Role of Salt In Meat Processing

Contributed by…

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Purpose

This experiment demonstrates the importance of salt in meat processing.

Materials

food preparation gloves
food scale that measures in metric units
100 grams raw ground beef, divided equally
small food processor
20 milliliters water, divided equally
2 grams salt
spoons
large white paper such as butcher paper
paper towels
newspapers

Procedure

Place 50 g ground beef into a small food processor.

Add 10 mL water. Chop the meat for 15 seconds.

Remove the meat from food processor. Form it into a ball. Flatten it like you are making a hamburger patty.

Now, put the slightly flattened meat in the palm of your gloved hand (palm up). Turn your hand over (palm down). What happens? Does the meat stick to your hand, or does it fall down?

Repeat step 1 in this procedure with the other half of the meat. In step 2, dissolve 2 g salt into the 10 mL of water before adding the water to the meat. Follow steps 3 and 4 with the new mixture.

Tape a piece of white (butcher) paper to the wall. Place plenty of newspaper on the floor below. Throw the two meat patties at the paper. Does either one stick to the paper?

Notes

In this experiment, ground meat without salt probably did not stick to your hand or to the target. When you added salt to the ground meat, it made the salt soluble proteins come to the surface of the meat. In scientific terms, it extracted the salt soluble proteins from the cellular structure. The proteins then acted like glue.

Salt serves many purposes. It brings out natural flavors, slows growth of spoilage microorganisms, and enhances a food's color, odor, and appearance. This experiment shows that salt also creates the protein structure necessary to make processed meats like hot dogs and deli meats. Salt helps bind meat by extracting its proteins, which "glue" together adjacent pieces of meat. Salt also increases water binding properties, which reduce cook losses and contribute to enhanced texture. It also helps give a smooth, firm texture to processed meats. In addition, it helps with the color development of ham, bacon, hotdogs, and other processed muscle food products.

Did You Know?

Without salt, it would be impossible to make hot dogs, deli meats, and other processed meats. Can you explain why

ROLE OF SALT AND PHOSPHATES IN MEAT PROCESSING/MEAT EMULSIONS

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Learning Outcomes:

1) **To understand the roles of salt and phosphate in meat emulsions (i.e. understand why salt and phosphate is needed to make a frankfurter, bologna, etc.**

2) **To understand which proteins are being extracted when you chop the meat with salt?**

3) **To understand what will happen to the meat if you bring the pH down to 6.0**

4) **To understand which ingredients are in a frankfurter and why they are there**

5) **To figure out who is the best baseball pitcher in your group?**

Objective:

The objective of this experiment is to demonstrate the importance of salt in meat processing.

Materials

- Small food processor/chopper
- Paper towels
- Spoons
- Gloves
- White paper (butcher paper)

Ingredients:

- 50 gm raw ground beef (2 portions)
- 2 gm salt
- 10 ml water
- 0.25 g phosphate

Procedure:

Wear gloves when working with raw meat and keep meat away from other food products. Wash hands and work place after finished.

1. Place 50 gm of ground beef into a small food processor.
2. Add 10 ml water. Chop the meat for 15 seconds.
3. Remove the meat from food processor, form into a ball and flatten it like you are making a hamburger pattie.
4. Now, put the slightly flattened meat in the palm of your gloved hand (palm up). Turn your hand down (palm down), what happens? Does the meat stick to your hand or does it fall down?
5. Repeat steps 1 through 4 in this procedure with new ingredients, but this time add 2 gm salt and 0.25 g phosphate into the 10 ml of water and stir to dissolve.
6. Make a ball, flatten it like you are making a hamburger pattie.
7. Put the slightly flattened meat in your gloved hand (palm up), turn hand upside down (palm down).
8. Tape a piece of white (butcher) paper on the blackboard, and throw the two meat patties at the paper. Does either one stick to the paper? Make sure there are plenty of newspapers on

the floor below the target.

Notes about the importance of salt in meat processing:

In this experiment, ground meat without salt should not stick to your hand or to the target. When salt was added to ground meat, salt made the proteins come to the surface (extracted them) of the food surface, allowing the proteins to act like glue.

Salt serves many purposes: 1) it brings out natural flavors (2) retards growth of spoilage microorganisms, 3) provides texture for processed foods, 4) provides color, aroma and improves appearance, and **5) creates the protein structure (texture) necessary to make processed meats (hot dogs, deli meats, etc.).** As a binding agent, salt helps extract the proteins in processed meats, providing strength between adjacent pieces of meat. Water binding properties also increase, and as a result, cook losses are reduced. Salt also gives a smooth, firm texture to processed meats and helps develop the color in ham, bacon, and hotdogs

1) Without salt, it would be impossible to make hot dogs, deli meats, and other processed meats. Can you explain why?
2) What are the proteins that act as emulsifiers in hot dogs?
3) What pH do you want your processed meat product to be? What pH do you not want your frankfurter type product to be?
4) Can you make a frankfurter out of PSE meat?

