Alginate bioplastic recipes

Sodium Alginate is extracted from brown seaweed. Alginate bioplastics are made by combining sodium alginate, glycerine and water with the curing agent calcium chloride, and are heat/water resistant!

Material properties:

- *Water resistance:* Alginate bioplastic, once dipped in calcium chloride, is waterproof for PH neutral or acid water. It starts dissolving in a couple of hours when the PH of the water is alkaline.
- *Heat resistance:* Alginate bioplastic is very heat resistant, even when cast in a thin sheet it can withstand temperatures up to 150 degrees Celsius.

RECIPE #1: Alginate Foil

An alginate based, heat-resistant and waterproof semi-transparent, matte foil. The foil has a feel that can be compared with a window foil (to blind windows but let the light through). It's matte but very translucent.
Image credit: Loes Bogers.

- Sodium alginate powder 12 gr
- Glycerine 20 gr
- Water 400 ml
- Sunflower oil 10 gr (optional)
- Calcium chloride solution 10% (10 gr to 100 gr water)

1. Mix the alginate with water and glycerine. The best way to get a smooth mixture is to use a hand-held mixer or blender. If you are planning to make a batch of multiple colors, prepare your colors in a jar or small containers, to which you will add the mixture.
2. This recipe uses sunflower oil as a filler to reduce shrinkage. Note that it will also make the resulting material slightly yellowish and opaque, leaving it out will render a bit more crispy and translucent foil. Add the sunflower oil to the blender and mix well.
3. Once the mixture is smooth and completely dissolved, let it sit for several hours or overnight - this will allow all the bubbles to leave the mixture.
4. Prepare a solution of water and calcium chloride, at 10%, and fill a small spray bottle with it.
5. Prepare your surfaces and molds by spraying the calcium chloride solution on them. Anything you cast on should be waterproof so the calcium chloride solution will not be absorbed.
6. Cast the alginate mixture onto the surface or mold. Once you start pouring, try to cast slowly and onto the mixture itself, so as not to encapsulate air. Spread the material to a

thin film using a wide spatula, a ruler, or by moving the mold around. You can also use a spatula or squeegy to push the material in the shape and thickness that you want it.

7. After a couple of minutes, spray the alginate with the calcium chloride mixture. Let it sit for a few minutes, then spray again if you see the liquid is starting to ooze out from the sides. The film that is created in the curing process can break from the weight of the liquid bubble. By respraying you can close these until the sheet is cured enough and stable to dry further.
8. The alginate can release quite a lot of water at this stage, so it's wise to place some kitchen paper around it to absorb excess water. The cast materials will shrink both in thickness and width.

Drying / curing:
Keep an eye on the material every few hours, especially on the first day. The thinner edges of a sheet might curl up when drying and pull off parts of the sheet. When it comes loose it will start to warp. Taping the edges down onto the surface you use helps to keep it in place and dry in the shape you want. Let it dry up to seven days to get to the final form. When it no longer feels cool to the touch it is dry enough to take off. If you want to trim the edges do it while the foil is still a bit softer for a clean cut.

RECIPE #2: Oyster shell Alginate Composite

This recipe creates a firm paste that can be extruded using e.g. a clay printer or a large syringe / kit syringe.
Image credit: Markos Georgiou.

- Sodium alginate powder 0,7 %
- Honey 4%
- Water 27,3 %

- Oyster shells 68%
- Calcium chloride solution 10% (10 gr to 100 gr water)

1. *Collect your shells from local waste streams (restaurants or fish mongers. Wash and clean the oyster shells from any remains and boil them for 30 minutes.*
2. *Then bake the shells for 45 minutes at 180°C to make them more fragile. Using a dish cloth on top, smash the shells into smaller pieces with a hammer.*
3. *Place the pieces in the oven again for another 45 minutes at 200°C. It will make them more brittle and easier to grind. In a blender or a mortar, grind the shells into the finest powder possible.*
4. *Sieve the ground shells to obtain the smallest particle size (in this example: 40 micron).*
5. *To create the alginate solution (binder), add Sodium Alginate powder (2.5% of total weight) and Water (97.5% of total weight). Stir well until a gel is formed and let sit for at least 3 hours.*
6. *Measure the desired amount of oyster shell powder. Add binder to the powder until the right ratio is met. The powder : binder ratio is 1 : 0,4.*
7. *Measure the total weight of the mixture and add 5% honey. Stir well until all dry powder is wet and homogenous. For the extrusion in this project, the material was printed with a* ***biogun*** *but you can also use a large syringe.*

RECIPE #3: Orange peel, Wool & Alginate bioplastic

The video shows the recipe for creating a sewable leather alternative using alginate, orange peel and wool.
Video credit: Fab Lab Barcelona.

https://www.youtube.com/embed/SB9D6yHGI7E?ab_channel=FabLabBarcelona

Sources

Lab Pastoe https://labpastoe.gitbook.io/lab-pastoe

Fablab Barcelona, REMIX EL BARRIO Making bioplastic from Orange peel

Loes Bogers: https://class.textile-academy.org/2020/loes.bogers/projects/outcomes/24_core_recipes/

Materiom open source materials library: https://commons.materiom.org/login

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