

## Water Bottle

The key ingredient for this project is sodium alginate, a natural gelling powder derived from algae. The sodium alginate reacts with calcium.



- water
- 1 gram sodium alginate
- 5 grams calcium lactate
- large bowl
- smaller bowl
- hand mixer
- spoon with rounded bottom

The size of the spoon determines the size of your water bottle. Use a large spoon for big water blobs. Use a tiny spoon if you want little caviar-sized bubbles.

### Make an Edible Water Bottle

1. In a small bowl, add 1 gram of sodium alginate to 1 cup of water.
2. Use the hand mixer to make sure the sodium alginate is combined with the water. Let the mixture sit for about 15 minutes to remove any air bubbles. The mixture will turn from a white liquid to a clear mixture.
3. In a large bowl, stir 5 grams of calcium lactate into 4 cups of water. Mix well to dissolve the calcium lactate.
4. Use your rounded spoon to scoop up the sodium alginate solution.
5. Gently drop the sodium alginate solution into the bowl containing the calcium lactate solution. It will immediately form a ball of water in the bowl. You can drop more spoonfuls of sodium alginate solution into the calcium lactate bath. Just be careful the water balls don't touch each other because they would stick together. Let the water balls sit in the calcium lactate solution for 3 minutes. You can gently stir around the calcium lactate solution, if you like. (Note: the time determines the thickness of the polymer coating. Use less time for a thinner coating and more time for a thicker coating.)
6. Use a slotted spoon to gently remove each water ball. Place each ball in a bowl of water to stop any further reaction. Now you can remove the edible water bottles and drink them. The inside of each ball is water. The bottle is edible too -- it's an algae-based polymer.

## Starch and glycerin

Bio-plastic ingredients:

1. 1 tbl cornstarch
2. 1 tsp vinegar
3. 1 tsp glycerin
4. 4 tbl water

Helpful tools:

1. Spatula
2. Small pot
3. Cookie sheet
4. Aluminum foil (optional)
5. Measuring cups
6. Stove top (or hot plate)



These are all ingredients that can be found in most kitchens, aside from the glycerin.

Glycerin is used as a plasticizer in this application, but is often an important additive in lotions and other skin care products because of its hydrating properties.

Different ingredients will affect the final outcome in different ways. For instance, glycerin will make the plastic more flexible. The acetic acid in vinegar helps the starch to dissolve easily, because it adds ions to the mixture. Vinegar is a much more readily available ingredient than ammonium acetate, which would be used in a larger scale commercial bio-plastics operation. Water is used as a solvent, also to denature the starch. That way, a thin film can be created as a final product.

The order does not matter. Simply measure all ingredients (this is not rocket science, so it doesn't need to be exact) and mix them together in the pot. Stir until combined, then turn on stove to low/medium heat.

After the heat is turned on, the mixture should be stirred regularly to avoid clumping. It will be a milky color at first, but will soon get thicker and turn slightly translucent. It is important to keep the heat low so that the heat is equally distributed throughout. This process happens fairly quickly (the pictures above were taken ~30 seconds apart), so keep stirring until the mixture thickens!

Once the mixture is easily scoopable, turn off the heat! Stir a few more times, then pour/scoop the mixture onto an aluminum foil lined cookie sheet. The foil is optional, but it will be easier to remove later when the plastic is dry.

The mixture will feel similar to hair gel when it is first on the pan, and will need to cool a bit before it can be formed. Let it sit for a minute or so, then spread with a spatula on the foil.

Over the next 15 minutes, the plastic will begin to harden and not stick to fingers when touched, but it will still be soft. The plastic should be left alone for several hours, until completely set.

<https://www.instructables.com/id/DIY-Bio-plastics/>

## Micro plastics

Weigh out 2 g of shower gel in the tea strainer. Wash out the shower gel and count the remaining micro plastic particles. How much particles do you find per gramm?



Think about:

- How micro plastic particles may be developed?
- What are the risks of micro plastics?
- Do you use micro plastics in your daily life?
- How do we could avoid micro plastics?

Develop a mind map or a graphic (or anything else) regarding these aspects.