5) Why is sodium nitrite added to hot dog formulations?
6) Why is Vitamin C or sodium erythorbate added to frankfurter formulations?
7) What is a major spice that helps define hot dog flavor?
8) What kind of starch is added to hot dogs and why?
9) Why is soy protein or carrageenan added to processed meat products?

Sodium Phosphate Functionality Demonstration

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Objectives:

Demonstrate the impact of salt, sodium phosphate and salt & phosphate have on water holding capacity of raw meat.

Supplies:

400 g of lean ground beef

4 glass funnels
4 250ml Erlenmeyer flasks
4 pieces of filter paper
500 ml Beaker

100ml graduated cylinder, filled with water

10 grams salt
4 grams sodium phosphate

Example 1: Meat and Water (no water hold)

Combine 100g of raw hamburger and 25 ml of water into the 500 ml beaker. Mix completely.

Drop glass funnel into the neck of one of the Erlenmeyer flasks; line the funnel with a filter paper that has been folded into a cone.

Pour mixture into funnel. Observe how much water is held (or not held) by the meat protein. Note: the water soluble proteins that will be “washed out”

Example 2: Meat, Water and Salt (low water hold)

Combine 100g of raw hamburger, 25 ml of water and 5g of salt into the 500 ml beaker. Mix completely.

Drop glass funnel into the neck of one of the Erlenmeyer flasks; line the funnel with a filter paper that has been folded into a cone.

Pour mixture into funnel. Observe how much water is held (or not held) by the meat protein. Note: the slight change in surface appearance of the raw meat. The salt will cause the meat to “swell” slightly. Note: the volume of water in the flask will be less than Example 1.

Example 3: Meat, Water and Sodium Phosphate (low water hold)

Combine 100g of raw hamburger, 25 ml of water and 2g of sodium phosphate into the 500 ml beaker. Mix completely.

Drop glass funnel into the neck of one of the Erlenmeyer flasks; line the funnel with a filter paper that has been folded into a cone.

Pour mixture into funnel. Observe how much water is held (or not held) by the meat protein. Note: the volume of water in the flask will be less than Example 1.

Example 4: Meat, Water, Salt & Sodium Phosphate (high water hold)

Combine 100g of raw hamburger, 25 ml of water, 5g of salt and 2 g of sodium phosphate into the 500 ml beaker. Mix completely.

Drop glass funnel into the neck of one of the Erlenmeyer flasks; line the funnel with a filter paper that has been folded into a cone.

Pour mixture into funnel. Observe how much water is held (or not held) by the meat protein. Note: the distinct change in surface appearance of the raw meat. The salt & sodium phosphate will cause the meat to “swell” greatly. Note: the volume of water in the flask will be less than any of the previous examples.

Various States of Myoglobin Demonstration

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Supplies:

1 lb of lean ground beef (minimum 90's lean)
3, 6 oz Whirl-pak bags
100ml graduated cylinder
Sodium nitrite (pure)
Sodium erythorbate
Water
5 quart stock pot
Hot plate

Example 1: Put 50-75 g of raw hamburger into one of Whirl-pak bags, add 1 g of sodium nitrite and mix completely.

Add 1 g sodium erythorbate to 10 ml of water, add this solution to the meat in the bag. Mix thoroughly by kneading the bag for about 3 minutes.

Cook the meat by dropping the sealed bag in a 180 - 200 F water bath (hot plate, pot & water) for 5 to 10 minutes;

Students will observe…
Oxymyoglobin – raw meat prior to addition of cure solution
Nitric oxide metmyoglobin – raw meat after mixing cure solution
Nitrosylhemochromogen – cooked "cured" meat out of the water bath

Example 2:
Put 50-75 g of raw hamburger into one of Whirl-pak bags

Cook the meat by dropping the sealed bag in a 180 - 200 F water bath (hot plate, pot & water) for 5 to 10 minutes;

Students will observe…
Oxymyoglobin – raw meat

Hemochrome – cooked meat out of the water bath

Example 3:

Put 50-75 g of raw hamburger into one of Whirl-pak bags

Dissolve 10 g of sodium nitrite into 10 ml of water

DO NOT ADD sodium erythorbate

Add “cure” solution to the meat in the bag Mix thoroughly by kneading the bag for about 3 minutes. Cook the meat by dropping the sealed bag in a 180 - 200 F water bath (hot plate, pot & water) for 5 to 10 minutes

Students will observe…

Greening of “Nitrite Burn”