Food Science & Technology

What makes NesQuik™ quick?

Look at the ingredient labels on the food you eat and learn about chemistry.

What makes NesQuik™ Quick?
You have to be a food chemist in order to answer this question. Try this series of experiments in your kitchen and discover how science is used in food technology. Record your results on the Observation Log.

Do • • • the activities

• • • • • Penny predictions

1. Gather these materials:
   1 medicine dropper, water, one penny
2. Predict how many drops of water you can fit on a penny.
3. Use the medicine dropper to add drops of water to the top of the penny. Count each drop until the water leaks off the side.
4. Were your predictions correct?
5. Repeat this test 3 times and record the number of drops. Calculate the average

What’s the science?
Water molecules are cohesive—this means that they tend to stick together. When they stick together, they form a “skin” or a dome. Because of this, an insect can stand on the surface of a pond and you can get many drops on the top of a penny! Test this idea with the next experiment.

Minimum Completion Time
45 minutes

Skill Level
Intermediate
Age 11-13

Learner Outcomes
• Explores the properties of water
• Demonstrates that surfactants disrupt the surface tension of water
• Discovers the purpose of soy lecithin as an ingredient

Science Skills
• Predict
• Observe
• Record data
• Identify variables and controls
• Infer

Life Skills
• Think creatively
• Reason

Educational Standards
• Properties and changes of properties in matter
• Understanding about science and technology
• Science and technology in society

Success Indicator
• Uses materials creatively
• Makes soy protein plastic
• Describes the outcome process

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Attractive molecules

1. Gather these materials: 1 empty plastic cup, water, 1 medicine dropper, 2 toothpicks
2. Turn over the plastic cup.
3. Use the medicine dropper to place two drops of water on the bottom of the cup about 1 inch apart.
4. Use the toothpicks to move one drop of water over to make one big drop of water. How easy was that?
5. Use the toothpicks to separate the big drop into two smaller drops. How easy was that?

What’s the science?

Water molecules are cohesive—they like to stick together. Putting two drops together is easier than pulling one drop apart. Do the next experiment using chemistry to break up cohesive water molecules.

What makes the pepper dance?

1. Gather these materials: 1 small plate, water, pepper, 1 soap dispenser
2. Fill the plate with water.
3. Sprinkle a little pepper evenly on the surface of the water.
4. Using the soap dispenser, squirt one drop into the middle of the pepper.
5. Observe what happens.

What’s the science?

Soap contains a surfactant. A surfactant causes water molecules that are cohesive to move apart. By watching the pepper, you can see the water molecules move.

Color swirls

1. Gather these materials: 1 small plate, soy/dairy milk, 1 small bottle food coloring, 1/2 tsp lecithin (granular; found in the health food section of the grocery store)
2. Fill the plate with milk.
3. Place three equally spaced drops of food coloring in the milk.
4. Predict: You are going to add a surfactant to the milk. Remember what happened to the pepper when you added a soap/surfactant? What do you think will happen when you add lecithin, another surfactant?
5. Add a few granules of the lecithin on the drops of color. Observe what happens. Was your prediction correct?

What’s the science?

Soy lecithin is a surfactant much like soap. When added to the food coloring and milk, it causes the water molecules to separate and move. The food coloring shows how they move. Why do the molecules move more slowly in milk than they did in the water (dancing pepper)? Milk has more fat and less water molecules—they move more slowly because of the fat! Show your understanding - which would move “faster,” whole milk or skim milk? Why?
Why is NesQuik™ quick?

1. Gather these materials: 2 empty plastic cups; water; 1/2 tsp baking cocoa; 1/2 tsp NesQuik™.
2. Turn over the empty plastic cups.
3. Place one large drop of water on the bottom of one cup.
4. Sprinkle a small amount of cocoa on the drop.
5. Observe what happens. How would you describe this to someone else?
6. Now place one large drop on the second cup.
7. Sprinkle a small amount of NesQuik™ on the drop.
8. Observe what happens. How would you describe this to someone else? What is the difference between how the cocoa looked and how the NesQuik™ looked?
9. Find “lecithin” on the ingredient label of the NesQuik™ container.

What’s the science?

Soy lecithin is a surfactant. Made from soy oil, soy lecithin causes molecules to separate and breaks surface tension. The lecithin in NesQuik™ causes the water drop to spread out and the chocolate to go into the drop. The cocoa does not contain soy lecithin so it “sits” on the top of the water drop. It does not break the surface tension or cause the water molecules to separate. In order to use cocoa to make a drink, you have to stir it a long time or use heat to “break up” the cohesiveness of the water molecules in the milk. Follow the directions on the label and make yourself a snack drink with NesQuik™.

