

# PRODUCTS FORMULATION





## Meat Processing Toolkit



### PRODUCTS FORMULATION

#### 1.- Performing Products Formulation

##### Addition of Chemical Substances

One of the most important tasks for the inspector in the sausage production facility is to check the formulation of the product. Inspection program personnel should select a batch of sausage product, check the sample batch for accurate identification of the types and weights of the component ingredients, and calculate the maximum and minimum amounts of restricted ingredients. Establishments which produce sausage product are encouraged to use as a reference a procedure chart that identifies the production process and ingredients for the product. The chart should include:

- the product type and name;
- the type and amounts of meats and meat by-products in the product;
- the type and amounts of cure agents;
- the method of formulation, such as chopping time and emulsifying time and method;
- the type of casing and method of stuffing;
- the smoking/ cooking time and temperature, along with expected shrinks;
- the chilling time and expected chill shrinks.

##### Calculating Added Water and Antioxidant

##### Example:

##### Fresh Goat Sausage Formulation (with BHA added to protect flavor)

##### Ingredients:

Goat, water, salt, sugar, spices, BHA (Formulated to yield a finished product fat limit of 40%)

##### Batch formula :

Regular Goat Trimmings (60% fat) 280.00 lb

Special Goat Trimmings (30% fat) 156.00 lb

Water 15.00 lb

Fresh Sausage Seasoning 9.00 lb

Total 460.00 lb

### **Usual Limitations:**

- . Limited to 50 % fat or less
- . Added water/ice up to 3%
- . Antioxidant amount based on fat-limited to 0.01%

The inspector reviews the sausage formulation and evaluates a number of issues. For example, the inspector would determine whether the added water content in the above formulation complies with the limit for this type of product, or whether the type and amount of antioxidant is allowed in this type of product. Let's quickly go over the process to answer each of these questions:

#### **1-) Is added water content within limits?**

If the amount of added water and/or ice in fresh sausage is limited to 3% of the product weight, the inspector will use these steps to determine the amount of water permitted in this formulation.

$460 - 15 = 445$  lb. First, subtract the water (3%) from the total formula weight (100%) to determine the total weight minus the water (97%)

$445 / .97 = 458.76$  lb. Then divide the formula weight minus the water by the total weight without water (0.97) to determine the total formulation weight with the allowed amount of water added.

$458.76$  lb.  $\times .03 = 13.76$  lb. Then multiply the total formulation weight with the allowed amount of water added by 3% (allowed percentage of water). This results in a total allowed water amount of 13.76 lb. in this formulation.

**In this case, the added water exceeds the allowable limits for this product**

#### **2-) Is the type and amount of antioxidant within limits?**

Antioxidants in fresh sausage are limited to 0.01% of the total amount of fat in the product. In this example, we will assume that the target fat amount of 40% in this formulation has been confirmed.

$460 \times 0.40 = 184$  lb. The first step is to determine the weight of the fat. Multiply the batch weight by the fat content (40%)

$184 \times 0.0001 = 0.0184$  lb. Then multiply the fat content by the permitted amount of antioxidant (0.01%) to determine the maximum allowable amount of BHA in this formulation.

$16\text{oz} \times 0.0184 = 0.294$  oz. Convert pounds to ounces (16 oz/lb.)

**In this case, the maximum allowed amount of the antioxidant BHA in this formulation is 0.294 oz. The Fresh Sausage Seasoning formulation specifies 0.36 oz. The BHA in this formulation exceeds the regulatory limit. The limit of the chemical agent depends upon the country legislation and the use of some substances can be forbidden in some countries. The inspector responsible for the production must check the legislation to know the indicated chemical substances.**

Inspectors can use similar calculations to determine a range of issues, such as whether the fat percentage or binder and extender amount targets will be achieved.

### Calculating Curing Agents - Frankfurter Formulation

#### Ingredients:

Beef and goat, water, nonfat dry milk, mustard, spices, erythorbic acid, sodium nitrite

#### Batch formula:

Beef 185 lb.

Goat 225 lb.

