

Testing Aspirin



Introduction

Aspirin is one of the oldest and most frequently used drugs in the treatment of illness or injury. Some 2,300 years ago, Hippocrates noted that people could chew willow bark to relieve pain and fever. Willow bark contains salicylic acid, which is an *antipyretic* (fever reducer) and *analgesic* (pain reliever). Unfortunately, salicylic acid is very irritating to the stomach's lining. In 1897, Felix Hoffman discovered a chemical reaction that changed salicylic acid just enough to reduce this side effect, producing *acetylsalicylic acid*, the active ingredient in aspirin. Because over 30 billion tablets of aspirin are produced each year, it is one of the least expensive drugs available.

When aspirin ages or is heated, the acetylsalicylic acid undergoes a reverse reaction, breaking down into the original ingredients of salicylic acid and acetic acid (vinegar). In this lab, you will test the pH and purity of several varieties of aspirin: brand name, generic, old, and heated. You will also perform these tests on salicylic acid. Finally, you will simulate how aspirin breaks down when it is digested in stomach acid.

Materials

aspirin tablets, various brands
 distilled water
 hydrochloric acid, 0.1M [HCl]
 iron (III) chloride solution, 1% [FeCl₃]

pH paper
 pipettes
 salicylic acid [C₆H₄(OH)COOH]

Equipment

graduated cylinder, 100-mL
 mortar & pestle
 oven
 stirring rod

test tube rack
 test tubes (medium), 4
 well plate

Safety Considerations

- Hydrochloric acid is toxic and irritating to the skin; you must wear goggles for the entire lab.
- Sometimes chemicals from previous labs still remain in glassware and on other lab equipment; wash all lab equipment before and after performing this lab.
- Wash your hands thoroughly after completing this lab.

Procedure

1. Set up four clean test tubes in a test tube rack. Label the test tubes #1-4.
2. For each brand of aspirin, crush one tablet in a mortar and pestle and place it in the appropriate test tube:
 - Tube #1: Bayer aspirin
 - Tube #2: generic aspirin
 - Tube #3: old, expired aspirin
 - Tube #4: Bayer aspirin that has been heated in an oven
 - Tube #5: salicylic acid (about the same amount as one aspirin tablet)
 Be sure to rinse and dry the mortar and pestle between each tablet to avoid cross contamination.

3. Add enough distilled water to each test tube so that it is approximately halfway full and shake gently to help dissolve the aspirin. The mixture will probably appear cloudy; you may want to use a stirring rod to help it dissolve better (make sure you rinse it between uses!).
4. Test the pH of each tablet using pH paper. Note the color of the paper and record its corresponding pH value in the Data Table.
5. Using a fresh pipette for each test tube, remove a small amount of solution and place it in a well plate. Add 2-3 drops of 1% FeCl_3 to each well to test the purity of the aspirin. FeCl_3 is normally an orange color, but it turns purple in the presence of salicylic acid. Record the color from each test tube in the Data Table.
6. Add enough 0.1 M hydrochloric acid to each test tube until it is around $\frac{3}{4}$ full. Use a stirring rod to mix the acid with the aspirin to help it react faster. After several minutes, record your observations for each tube in the Data Table.

Clean-up

1. Dispose of any leftover solutions in the sink.
2. Clean all used lab equipment with soap, water and a test tube brush.
3. Return all equipment to its proper location.
4. Wipe down your lab area and wash your hands before leaving the lab.

Data Table

Test Tube	pH	purity	reaction with acid
#1: Bayer			
#2: generic			
#3: expired			
#4: heated			
#5: salicylic acid			

Questions

1. Which type of aspirin reacted **best** with the hydrochloric acid? Which type reacted **worst** with the hydrochloric acid?

2. Based on what you learned from this lab, why do you think doctors and pharmacists recommend that you not take expired medicines?

3. Based on your results, do you think there any differences in performance between the “name brand” aspirin and “generic” aspirin? Explain.

4. Buffered aspirin contains a coating of calcium carbonate that is supposed to make it less irritating to the stomach when it is taken. Based on the results of the Testing Antacids lab, why do you think this would be effective?

5. List one way you could change this lab and describe how your results might be different.
