



Biomaterials You Can Make at Home

One of the exciting things about biomaterials is just how accessible they are: often they can be created from what you already have at home, or with ingredients readily available at the grocery store. Over the next few weeks we will highlight some of the options you might try. This list will be updated weekly for the next month or two.

*If you decide to explore any of the below recipes, please let us know how it turns out through **this form**. We would love to see!*

WEEK 7



Agar and Wood-ash Based "Concrete"

Agar and alginate are ingredients derived from seaweed and agar is a common stand in for gelatin as a vegan alternative in biomaterial recipes. Agar, alginate, and wood-ash can all be ordered online. Glycerine can be found with the moisturizers at a pharmacy. The following recipe is based on an agar bioplastic composite recipe.



- Agar 15ml
- Alginate 5ml
- Water 200ml
- Wood ash 70 grams (about ½ cup)
- Glycerol 5ml

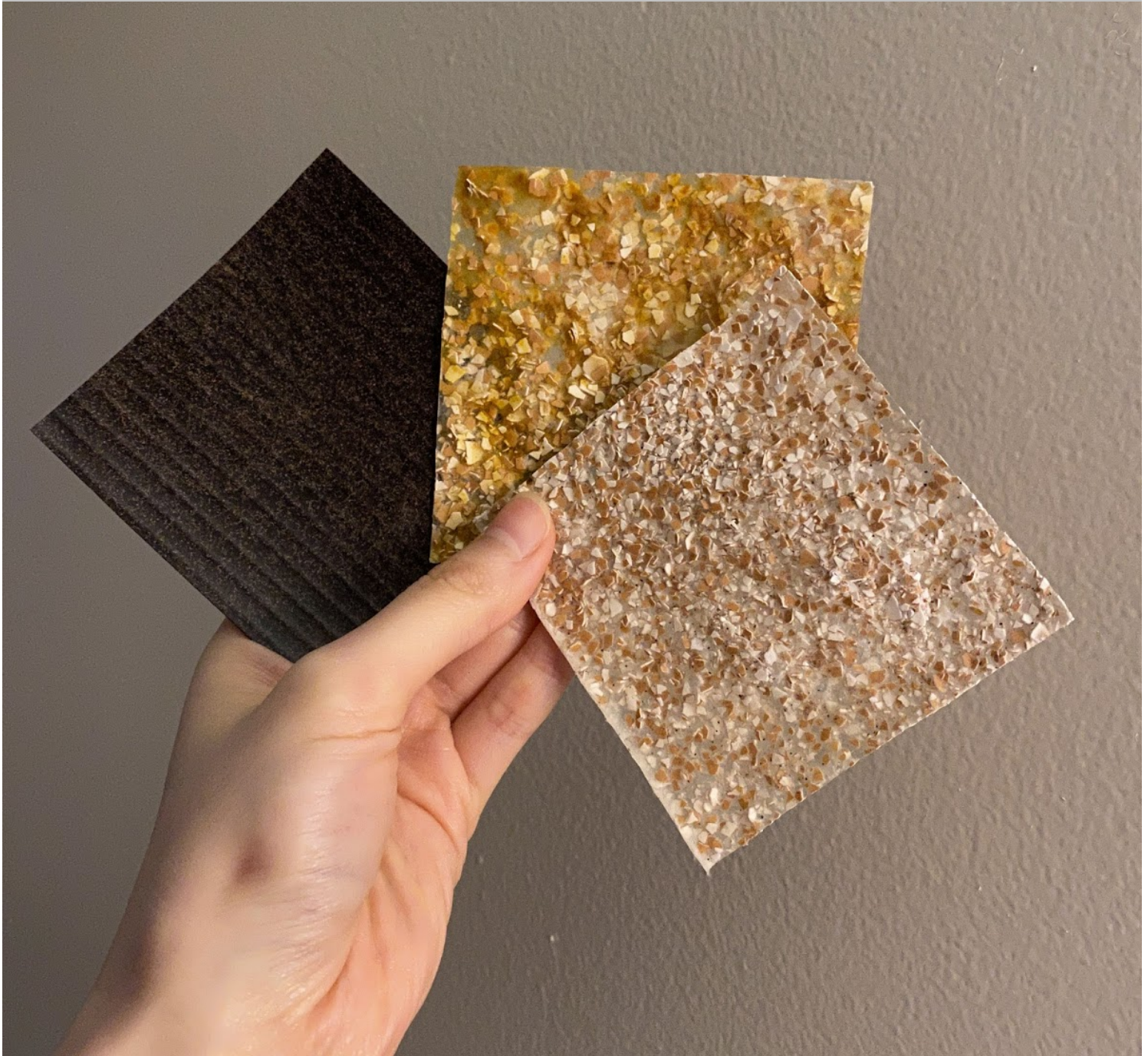
Method:

- Mix the ingredients together in a pot (*please do NOT use a pot you will later use for food!)
- Set the heat level of medium low and boil until the liquid gets sticky and thick
- Pour the liquid in a prepared mold
- Allow to dry (6-7 days)

Note:

For the ball pictured here, the mixture was allowed to dry in the tray (a day or two) until just sticky, rolled into the final shape, and then allowed to finish drying.