Bacon ends and pieces 50 lb.

Water and ice 80 lb.

Rework (like product) 50 lb.

Nonfat dry milk 20 lb.

Salt 9 lb.

Mustard (29% protein) 5 lb.

Spice mix (12% protein) 4 lb.

Erythorbic acid 4 oz.

Cure mix (8% nitrite) 12 oz.

Inspectors analyze sausage formulations to determine if the amount of nitrites is within acceptable limits. Since it may be difficult to accurately measure small amounts in a commercial production environment, manufacturers often use a commercially premixed cure mix, containing the proper amount of nitrites and nitrates along with a salt carrier. To minimize the risk of using too much of these ingredients, cure mix is often marketed in small packets that are pre-weighed for a certain size batch of product. This eliminates the need to weigh out the cure mix at the facility. It is still important to ensure that the cure mix packet is being added to the proper size batch of product.

$185 + 225 = 410$ . For example, to review the amount of nitrites in the above formulation, first determine the total amount of meat and meat by-products. In this case, add the goat. Note that the pieces and rework are not factored in, since they are already assumed to have cure added to their formulation.

$410/100 = 4.1$ . The total allowed amount of nitrites for chopped meat sausage is 0.25 ounces per 100 pounds of meat and meat-by products, so the next step is to divide the total amount of meat by 100 to determine how many units of 100 pounds are in the formulation.

$4.1 \times .25 = 1.025$  oz nitrite allowed. Then multiply the units of 100 pounds of meat by 0.25 to determine how many ounces of nitrite are allowed in the formulation.  $1.025 / 0.08 = 12.81$  oz. Since the amount of nitrite in the cure is 8%, divide the amount of allowed nitrite by 0.08 to determine the total amount of cure mix that is allowed in this mixture.

**In this case, the cure mix amount specified for this formulation is within acceptable limits.**

## **2.- Brine injection considerations**

Injection equipment is used to introduce the brine solution (water, salt and flavorings) into large whole muscle products. The injectors can consist of a single needle operated manually or a few dozen needles automatically controlled to deliver a precise volume of brine. The composition of a typical brine solution is shown below. The proportions used are designed to provide the desired quantity of salt, sugar, nitrite, water, etc., in the product. The delivery of the exact amount is very important in meeting flavor requirements (e.g., saltiness, sweetness) and government regulations (e.g., nitrite concentration). If mistakes occur in the delivery system flavor problems might take place in products. If a 10% injection is desired, a problem with a few clogged needles will result in a lower than expected salt concentration (e.g., half the salt if only 5% is delivered). Special care should also be given to the uniformity of the injection process to prevent high salt and/or nitrite concentrations in localized areas where bones, etc.

High concentrations of salt and/or nitrite can cause flavor and color defects (e.g., cured and non-cured colored areas; nitrite burns due to extremely high nitrate are very rare) in the final product. Therefore, the injector should be constantly monitored, and quality control checks of pumped weight should be performed on a regular basis.

### **Ingredient and Concentration (%)**

Water : 75,5

Salt : 17,5

Sugar : 3,5

Phosphate : 3

Na-ascorbate : 0,35

Na-nitrite : 0,15

### **Importance of precise control of injection rate**

% Pump Salt in product (%)

5            0,875

10          1,75

15          2,625

20          3,5

The percent pump and percent yield can be calculated. The finished product weight is used to calculate the actual salt, sugar, etc., concentration needed to be injected into the raw meat in order to achieve a certain flavor.

