

What Is a Cooked Egg?

Introduction

Everyone is familiar with the change that occurs when an egg is cooked: it solidifies. But why? Strangely enough, the chemistry involved in the change that *coagulates* the egg protein is an unsolved mystery. Scientists believe it involves the unraveling of long protein molecules. As the proteins unravel, they can link up with each other in new ways and form the solid. Several different chemicals can also cause the coagulation of protein.



In this lab, you will study some of the ways that egg white protein, or *albumin*, can “cook”. Each chemical we will use will change the structure of the protein by coagulating it. When this new molecular structure is formed, we say that the protein is *denatured*.

Materials

distilled water
ethyl alcohol
fresh egg white

lead (II) nitrate [$\text{Pb}(\text{NO}_3)_2$] solution, 10%
pipettes
strong tea

Equipment

beakers, 250-mL & 400-mL
hotplate
test tube rack

test tubes, 5 small
thermometer

Safety Considerations

- **Lead nitrate is toxic – you must wear goggles at all times during this lab!**
- Ethyl alcohol is flammable; extinguish all flames in the room.
- 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. In a 250-mL beaker, combine one egg white with 100 mL of distilled water. Share any leftover egg white with another group.
2. Fill five medium test tubes half full with the egg white solution.
3. Prepare the test tubes as follows:
 - Tube 1: Add nothing (egg white only).
 - Tube 2: Heat the tube for several minutes in a hot water bath on a hot plate, beginning at 50°C. Record the temperature at which the egg white coagulates.
 - Tube 3: Add 10 mL of ethyl alcohol.
 - Tube 4: Add 10 mL of strong tea.
 - Tube 5: Add several drops of 10% $\text{Pb}(\text{NO}_3)_2$ solution.
4. After all reactions have completed, record your observations in the Data Table.

Clean-up

1. Dispose of the contents of test tube #5 in the specially marked waste container, NOT THE SINK OR THE TRASH. Dispose of any other egg waste in the trash, NOT THE SINK.
2. Clean all used lab equipment with soap, water and a test tube brush.
3. Return all equipment to its proper location.

- Wipe down your lab area and wash your hands before leaving the lab.

Data Table

Test Tube	Observations	Coagulated?
#1: egg white		
#2: egg white + heat		
#3: egg white + ethyl alcohol		
#4: egg white + strong tea		
#5: egg white + lead nitrate		

Questions

- How do the egg white samples in tubes #3-5 compare with the sample in tube #2?

- At what temperature did the egg white coagulate in tube #2? Is this greater than or less than the boiling point of water?

- Think about what bacteria and viruses are made of. Based on the results of this lab, why do you think nurses swab your skin with alcohol before giving you a shot?

- Tea contains tannic acid. Why do you think tannic acid would be the useful in the tanning process used to turn hides into leather?

- Why would swallowing egg white be good for people who have ingested toxic lead salts?
