

Dynamic States of Myoglobin

Contributed by...

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Student Learning Outcomes:

- Critical nature of appearance to consumer acceptance
- Names and colors of the typical pigments of fresh meat
- Inter-relations of three pigments to the fresh meat color triangle
- Role of packaging in color formation
- Critical role of oxygen partial pressure for oxygenation and oxidation of myoglobin
- Importance of having meat chemistry be functional
- Relation to what goes on in packages of meat in their apartment refrigerators

Supplies:

Cup of very hot coffee in a metal or ceramic container

Small packages of ground beef:

Freshly prepared and PVC overwrap – Oxymb

Not so fresh and PVC overwrap – Mostly Metmb, some Oxymb

Vacuum package of freshly ground beef – Should appear as Oxymb

Vacuum package of stored ground beef – Deoxymb

Example 1:

- Show 3 packages and ask which they would buy?
- Emphasize importance of appearance
 - Present names of the three pigments: Deoxymb, Oxymb and Metmb
 - Casually nestle your cup of coffee on to the center of the freshly overwrapped package
 - Continue on with lecture

Example 2:

- Occasionally check the color changes on the surface of the “fresh” vacuum package
 - Should see less Oxymb, some Metmb, if the conversions are fast maybe some Deoxymb
- Toward end of lecture, check under the coffee for discolored Metmb
 - Relate the warming of the surface to oxygen occlusion and increase of meat consumption of oxygen
 - The decreased oxygen partial pressure causes oxidation of Oxymb to Metmb
 - Could relate this also to stacking of product after slicing or meat going into a large combo

Example 3:

- Bring three packages back to class next period
- Discuss colors of each
- Open packages and examine the layers of myoglobin
- Especially look for formation of Deoxymb in the interior of the packages

Overcooked Hotdog Demonstration

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Objective:

This demonstration will help students to evaluate the product quality and ingredients used in cooked sausage, cooked for an extended period of time.

Lower price point hotdogs with more cereal fillers will gain more weight (water), lose more color and lose flavor: as compared to all pork or all beef hotdog.

Supplies:

3, 1 L Beaker or house hold pot
3, Hot Plates
Small Scale (capable of gram measurement)
3 Different Hotdogs (high, medium and low price point)

Procedure:

Record the uncooked weight for 1-2 hotdogs from each sample

Fill each beaker with 1000ml of water and bring to a boil.

Add hotdogs to each beaker of water and boil for 30 minutes.

Remove the cooked hotdogs and re-weigh them.

Observe the color and condition of the water for each hotdog

Once again weigh the cooked hotdogs. Note the weight loss during cooking.

Another option is to taste each of the cooked sausages.

Premature Browning (PMB) and Persistent Pinkness (PP) in Cooked Ground Beef

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Student Learning Outcomes:

Cooked meat pigment development, colors and names
Basis of cooked color for determination of the “Degrees of Doneness”
Critical importance of internal cooked color to safe consumption of ground beef
How easy it is to measure temperature of patties with the right thermometer
Role of pigment form, pH, oxygen partial pressure, and packaging on cooked color of ground products

Supplies:

3 packages of ground beef:
Freshly ground with PVC overwrap – Oxymb
Not so fresh product and PVC overwrap – Mostly Metmb, some Oxymb
Vacuum package of ground beef – Deoxymb
Rubber gloves, Paper plates, Electric skillet, Spatula, Hand towel
Thermometer with a very small diameter end or a needle-like thermocouple

Example 1:

- Show 3 packages and relate colors to practical store conditions and their refrigerators
Emphasize importance of appearance – mention names of Deoxymb, Oxymb and Metmb
- Can have students make patties from random portions of the packages
- Some should be mostly Oxymb --- Some mostly Metmb --- Some mostly Deoxymb
- Heat skillet to 350F or use bagged product and cook in a hot water bath
- Check temperatures with thin needle temperature probe and cook patties to 150 to 155F

Students should observe:

- Oxymb patties should be tan = PMB occurred
- Metmb patties should be tan = PMB occurred (actually they were tan at start)
- Deoxymb patties should be reddish pink
- 2 of the 3 major fresh meat pigments will PMB and are not reliable indicators of doneness and safety

Example 2:

- Pre-treat some GB with 0.5 to 1% phosphate to elevate pH to >6 (higher is better)
- Patty and heat to 160 (medium) and 180F (well done)

Students should observe:

- Patty with a high pH will be very pink at 150 and still pink at 180 = PP occurred
- Safety is not an issue with PP, but people are afraid to consume this product
- PP often causes processors problem and product return or rejection

Protein Extraction Demo

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Materials:

1 lb. sliced lean meat
113.5 g. water
2.5 g. sodium tripolyphosphate
10 g. salt
1 g. sodium nitrite (Prague Powder)

Mixing bowl
Scoopula
Disposable gloves
50 or 100 mL beaker
Waterbath

Procedure:

Part 1

During protein extraction presentation/discussion, ask for a volunteer to mix ingredients with meat slices until water is absorbed and an exudate is formed on the meat slices.

After mixing, scrape exudates off of slices (and gloves) into beaker. Using a water bath, cook exudate to 160F internal temperature, cool, and remove from beaker to demonstrate denaturation and coagulation of extracted proteins.

Gel can be eaten by more curious students and it typically tastes like a soft bologna.

Part 2:

Place slices in a loaf pan and cook. The finished product will show binding capacity of extracted protein.

Cooked Gel