### Calculating Processing Yields

$$\% \text{ Pump} = [(\text{Pumped weight} - \text{Green weight}) / \text{Green weight}] \times 100$$

Example :

Green weight (initial meat weight) :

200 Kg

Pumped weight (meat + brine) :

220 Kg

$$\% \text{ Pump} = (20/200) \times 100 = 10\%$$

$$\% \text{ Yield} = (\text{Finished weight} / \text{Green weight}) \times 100$$

Example :

Finished weight (weight after cooking, smoking or drying) :

190 Kg

$$\% \text{ Yield} = (190/200) \times 100 = 95\%$$

If finished weight is : 210 Kg

$$\% \text{ Yield} = (210/200) \times 100 = 105\%$$

### 3.- Poultry Formulations

#### Ingredients

Meat: 100.0 kg boneless, skinless turkey breast

Brine: 30.0 kg

The brine is made by mixing:

21.8 kg cold water

3.8 kg ice flakes

4.0 kg brine and cure unit (salt, sugar, phosphate, erythorbate, nitrite)

0.4 kg roast seasonings (natural roast flavor, spices)

Spice rub: 6 g roast-flavored rub mixed with 18 ml of water, per 1 kg of tumbled roast.

#### Processing

Inject the turkey breast meat with 30% brine. Tumble (preferentially under vacuum) for 4 hours at 12 - 15 rpm; start immediately after injecting. Rest overnight and tumble for 1 - 2 hours at 12 - 15 rpm. Combine two turkey breasts (thick end over thin end) and wrap with collagen film before stuffing into a ham net #22 - 3 (i.e., a net with 22 squares around the

circumference, made up of three stitches between squares). Clip both ends of the net. Mix five parts of roast-flavored rub together with three parts of water until a thick paste has been formed, and rub the roasts evenly. Place roasts on smoke screens, place in an oven and cook. Dry cook at 90°C for 1 hour or until the surface is completely dry. Steam cook at 78°C to an internal temperature of 71°C. Shower with cold water to cool down quickly.

### **3.1.- Flavored Turkey Roast (30% pump)**

#### **Ingredients**

Meat: 100.0 kg boneless, skinless turkey breast

Brine: 30.0 kg

The brine is made by mixing:

21.8 kg cold water

3.8 kg ice flakes

4.0 kg brine and cure unit (salt, sugar, phosphate, erythorbate, nitrite)

0.4 kg roast seasonings (natural roast flavor, spices)

Spice rub: 6 g roast-flavored rub mixed with 18 ml of water, per 1 kg of tumbled roast.

#### **Processing**

Inject the turkey breast meat with 30% brine. Tumble (preferentially under vacuum) for 4 hours at 12 - 15 rpm; start immediately after injecting. Rest overnight and tumble for 1 - 2 hours at 12 - 15 rpm. Combine two turkey breasts (thick end over thin end) and wrap with collagen film before stuffing into a ham net #22 - 3 (i.e., a net with 22 squares around the circumference, made up of three stitches between squares). Clip both ends of the net. Mix five parts of roast-flavored rub together with three parts of water until a thick paste has been formed, and rub the roasts evenly. Place roasts on smoke screens, place in an oven and cook. Dry cook at 90°C for 1 hour or until the surface is completely dry. Steam cook at 78°C to an internal temperature of 71°C. Shower with cold water to cool down quickly.

### **3.2.-White Turkey Roast (50% pump)**

#### **Ingredients**

Meat: 100.0 kg boneless skinless turkey breast

Brine: 50.0 kg.

The brine is made by mixing:

34.9 kg cold water

8.8 kg ice flakes

5.0 kg turkey roast brine unit (salt, sugar, phosphate)

1.3 kg spice unit (soy protein isolate, sugar, spice extracts)

## Processing

Inject turkey breast meat with 50% brine. Tumble (preferentially under vacuum) at 12 - 15 rpm for 3 - 4 hours; start immediately after injecting. Rest overnight and tumble for 1 - 2 hours under vacuum (in order to obtain maximum yield, use refrigerated environment, and total tumble plus rest time should be 12 - 14 hours).

Wrap breast meat in edible collagen film and place in ham net #22 - 3. The film will allow easy removal of the netting after cooking. Steam cook the roasts at 78°C to an internal temperature of 71°C. Shower with cold water to cool quickly.

### 3.3.-Smoked Turkey Roast (30% pump)

#### Ingredients

Meat: 100.0 kg boneless skinless turkey breast

Brine: 50.0 kg.