WEEK 6



Composites/Dyes with Potato Starch Bioplastics by Yujin Hwang 21 MID

This week we're highlighting some of the versatility of last week's bioplastics recipe. Ingredients are the same, with the addition of natural dye for color, or kitchen waste dried and used as composite for texture.

This is a flexible sheet, potato starch+gelatin recipe that makes one 6 inch x 9 inch sheet. Corrugated plastic is an ideal re-usable material for making the drying tray.



60 ml water

6 grams potato starch

6 grams gelatin

6 grams glycerin

Inclusions such as coffee grounds, eggshell or ground pistachio shell

**To create naturally dyed water, boil material such as onion skins or avocado pits in water for 1 hour. Be sure to use more than 60ml of water, as the amount of water will decrease through evaporation. Some dyes, like turmeric, can just be added to final mixture*

Directions:

Mix all ingredients well in a small pot

Heat at medium, stirring continuously

Continue stirring until mixture begins to turn whitish and thickens slightly

Turn off stove

Carefully pour the liquid out into your tray

Quickly tilt tray to make sure the liquid reaches all 4 corners; place on heat-proof surface

**Composites can also be made by putting the composite material into tray first, and pouring the bioplastic mixture over them.*

WEEK 5



Bioplastics by Kevin Tang 22 ID

This is a flexible sheet, potato starch+gelatin recipe that makes one 6 inch x 9 inch sheet (*recipe can be scaled up – we’ve made 4 feet x 4 feet sheets with these ratios*).

Materials:

—Shallow tray for drying (corrugated plastic works very well, which can be cut to desired size with 1 inch edges folded up to create a tray)

Method:

- 60 ml water
- 6 grams potato starch
- 6 grams gelatin
- 6 grams glycerin (3 grams makes a stiffer sheet)

Directions:

- Mix all ingredients well in a small pot



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- Turn off stove
 - Carefully pour the liquid out into your tray
 - Quickly tilt tray to make sure the liquid reaches all 4 corners; place on heat-proof surface

Recipe Notes:

- Overheating or rapid stirring will cause bubbles to form that will impact your results*
- Depending on temperature and humidity, bioplastic will take 4-7 days to cure before you peel it off the sheet. Don't let it sit longer than a week before peeling it off the tray*
- The sheet needs to be slightly rough to constrain the bioplastic – too smooth (don't use glass or non-stick!) and the bioplastic will slip off of it and deform, too rough and it will be hard to remove*
- This recipe can be used as a base to create composites: consider adding dyes, fibers, paper scraps, etc.*

WEEK 4



Kombucha Leather by Sarah Garrison 20 MID

This is part 2 of a 2 part series on how to make your own kombucha bioleather. Here's how to harvest a SCOBY (Symbiotic Culture of Bacteria and Yeast), condition it, and prepare it for your projects.

View the three how-to videos below, with Sarah Garrison [20 MID] taking you through the kombucha bioleather making process.



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- Coconut Oil
 - Unfinished Wood Sheet (larger than your SCOBY)
 - Paper Towel or Cloth Rag

Method:

- Once your SCOBY is at least $\frac{3}{8}$ inches thick it can be harvested
- Remove from kombucha
- Wash with lukewarm water and a small amount of dish soap
- Rinse thoroughly (if you chose to dye your SCOBY, do so at this point)
- Place on unfinished wood sheet to dry
- Wait until it is completely dry, but not brittle, before removing. This could take 10+ days depending on thickness and environmental conditions
- Warm a spoonful of coconut oil in your hands, then thoroughly massage into bioleather.
- Repeat until a heavy coat has been applied to both sides of the SCOBY
- Wait 24 hours
- Use a paper towel or clean cloth rag to buff off excess coconut oil

Enjoy your bioleather!

