Cooking with Acid

What do you believe to be the most versatile ingredient in the kitchen? Did anyone say acid? Probably not. But there are so many ways we can use acid in cooking - let's find out how!

Materials

- pH test strips
- Lemon juice
- Orange juice
- Soda
- Condiment cups
- Stove
- Whole milk (4 cups)
- Ricotta cheese recipe
- Mixing bowl
- Vinegar (different kinds)
- Citric or ascorbic acid
- Water
- Honey
- Fruits (apples, bananas, avocados)
- Buttermilk
- Pens/pencils
- Paper plates
- Salt
- Sieve
- Cheesecloth
- Paper
- Heavy cream (2 cups)
- Medium saucepan
- Ziploc bags

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Instructions

1. We'll start by pH testing a variety of ingredients. Begin with some predictions, having campers make a number line from 0-14 and place where they think the ingredients will go. If appropriate, allow campers to taste ingredients to help them. One by one, test the ingredients (follow the specific instructions for your pH test strips) and record your findings. Discuss!
2. Next, we'll explore how acid can stop cut fruit from browning. Watch this video discussing why apples turn brown after you cut them: https://www.youtube.com/watch?v=gbArE5dv0W4&feature=youtu.be.
3. What can we do to prevent the cut apples, bananas, and avocados from browning? Design your experiment, using the acids you just tested for their pH values. Make sure you create some way to record your findings.
4. Lemon juice helps keep apples from turning brown because it is full of ascorbic acid (vitamin C) and it has a low (acidic) pH level. Ascorbic acid works because oxygen will react with it before it reacts with the polyphenol oxidase enzyme in the fruit. What happened with the other ingredients?
5. Now, we'll explore another way acid can help us out -- in making ricotta (i.e. the cheese you'll find in raviolis and lasagna). Ricotta cheese is made from heat-acid precipitation of proteins from milk. During heating, whey proteins begin to coagulate. The rate of coagulation increases as the temperature is raised, and a thick layer of curd forms on the surface of the whey. Addition of acid will induce a second rise of coarser curd.
6. Finish up by asking yourself:
   a. How did your pH predictions differ from reality? What surprised you? Why?
   b. How did your findings from the pH testing help you stop the fruits from browning? How did pH value affect the ingredient's anti-browning powers?
   c. What happened to the milk? What other dairy products can you think of? How does this differ? Why do you think that is?

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What's the science behind it?

There are so many ways we can use acid in cooking -- to stop fruits from browning, to naturally ferment foods (like pickles), to create fluffy baked goods (remember the lactic acid in our sourdough bread), to tenderize meats and other tough ingredients, and to provide balance to otherwise rich dishes. There's also a fair amount of science involved:

- Acid: a substance that donates hydrogen ions. Because of this, when an acid is dissolved in water, the balance between hydrogen ions and hydroxide ions is shifted. Now, there are more hydrogen ions than hydroxide ions in the solution. This kind of solution is acidic.
- Base: a substance that accepts hydrogen ions. When a base is dissolved in water, the balance between hydrogen ions and hydroxide ions shifts the opposite way. Because the base "soaks up" hydrogen ions, the result is a solution with more hydroxide ions than hydrogen ions. This kind of solution is alkaline (or basic).
- pH: in chemistry, pH is a scale used to specify how acidic or basic a water-based solution is. Acidic solutions have a lower pH (less than 7), while basic solutions have a higher pH (more than 7). At room temperature, pure water is neither acidic nor basic and has a pH of 7.