MATERIALS + RECIPES

Fiona Bell / Leah Beuchley Biomaterial Recipes for 3D Printing

Materiom materials reference database

Collection of recipes and experiments from 2022 MICA class

A.LIVE Bioplastic Cook Book - Great examples and descriptions

STARTER MATERIALS:

BIOPOLYMERS: (thickening, durability, texture, strength)
Agar, carrageen, cornstarch, potato starch, alginate

PLASTICIZERS: (flexibility)
glycerine, sorbitol

ADDITIVES: (various qualities- stability against shrinkage if too much water)
vinegar, sunflower oil, soap, baking soda, clay powder, fiber, wax, eggshells, coffee grounds, orange peels

3D PRINTER SLICERS FOR BIOMATERIALS

Hand + Machine various slicers for 3D printing with Biomaterials

Test print STL files

Some recommended tools to get set up for 3D oozing with biomaterials:

Eazao Heater added to print head suggested for uniform printing qualities

Food dehydrator - to prevent uneven shrinkage and cracking

Tools

Beyond the required measuring equipment, mixing bowls, stirring utensils, and paste extrusion 3D printer, we identify the following optional tools that can assist in working with these biomaterials.

Specialized Equipment

Grinder. Grind large ingredients to a smaller particle size to ensure the biomaterial paste is cohesive in texture. Electric blenders and coffee grinders are the most efficient, but a mortar and pestle can also work.

Sieve. Use a mesh sieve to get all the ingredients to a small enough particle size for easy extrusion. We use a sieve with a mesh size of 60, which results in particles that are 250 microns in size. The maximum printable particle size is determined by the size of nozzle used when printing.

Stand Mixer. Make large batches of biomaterial quickly and easily by mixing ingredients in an electric stand mixer.

Penetrometer. Measure the hardness of the biomaterial paste before printing it with a hand-held fruit firmness penetrometer. We aim for a hardness between 0.2-0.3 kg/cm^2.

Heater. We use a custom heater that sits around the nozzle of our printer to improve stability of the biomaterial on the print bed. The heater is made up of two fans that blow air across two coils of nichrome heating wire. Find instructions for how to make this open-source heater in our supplementary materials.

Dehydrator. A food dehydrator set to 130°F (55°C) can be used to quickly and evenly dry printed biomaterial objects.

Universal Testing Machine. To test the strength of printed biomaterials, use a universal testing machine. A 50-kilonewton force load cell, at a 10 mm/min rate provides reliable results.

Process

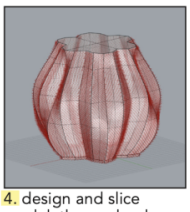
Making Recipes

1. select recipe

2. prepare all tools and ingredients

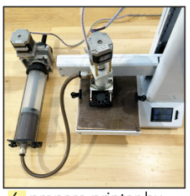
3. combine ingredients into a cohesive paste

Printing Recipes



4. design and slice model, then upload .gcode to 3D printer

5. fill print tube with biomaterial paste



6. prepare printer by attaching print tube and setting up print bed

7. print model

8. remove printed object from print bed and let it dry

9. once completely dry, use finished object