Kombucha How To Part 2 A

Kombucha How To Part 2 B

Kombucha How To Part 2 C

WEEK 3



Kombucha Leather

This is part 1 of a 2 part series on how to make your own kombucha bioleather. Below details how to brew kombucha and set it up to grow a SCOBY (Symbiotic Culture of Bacteria and Yeast), which is what you will harvest later for the bioleather. The SCOBY will grow to the dimensions of your liquid's surface, so keep that in mind when selecting a glass pan/container for it to grow in. The SCOBY will need time to grow thick enough to harvest, so plan on waiting at least 6 weeks before you will be able to have your first finished sheet of bioleather.

View the three how-to videos below, with Sarah Garrison [20 MID] taking you through the kombucha bioleather making process.

Materials:

- Large pot
- Large glass pan
- Cooking spoon



Ingredients:

- $\frac{3}{4}$ cup sugar
- 8 black tea bags (or 3 tbsp loose leaf black tea)
- 16 oz store-bought unflavored kombucha
- 12 cups water

Method:

- In a large pot, boil 4 cups water
- Dissolve sugar in water
- Remove from heat
- Steep tea for 15 minutes
- Add 8 cups cold water (solution must be room temperature BEFORE adding kombucha)
- Add bottle of kombucha and stir
- Fill sterilized large glass pan, leaving at least $\frac{1}{2}$ from surface to lip of pan
- Refrigerate remaining liquid for a later step
- Cover with cotton fabric and secure (if you are using tin join or plastic wrap poke a lot of tiny holes in the material so you liquid can get plenty of fresh air)
- Place in a warm, dry location away from direct sunlight

The SCOBY is a living thing and will need new nutrients to continue growing!

- Add more liquid once a week, or more often if your pan begins to dry out. If you run out of liquid, make a $\frac{1}{2}$ or $\frac{1}{4}$ batch of this recipe, omitting bottled kombucha.
- Within 1 week a film should start to form on the surface. It will look strange, don't worry!
- Wait 3-4 weeks to see proper SCOBY growth
- Seed mat can be placed below the glass to speed up metabolism

Kombucha How To Part 1 A With Captions

Kombucha How To Part 1 B With Captions

Kombucha How To Part 1 C With Captions



Quick CoRncrete

Ingredients:

- 25 g corn starch
- 125g sand
- 22.5 ml water

Method:

- Mix the cornstarch and sand well
- Add water (mixture will be dry and form small clumps)
- Press mixture into a (microwave safe!) mold (for example, balloons were used for the rounded shapes)
- Microwave mixture for 3-5 minutes

Experiment with: sand coarseness, alternative composite materials and dyes (keeping the ratios of cornstarch:water aggregate the same). The larger brown sphere was made with cornstarch and cork granules - it's a solid, but very light form.

WEEK 1



Natural Dye — Avocado

Ah, complementary colors. Who knew that the skin and peels of this creamy wonder would yield such a dye?

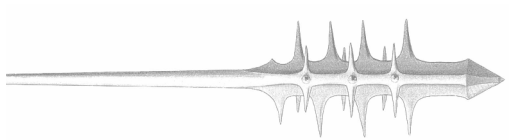


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- Water
 - Baking soda (optional - will shift color towards russet/orange)
 - Material for dying (natural fabrics like cotton, wool or silk take natural dyes best)

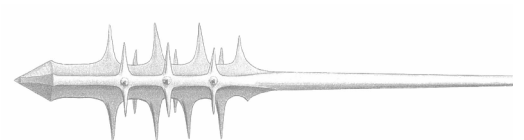
Method:

- Heat water and avocado pit/peels over medium heat - hot enough to simmer, but not boil.
- When desired color intensity is reached, turn off heat (a nice color can usually be achieved in 30-45 minutes)
- Add baking soda if you want to shift it a bit more orange - you will need to play with the amount.
- Add fabric — samples shown above were allowed to sit in dye overnight (12-16 hours)

Other food-source dyes to try: black tea (brown), red onion skins (pink to reddish brown), yellow onion (golds), turmeric (orange/golds), etc



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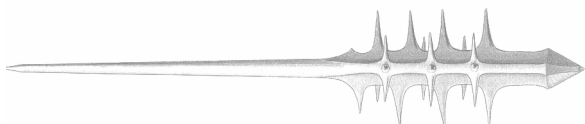
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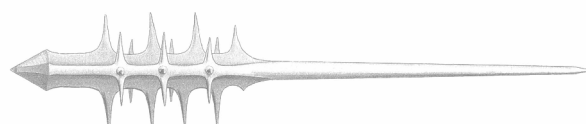


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