The brine is made by mixing:

34.9 kg cold water

8.8 kg ice flakes

5.0 kg turkey roast brine unit (salt, sugar, phosphate)

1.3 kg spice unit (soy protein isolate, sugar, spice extracts)

#### Processing

Inject turkey breast meat with 50% brine. Tumble (preferentially under vacuum) at 12 - 15 rpm for 3 - 4 hours; start immediately after injecting. Rest overnight and tumble for 1 - 2 hours under vacuum (in order to obtain maximum yield, use refrigerated environment, and total tumble plus rest time should be 12 - 14 hours).

#### Heating and Smoking

Dry cook at 65°C for 45 - 60 minutes. Hot smoke at 65°C for 1 - 2 hours or to the desired color. Steam cook at 78°C to an internal temperature of 71°C. Shower with cold water to cool quickly.

### 3.4.-Turkey Pastrami

#### Ingredients

Meat: 65.0 kg turkey thighs, ground through a 25 mm plate, 6.4 kg dark turkey trim, ground through a 3 mm plate

Brine: 28.6 kg. The brine is made by mixing:

20.0 kg cold water

1.8 kg ice flakes

6.8 kg pastrami pickle and cure unit (salt, sugar, carrageenan, phosphate, spices, erythorbate, nitrite).



## Processing

Tumble all ground turkey meat in a vacuum tumbler. Completely dissolve the pastrami pickle and cure unit in the cold water before adding the ice. Add the brine to the ground meat in the tumbler. Tumble for 6 hours at 10 - 12 rpm, rest overnight and tumble for additional 2 hours. Fill the meat batter into loaf pans approximately 10 - 12 cm wide and 5 - 6 cm high. Sprinkle a pastrami rub spice mix on top for a nice presentation (optional). Place the loaf pans on smoke screens, allowing sufficient space for a free airflow. Bake at 80°C dry heat for 45 minutes or until the top surface feels dry. Steam cook at 78°C to an internal temperature of 70°C. Bake at 80°C dry heat to an internal temperature of 71°C. Air cool in a refrigerator overnight. Remove product from pans and place on smoke screens. Hot smoke at 65°C, 40% relative humidity until the desired color is reached. Store under refrigeration overnight prior to vacuum packing.

Note: the product can also be prepared in casings.

## 3.5.-Smoked Turkey Sausage

### Ingredients

Emulsion part (60 kg): 42.0 kg turkey thigh meat (ground 3 mm); 8.0 kg turkey skin (frozen, ground 3 mm); 10.0 kg ice

Coarse insert (40 kg): 34.0 kg turkey thighs (ground 5 mm); 6.0 kg cold water

Spice/ingredients mix:

3 kg seasoned binder (salt, potato starch, dextrose, spices, erythorbate)

1 kg brown sugar

0.3 kg curing salt

0.3 kg phosphate

0.2 kg garlic powder

0.1 kg black pepper (fine grind)

### Processing

Mix the coarse ground meat, one day prior to processing, together with all its water and 40% of the spice/ingredient mix, until a good bind develops. Store the meat under refrigeration overnight. Chop the ground meat and skin, intended for the emulsion part, while adding the rest of the spice/ingredient mix. Chop for a few revolutions at the slow speed before adding about 1/3 of the ice. Continue cutting at fast speed to a temperature of 12°C, add the rest of the ice and proceed cutting to a final temperature of 8°C. Add the preseasoned coarse insert and mix well before cutting at slow speed to the desired size. Stuff the meat into hog casings (29/32 caliber) or any other smoked sausage casings. Dry in a smokehouse at 55°C for 15 minutes. Hot smoke at 60°C, 25 - 30% relative humidity for 30 minutes or until the desired color is reached. Steam cook at 78°C to an internal temperature of 71°C. Shower with cold water for fast cooling.

### **3.6.-Chicken Hot Dogs/Bologna**

#### **Ingredients**

Meat: 86.0 kg mechanically deboned chicken meat

Ice: 14.0 kg

Spices and Additives Binder unit 8.70 kg (salt, soy/whey proteins, spices, erythorbate)

Curing salt 0.3 kg

Phosphate 0.3 kg

#### **Processing**

Chop the slightly frozen meat with about 5 kg of flaked ice in a bowl chopper for a few revolutions. Add the binder unit, salt and phosphate and chop at the high speed setting while adding the rest of the ice until the temperature reaches 8–10°C. Remove the batter from the chopper. Stuff into easy-peel hot dog casings and link to desired size. Place the product on a smokehouse tree.

