of esthetically pleasing, nutritionally controlled foods customized for individual requirements," added

Assistant Professor Michinao Hashimoto, the principal investigator of the study.

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More information: Cheng Pau Lee et al, 3D printing of milk-based product, *RSC Advances* (2020). DOI: 10.1039/D0RA05035K

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