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Exploring Fabrication— Gummy Capsules

How can things build themselves?



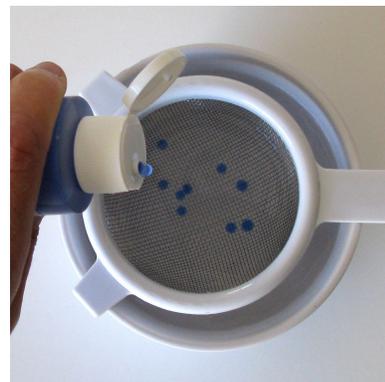
NanoDays™
The Biggest Event
for the
Smallest Science!

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Exploring Fabrication—Gummy Capsules

Try this!

1. Place the sieve into the bowl of salt water (calcium chloride solution).
2. Gently squeeze the bottle of sodium alginate “worm goo,” so that individual droplets of liquid fall into the sieve.
3. Lift the sieve out of the bowl.
4. Feel the droplets. Are they still liquid?
5. Try squeezing a droplet. What happens?



What’s going on?

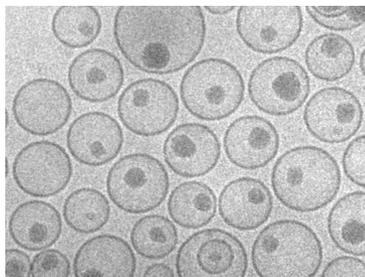
When the liquid droplets come into contact with the salt water, a chemical reaction takes place and creates a *polymer*. A polymer is a long chain-like molecule made up of many repeating units linked together.

The polymer forms on the outside surface of the droplets, where they touch the salt water, creating a shell around the liquid interior. The salt water is a solution of calcium chloride. The liquid in the squirt bottle is *sodium alginate*, a polysaccharide with many short polymer molecules. The calcium ions in the salt water cross-link (bond) these short polymer molecules into longer strands, turning the sodium alginate liquid into a thick gel.

The polymer droplets you made are similar to *nanocapsules*, tiny particles with an outside shell and hollow interior that can be filled. To create functional structures that are 100 nanometers or smaller in size, scientists use a process called *self-assembly*, in which nanostructures actually assemble themselves! (A nanometer is a billionth of a meter.)

Nanocapsules can be designed to deliver medicine to diseased parts of the body, bypassing healthy parts. For example, research at Duke University led to the development of liposome nanocapsules that bring cancer medication to tumors. These targeted delivery systems use much less medicine, so they can have fewer and less harmful side effects.

How is this nano?



Nanocapsules carrying cancer medication
100 nm diameter

Self-assembly is a process by which molecules and cells form themselves into functional structures. Self-assembly occurs in nature—snowflakes, soap bubbles, and DNA are just three examples of things that build themselves.

Researchers in the field of nanotechnology are studying self-assembly in order to create new materials and technologies smaller than 100 nanometers in size. (A nanometer is a billionth of a meter.)

Nanotechnology allows scientists and engineers to make things like smaller, faster computer chips and new medicines to treat diseases like cancer.

