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POSTER

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Effect of the Parameters of GELMA Synthesis on Rheology

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tissue engineering, 3D printing, gelatin methacryloyl

Gelatin methacryloyl (GelMA) is a commonly applied biomaterial in tissue engineering, valued for its adjustable physicochemical characteristics and high biocompatibility. Nevertheless, its effectiveness in additive manufacturing is largely influenced by the conditions of synthesis and purification, which affect its rheological properties and printability.

The objective of this work was to examine how different synthesis parameters of GelMA impact its rheological behavior and applicability in three-dimensional (3D) printing. GelMA samples were prepared using three distinct synthesis approaches and subsequently purified using two different methods to assess how processing variables shape material performance. Structural characterization of the obtained polymers was carried out using nuclear magnetic resonance (NMR) spectroscopy, while viscosity measurements were used to evaluate rheological properties. Printability was assessed through extrusion stability and the ability to maintain the intended shape after printing. Additionally, cytotoxicity analyses were performed to confirm material safety.

The findings reveal that both the synthesis method and purification strategy play a crucial role in determining the rheological characteristics of GelMA, which in turn directly affect its printability. Differences in viscosity and flow behavior were shown to influence extrusion efficiency and the structural stability of printed constructs. These results underline the importance of precise control over synthesis conditions and minimizing degradation during the synthesis stage to improve GelMA-based bioinks for additive manufacturing applications.

This study emphasizes the link between processing conditions and functional properties, offering practical insights for the development of bio-based inks in tissue engineering.

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