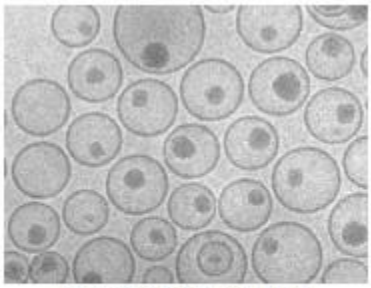
Gummy Capsule Activity

Introduction

Self-assembly is a common technique used in nanoscale science and technology in order to assemble nanoparticles into well-defined configurations. The arrangements of these structures can be used in a wide variety of materials. Self-assembly of nanoparticles has been used to build sensors to detect chemical and biological molecules. It has also been used to create smaller computer chips with more computing power.



Nanocapsules carrying cancer medication
100 nm diameter

Nanocapsules are one way in which scientists use self-assembly to fight diseases. Self-assembly is used to make liposome structures which have an outside shell and a hollow interior that can be used to store medicine. This can allow for targeted delivery in which the medicine is brought selectively to the tumor cells. This allows for less medicine to be used and fewer negative side effects.

In this activity, a chemical reaction takes place once the liquid droplets come in contact with the salt water. A polymer is formed which means that a chain-like molecule with repeating units is formed. As the sodium alginate, a polysaccharide, is added to the salt water, the short polymers of the alginate are bound into longer chains by the calcium ions creating a capsule similar to a nanocapsule.

Safety

- DO NOT eat the capsules (they are not food grade).

Materials

- Sodium alginate liquid
- Calcium chloride
- Water
- Bowl
- Spoon
- Sieve
- Paper Towel

Procedure

1. Fill a bowl half full with warm water.

2. Add half a spoon full of calcium chloride and stir.

3. Gently squeeze the bottle of sodium alginate so that individual droplets of liquid fall into the bowl.

4. Lift the droplets out of the bowl by sieve or spoon.

5. Feel/squeeze the droplets.

Questions to Consider

1. How did the gummy capsule feel?
    a. What happened when you squeezed it?
2. Did anything surprise you in this activity? If so, what?
3. What factors do you think played a role in the self-assembly of the gummy capsules?
4. What do you think would happen if you heated up the water solution before adding the sodium alginate?
    a. What if you cooled it down?

References

http://www.nisenet.org/sites/default/files/catalog/uploads/8879/fabricationgummy_guide_31oct11.pdf

http://blog.khymos.org/2007/03/30/first-experiments-with-sodium-alginate/

(this website shows you how to make the sodium alginate solution)