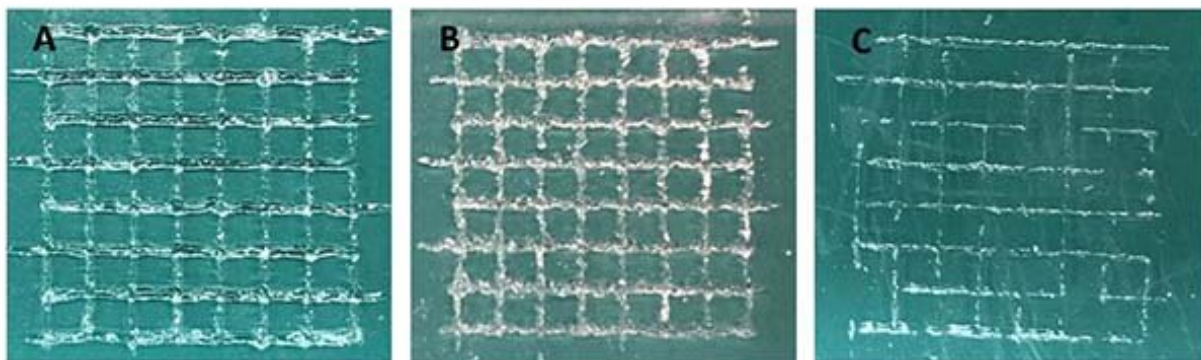


Preheating gelatin as a facile approach to increase 3-D printing duration

September 29 2020



A) Ideal state of 3D printed gelatin with transglutaminase. B) Clumps forming due to solidification of gelatin ink with transglutaminase, reducing printing time. C) Uneven printing due to solidification of gelatin ink with transglutaminase in the nozzle. Credit: SUTD

Researchers from the Singapore University of Technology and Design (SUTD) demonstrated a simple yet effective approach to increase the printing time of gelatin by preheating it before mixing the gelatin with transglutaminase.

Gelatin has often been hailed as a promising candidate for bioprinting and 3-D food printing because it is generally inexpensive to produce,

edible and non-toxic to cells. However, gelatin is unable to retain its structure and melts at body temperature. Therefore, 3-D printing of gelatin often includes transglutaminase (also known as meat glue), an enzyme which facilitates bonding between [amino acids](#) within the gelatin. However, the fast bond formation results in the rapid solidification of the liquid gelatin ink, forming clumps in the ink which lowers the quality of the 3-D printed structures and clogs the nozzle during printing.

To overcome this limitation, the researchers from the Soft Fluidics Lab at SUTD developed a method to preheat the liquid gelatin ink and demonstrated the increase in printing duration of the gelatin ink in direct ink writing (DIW) 3-D printing. The team found that preheating gelatin prior to 3-D printing increased its printing time and produced high quality prints over a longer period of time.

Extensive studies on the rheological properties of preheated and freshly prepared gelatin were conducted to understand the differences in their print behaviors. The study also showed that preheated gelatin exhibited greater change in volume in phosphate buffer saline, which allowed for size changes post-printing.

"This inexpensive and simple approach has many useful applications involving gelatin in 3-D printing, especially in the fields of food and medicine," said the lead author and post-doctoral research fellow from SUTD, Dr. Justin Tan.

"Gelatin inks are increasingly used in DIW 3-D printing to fabricate complex 3-D structures that require a long [printing](#) duration. We believe that the preheating of gelatin would serve as a facile route to improve the usability of [gelatin](#) in extrusion-based processes," added Assistant Professor Michinao Hashimoto, the principal investigator of the team.

More information: Justin Jia Yao Tan et al, Preheating of Gelatin Improves its Printability with Transglutaminase in Direct Ink Writing 3D Printing, *International Journal of Bioprinting* (2020). [DOI: 10.18063/ijb.v6i4.296](https://doi.org/10.18063/ijb.v6i4.296)

Provided by Singapore University of Technology and Design

Citation: Preheating gelatin as a facile approach to increase 3-D printing duration (2020, September 29) retrieved 16 April 2024 from <https://techxplore.com/news/2020-09-preheating-gelatin-facile-approach-d.html>

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