Mystery Powders

Procedure:

1. Always wear safety goggles.
2. Rinse the flask, spot plate, and scoop.
3. Choose one of the mystery powders. You are going to identify it.
4. Add one scoop of your powder to the flask.
5. Use the graduated cylinder to measure 20 ml of water and pour it into the flask. Swirl vigorously for about 30 seconds.
6. Add 5 drops of indicator to the flask. Make observations as follows:
   a) Is the solution purple? Are there bubbles? 
      If yes, then you have detergent! Start over with another powder.
   b) Is the solution pink?
      If yes, then you have citric acid! Start over with another powder.
   c) Still don’t know which powder you have? Go on to step 7.
7. Put a scoop of the powder in each of 2 wells in the spot plate. 
   To the first, add 5 drops of vinegar. Stir with a toothpick. Are there bubbles?
8. To the second well, add 3 drops of iodine. Make observations:
   a) Is the mixture light brown? Were there bubbles with vinegar?, 
      If yes, then you have baking soda! Start over with another powder.
   b) Is the mixture purple or black? Were there bubbles with vinegar?
If yes, then you have **baking powder**! Start over with another powder.

c) Is the mixture **purple** or **black**? Were there **no bubbles with vinegar**?
If yes, then you have **starch**! Start over with another powder.

9. Empty and rinse the flask and the spot plate.
How can we identify mysterious substances using chemistry?

A Closer Look:

Although each white mystery powder looks like the other powders, you were able to identify them by their very different chemical properties.

- **Detergent** is the only mystery powder that will make suds. It is also a weak base, and turns the indicator purple.
- **Citric acid** is an acid, and will turn indicator pink.
- **Starch** interacts with iodine and turns black, dark brown, or purple. Scientists are still guessing how this works. Complicated iodide ions (I$_5^-$) probably stick inside starch molecules, changing their color. Starch also has limited solubility in water at room temperature, so the solution is cloudy.
- **Baking soda** is a base that reacts with the acid vinegar to give off carbon dioxide gas. We see the gas bubbling from the solution.
- **Baking powder** contains baking soda and starch, as well as other ingredients. The baking soda bubbles in vinegar and the starch turns iodine black, or purple.
Forensic scientists often use similar techniques to identify suspicious powders and other unknown chemicals found at crime scenes.