Globular Protein Preparation and Deposition as a 3D Printing Substrate

Advancements in tissue engineering and bioprinting are challenged by the lack of available materials to improve hydrogel developments. The incorporation of affordable and naturally sourced tannic acid (TA) in hydrogels can tune the swelling behavior and mechanical properties for 3D printing.

What is the Problem?

A major barrier to the advancement of tissue engineering and bioprinting is the lack of available materials designed for these fields. Hydrogels, the most used class of materials for these fields, are limited due to their complex preparation and their poor range of mechanical properties. Therefore, the development of facile strategies to tune the mechanical properties of hydrogels to fit a given application is of utmost importance.

What is the Solution?

Affordable and naturally sourced tannic acid (TA) can be used to tune the swelling behavior and mechanical properties of 3D printed methacrylated bovine serum albumin (MA-BSA) hydrogels. Depending on the concentration of TA in solution and the post-print processing conditions, the degree of swelling can be tuned to as low as 13% up to 245%. Under the same processing conditions, the compressive strength of fully hydrated constructs was demonstrated to be as low as 0.8 MPa and as high as 104 MPa. Additionally, the hydrogels showed a similarly broad range in toughness, possibly enabling suturability.

What is the Competitive Advantage?

Existing hydrogel production is time intensive, inconsistent, and yields poor mechanical properties, limiting the adoption of the technology. This simple technology can allow for consistent and rapid production coupled with a very broad range of mechanical properties, allowing one to tailor the mechanical properties for each specific application. The competitive advantage is rapid hydrogel production that yields consistent and tunable mechanical properties with suitability to a variety of applications.

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References

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