More Challenges

1. Sticking Together: Demonstrate the cohesiveness of water with this experiment!
2. Gather these materials: 2 pieces of aluminum foil, water
3. Rub two flat pieces of foil together and then let them go. Do they stick together?
4. Rub each piece with water on one side.
5. Place the two wet sides together, hold them up and let them go. Do they stick together?

What’s the science?

Two pieces of foil will not stick together when they are dry. But when you add water to each of pieces and then rub the wet sides together, they stick! Water molecules are cohesive. They stick together. Can you think of other ways to demonstrate cohesion?

Glossary

lecithin—a fatty substance which occurs in some animal and plant tissues

surface tension—the cohesive forces among liquid molecules that form a surface “film” which allows it to resist an external force

surfactant—substances that adjust the surface properties, and surface tension, of the liquid or solid to which it is applied. The term surfactant is made up from letters of the words ‘surface active agent’. Emulsifiers, detergents, foam inhibitors and wetting agents are all examples of surfactants.
**Share**

Describe what you did to prove why NesQuik™ is quick using these science words: cohesive, surface tension, surfactant, quick.

**Reflect**

Check the labels on your food. What questions do you have? Where can you get the answers? Where do you see chemistry being used?

**Generalize**

Scientists do experiments very carefully. Why is it especially important for food technologists to be careful?

**Apply**

Consider food technology as a career. How do food technologists make food healthier, easier to get, and more tasty? Where can you get the answers to these questions?
What is lecithin and what can it do?

Lecithin

Lecithin is an oily substance found in some plants (soybeans) and animals (egg yolks). After soybeans are harvested, they are cleaned, cracked and de-hulled. The soybean oil is separated from the soybean meal. Soy lecithin can be mechanically or chemically removed from the soybean oil.

Lecithin in food technology

Soy lecithin is a versatile tool in food technology. Lecithin does not dissolve easily in water, which results in its surfactant qualities. Lecithin is sometimes sold as a food supplement. In cooking, it is used as an emulsifier. Lecithin is also used to prevent sticking in non-stick cooking spray.

Lecithin also acts as an emulsifier, or mixing agent. When used as an ingredient it helps fat and water stay mixed. As an emulsifier, lecithin improves the smoothness and creaminess of chocolate. That is important in both the manufacturing process and the shelf life of the chocolate.

Lecithin in other products

The unique properties of lecithin make it useful in pharmaceutical and cosmetic applications as well as many industrial products. Lecithin is used as an ingredient in crayons, sunscreen, lip balm, the protective coating on CDs, inks, paints, textiles, lubricants and waxes. Soy lecithin is even used in today’s oil fields, as a “green option” reducing friction in drill bit lubrication and to achieve viscosity requirements in fresh, saltwater and other drilling muds.
Chemistry and biotechnology are used to solve food problems and to make food healthier and more convenient. Be a food chemist and discover why NesQuik™ is so “quick!” Collect your lab notes on this page as you do your experiments.

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**Penny Predictions**

How many drops of water fit on the penny?

<table>
<thead>
<tr>
<th>Test 1:</th>
<th>Test 2:</th>
<th>Test 3:</th>
</tr>
</thead>
</table>

Here is what the penny looked like with the water on top. Draw 2 different angles.

<table>
<thead>
<tr>
<th>Average for all three tests:</th>
<th>Difference between my prediction and the average:</th>
</tr>
</thead>
</table>

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**Attractive Molecules**

Was it easy or difficult to put the drops together?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>very easy</td>
<td></td>
<td></td>
<td></td>
<td>very difficult</td>
</tr>
</tbody>
</table>

Was it easy or difficult to separate the one drop into two drops?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>very easy</td>
<td></td>
<td></td>
<td></td>
<td>very difficult</td>
</tr>
</tbody>
</table>
What makes pepper dance?

Draw a picture of the pepper on the surface of the water BEFORE you added the surfactant.  

<table>
<thead>
<tr>
<th></th>
<th>Draw a picture of the pepper on the surface of the water AFTER you added the surfactant.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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Color Swirls

What do you think will happen when you add the soy lecithin (a surfactant) to the food coloring in the milk? Write your prediction here.

Test your prediction. What happened? Write it here.

Why is NesQuik™ quick?

Describe this experiment in pictures here. Use step by step drawings.