Use an extract from seaweed to synthesize a gel!

Materials needed:
Sodium alginate (pre-mixed), ½ teaspoon calcium lactate, Squeeze Bottle, 16oz Cup, Spoon, 1 Cup of Water, Coloring

VIDEO INSTRUCTIONS at SciWorkshop.org/KITS

1. Fill a 16 oz cup halfway with water (1 Cup)

2. Add the calcium lactate powder to the water and stir until you can't see it anymore.

What happened to the calcium lactate?

3. Squeeze some sodium alginate (the goo in the squeeze bottle) into the calcium water. Feel a little bit of it *before* it goes in, so that you know what it is like before the reaction!

4.. Can you see the alginate in the water? Lift it out with the spoon and examine it!

What does it feel like now? Try pulling a piece apart. What's inside?

5. Put the gel "worm" back in the calcium water for a while. While you are waiting you can create different gel shapes. Try putting a big spoonful, or little drops, of sodium alginate in the calcium water.

6. Remove the gel worm after ~10 minutes. How has it changed?

What are the reactants? Sodium alginate, the slimy goo in the squeeze bottle, is a *natural* compound found in the cell walls of brown algae. Sodium alginate is a polysaccharide, a type of polymer where millions of sugar molecules are linked together in a long chain. A polymer is any large molecule that is made of repeated units of a smaller molecule.

If you like ice cream that doesn't drip when it melts, you can thank sodium alginate! It is often added as a thickener to foods like ice cream, pies, and yogurt.

Calcium lactate is a salt that some people take as a supplement if they need more calcium in their diet.

What is happening? First you made a solution by *dissolving* the calcium lactate in water. Water molecules, H_2O, are polar which means that one side (oxygen) has a slightly negative charge, and the other side (hydrogen) has a slightly positive charge. Calcium ions have a +2 charge. When calcium lactate is added to the water the positively charged calcium breaks free because it is attracted to the negatively charged side of the water molecule. (continued on next page)

7. ***Optional***: make colored gel by mixing alginate goo with food coloring or washable kid's paint. Drip or pour colored alginate into the calcium water. When the colored shapes have firmed up, but them in a cup of *fresh water*. Place it where it won't be disturbed overnight. Examine them in the morning… was there any change?

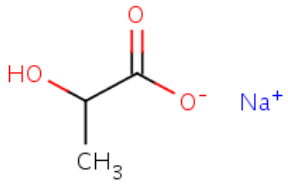
8. Clean up time!
When you are all done, pour the calcium water down the sink. The gel shapes can be thrown in the trash.

When sodium alginate is added to the calcium solution a chemical reaction occurs immediately! The long polymer chains have negatively charged parts (see diagram below). The positively charged calcium ions cross-link one polymer chain to another, bonding them together. This results in a semi-solid gel structure. As sodium alginate sits in the solution, more and more calcium ions diffuse into the gel. The more cross-linking, the more rigid the gel.

Food coloring and paints use different types of pigment. If the pigment molecules are large enough, they will stay trapped inside the calcium alginate. If they are small, they will diffuse out over time!

Materials Science What else do you think sodium alginate could be used for? It is both biodegradable and bio-compatible. Scientists are trying it out as a a slow-delivery mechanism for medicine. It is also being developed into new dressings for wounds that are soft and flexible and can be rinsed away with salt water.

Molecular Structures



calcium lactate