"Exploding Marshmallows"

Contributed by…

Dr. M.W. Schilling, Viodelda Jackson, and Dr. J.B. Williams

Department of Food Science, Nutrition, and Health Promotion
Mississippi State University

Purpose

This experiment demonstrates (1) the principles of air pressure, (2) how changes in air pressure can affect food products, and (3) the principle behind applying a vacuum in meat processing.

Materials

- Vacuum pump
- Glass jar suitable to be attached to the vacuum pump (The jar should have a rubber stopper with a hole in it to insert a tube. The tube connects to the vacuum pump. You could also use a capped Erlenmeyer flask with a side arm to attach a tube that will connect to the vacuum pump.)
- Marshmallows (different sizes)

Procedure

1 Place a marshmallow inside the glass jar.
2 Cap the jar. Connect the tube from the rubber stopper to the vacuum pump.
3 Turn on the vacuum pump. What happens?
4 Turn off the vacuum pump. What happens now?
5 Discuss your results.

Variations: You can place several marshmallows inside the glass jar or make a marshmallow man. You can also try expanding chicken meat.

Notes

Marshmallows are a mixture of sugar, air, and gelatin. The sugar makes them sweet, the air makes them fluffy, and the gelatin is a protein that holds everything together. By volume, marshmallows are mostly air. When subjected to vacuum, the air from around the marshmallow is removed. This decrease in pressure causes the air trapped inside the marshmallow to push outward, expanding it. Eventually the vacuum is strong enough to pull air from inside the marshmallow, causing it to shrink. When the air in the jar returns to normal atmospheric pressure, you end up with a "mallow grape" because the air has been removed from inside the marshmallow.

This same principle is used in the meat and poultry industry to marinate chicken and other pre-marinated meats. Vacuum meat tumblers marinate meat in a very short time. Under vacuum, the foods' fibers stretch, becoming more porous. This allows the marinade to penetrate evenly throughout the product. Vacuum tumbling allows meat to absorb up to about 20 percent of its starting weight in marinade without extended preparation. There is an increased yield in the raw product, which means increased yield after cooking and a product that is juicy and tasty.

“Gassing off” Nitric Oxide Demonstration

Contributed by…

Dr. Alden Booren

Department of Animal Science &
Department of Food Science and Human Nutrition
Michigan State University

NOTE: This demonstration needs to be conducted in a fume hood. This demonstration produces nitric oxide gas which is an eye irritant and is toxic in high amounts. Although, the amount of gas generated by this demonstration is low, proper laboratory safety is critical.

Objective:

The results of this demonstration will help the student understand how sodium nitrite is reduced to nitric oxide, after the addition of a reducing agent, like ascorbic acid.

The amounts of sodium nitrite and ascorbic acid far exceed the regulatory limits for processed meat products. However, the visual “gassing off” of nitric oxide will help the student conceptualize what is happening in a cured meat system.

Supplies:

10g of sodium nitrite
3g of ascorbic acid

250 ml Beaker
Glass Stirring Stick

Procedure:

Fill the beaker with 100ml of water

Add the 10g of sodium nitrite and mix completely

THIS NEXT STEP NEEDS TO BE CONDUCTED IN A FUME HOOD

Slowly add the 3g of ascorbic acid to the sodium nitrite solution. The solution will immediately begin to “fizz” and produce bubbles. Stir continuously and watch for the “red tinted” nitric oxide gas to rise from the beaker.

Hand Sanitation Demonstration

Contributed by…
Dr. Mark Miller
Department of Animal Science
Texas Tech University

Items needed:

1. Glow Germ Lotion
2. Black Light
3. Sink with soap and water

Procedure

Have the students to wash their hands and to view their hands under the black light with all of the lights off. All student's hands should not glow under the black light.

Have them to coat their hands with the glow germ lotion and turn off the lights again and let them view their hands again under the black light. They will see their hands glowing and tell them that all of the glowing portions are bacteria which may cause contamination.

Have them to try to wash their hands to remove all of the bacteria "glow germ" from their hands. Look at each student's hands again under the black light one last time after washing and see if any of the students were successful in removing all of the glow germ.

Most students will not be able to remove all of the glowing particles and it will show the need for proper hand washing and sanitation.

Isoelectic Point Demonstration

Contributed by…

Dr. Matt Doumit and Dr. Chuck Allison

Department of Animal & Veterinary Science
University of Idaho

Smithfield Packing Company

Objective:

This experiment illustrates how protein will precipitate out as the system reaches its isolectric point. Although, casein is the protein in this example… the two treatments (hot and cold) can be used to better explain the relationship temperature and pH decline has on carcass quality.

This demonstration is helpful when discussing the importance of rate of chill for a carcass and early post mortem pH. When acid is added to the hot milk, the protein precipitates very rapidly, and opposed to the cold milk. A similar event is noted when the pH decline is rapid in hog carcasses with elevated temperatures.
Irreversible damage (PSE) to the meat is often the result.

Materials:

30g Non Fat Dry Milk (NFDM) power
2 – 500ml beakers
Hot Plate
100 ml vinegar
pH meter

Procedure:

Treatment 1
Blend 15g of NFDM powder into 300ml of water
Chill this sample to 35-40 F
Treatment 2
Blend 15g of NFDM powder into 300 ml of water
Warm this sample to 120 F

For the demonstration…slowly add vinegar to each beaker of milk.
Record pH of the milk as acid is added to the system.

At the isoelectric point, the casein will precipitate out. Note the rate in which the samples precipitate. Explain the pH / temperature relationship and how this ties into meat quality.

Colorimeter Operation Demonstration

Contributed by…

Dr. Dana J. Hanson

Department of Food, Bioprocessing and Nutrition Sciences
North Carolina State University

Supplies:

Colorimeter
Beach ball
Apple
Lime
Blueberries
Lemon
Black 4x4 ceramic tile
White 4x4 ceramic tile
Meat sample

Objective:

Describing the 3D color space for L*, a*, b* can be somewhat challenging. Using the listed items, you can show how various colors range on the L*, a*, b* scale.

Procedure:

Using each piece of fruit…demonstrate how the colorimeter values will change (+60 to -60) red to green, blue to yellow & (100 to 0) black to white.

Using the beach ball, show students the points where each color resides in a 3D color space. Mark each region with a colored sticker or piece of colored paper.

Finish up this demo with a reading coming from a meat sample… in order to show the normal range of L*, a*, b* values for meat.