



Curiosity Guide #408

Chocolate Chemistry

Accompanies Curious Crew, Season 4, Episode 8 (#408)

Chocolate Texture

Investigation #4

Description

Smooth and silky, or hard and grainy? How do you like your chocolate?

Materials

- European chocolate
- Mexican chocolate
- Friends
- Bottle with cap
- Powdered chocolate mix
- 2 Spoons
- 2 Drinking glasses
- Vegetable oil
- Water
- Liquid soap

Procedure

1. Give each friend a piece of European and Mexican chocolate.
2. Have the friends describe the appearance of each.
3. Have the friends taste each type of chocolate.
4. How are the two chocolates different?
5. Fill a drinking glass with water and a second glass with oil.
6. Add a spoonful of powdered chocolate mix to each glass. Stir.
7. What do you notice?
8. Now fill a bottle with some water and some oil.

9. Put the cap on the bottle.
10. Shake the bottle.
11. What do you notice?
12. What happens if you add a bit of soap and stir?

My Results

Explanation

The European chocolate is going to taste smoother than the grainier Mexican chocolate for a couple of reasons. First, the particles of the sugar and cocoa beans may be milled to different sizes, which impacts the texture of the chocolate. Second, there is a chemical difference. Reading the label on the chocolate reveals the primary ingredients, which include cocoa beans, sugar, cocoa butter, and soy lecithin. The ground cocoa is hydrophilic, which means it likes water. That is why the chocolate powder will suspend in the water, but doesn't disperse well when it is added to oil. The cocoa butter is hydrophobic, so its carbon and hydrogen molecules do not interact well with water.

When you shake the oil and water mixture in the bottle, the oil droplets disperse throughout the water. However, in time, the liquids try to separate because water is hydrophilic, and oil is hydrophobic. So how can the two ingredients of the ground cocoa and cocoa butter mix together in a chocolate bar? Adding soap to the water allowed the different molecules to remain mixed. The soap acted as an emulsifier, which is a stabilizer that keeps substances that don't ordinarily mix from separating. The chocolate needs an emulsifier to help mix the two ingredients together, and that is what the soy lecithin does. The soy lecithin coats the cocoa solids, making the exterior hydrophobic. This emulsifier keeps the cocoa and cocoa butter well mixed, giving a smooth texture when you taste the chocolate.

Think about this: Have you ever seen someone making a tossed salad? Did you notice that before adding the vinegar-and-oil dressing, the cook began to shake the bottle? You see, when the bottle has been sitting still, the vinegar settles at the bottom, and the oil floats on top. Vinegar is a hydrophilic substance, which means that the vinegar likes water and will mix with it. Oil is hydrophobic and doesn't like water, so the liquids will stay separated until you shake bottle and disperse the oil droplets. We discovered that soy lecithin is an emulsifier that can keep chocolate ingredients together. With oil and vinegar, you could try an egg or mustard as an emulsifier to keep them mixed. Time to eat!

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