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The Particle Analysis and Mechanical Characterization of FRESH v0.1 Gelatin Slurry

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ABSTRACT

Tissue engineering has been making great advances in the last decades in the production of artificial organs and tissues, however, it still has its difficulties in creating complex 3D scaffolds for recreating the function and structure of human organs and tissues. This is where the emergence of technologies such as the Freeform Reversible Embedding of Suspended Hydrogels (FRESH) plays a role. FRESH is an embedding printing process that uses a gelatin slurry bath as a base for bioinks to be printed into. The slurry is a yield-stress support which holds the bioinks in their printed position until they are fully cured. In this study, a gelatin slurry called FRESH v0.1 which is made of gelatin type B was tested for its rheological properties using a rheometer and particle size which was done by using a microscope. The results showed that the FRESH v0.1 did not have uniformity within its particles. The particles ranged from 385.11 µm to 1372.83 µm in length. This gives a mean ferret diameter of around 878 µm, however, the mean ferret diameter should have been closer to 55.3 ± 2 µm. Regarding the rheological properties, it was expected to the gelatin slurry to have properties of a Bingham plastic to behave as a rigid body at low stresses but flows as a viscous fluid at high stress, but the results showed that the slurry has more plastic properties. Running a needle through the material to test its behavior for printing showed that the needle easily moved through the material and closing up the path behind the needle. This represents that while the material did not have the expected properties, it still possessed the needed behavior for a support bath.