#### **Smoke and Cook**

Dry cook for 5 minutes or as required at 55°C. Hot smoke at 55°C and 25% relative humidity for 20–30 minutes. Steam cook at 75°C to an internal temperature of 71°C. Shower with cold water for 10 minutes. Refrigerate overnight prior to peeling the casings. Note: for bologna, use the same formulation and procedure, and then stuff into large-diameter cellulose or fibrous casings. The heat process should be lengthened to achieve a 71°C internal temperature.

### **3.7.-Honey Garlic Marinated Chicken Wings**

#### **Ingredients**

Meat: 90.0 kg chicken wings

Water: 10.0 kg (cold)

Spice: 5.5 kg honey garlic marinade (sugar, salt, garlic, natural honey flavor, vinegar, spices)

#### **Processing**

Dissolve the spice unit in the cold water. Vacuum tumble the well-chilled chicken wings together with the liquid marinade; use a slow speed for 30 - 45 minutes. Remove the marinated chicken wings from the tumbler and pack in vacuum bags or individually quick freeze (IQF). Keep product refrigerated or frozen prior to shipping.

### **3.8.-Lemon Ginger Chicken Drum Sticks**

#### **Ingredients**

Meat: 85.0 kg chicken drumsticks

Water: 15.0 kg (cold)

Spice: 6.5 kg lemon ginger marinade (salt, sugar, lemon juice, spices)

## Processing

Mix the spices together with the cold water. Vacuum tumble the well-chilled chicken drumsticks together with the liquid marinade; use a slow speed for 30 - 45 minutes. Remove the marinated chicken drumsticks from the tumbler and pack in plastic bags or immediately freeze.

Note: other variations, such as Hot Buffalo Chicken Wings can also be made the same way, but with a different spice mix. Keep product refrigerated or frozen prior to shipping. Meat: 100.0 kg boneless, skinless turkey breast

Brine: 30.0 kg

### The brine is made by mixing:

21.8 kg cold water

3.8 kg ice flakes

4.0 kg brine and cure unit (salt, sugar, phosphate, erythorbate, nitrite)

0.4 kg roast seasonings (natural roast flavor, spices)

Spice rub: 6 g roast-flavored rub mixed with 18 ml of water, per 1 kg of tumbled roast.

## Processing

Inject the turkey breast meat with 30% brine. Tumble (preferentially under vacuum) for 4 hours at 12 - 15 rpm; start immediately after injecting. Rest overnight and tumble for 1 - 2 hours at 12 - 15 rpm. Combine two turkey breasts (thick end over thin end) and wrap with collagen film before stuffing into a ham net #22 - 3 (i.e., a net with 22 squares around the circumference, made up of three stitches between squares). Clip both ends of the net. Mix five parts of roast-flavored rub together with three parts of water until a thick paste has been formed, and rub the roasts evenly. Place roasts on smoke screens, place in an oven and cook. Dry cook at 90°C for 1 hour or until the surface is completely dry. Steam cook at 78°C to an internal temperature of 71°C. Shower with cold water to cool down quickly.

## 3.9.-Jellied Turkey Roll

### Ingredients

Meat: 45 kg white turkey roast (see White Turkey Roast recipe)

Vegetables: 15 kg broccoli heads and/or canned mushrooms

Gelatin: 40 kg gelatin solution (7 kg seasoned gelatin powder plus water)

### Processing

Dice the turkey roast into 1 x 1 x 1 cm cubes. Rinse the broccoli (and/or mushrooms) with hot water and mix with the diced meat. Completely dissolve the dry gelatin powder in hot water (80°C). You can add a little bit of oil to the hot water to avoid foaming. Fill clear plastic casings (e.g., 12 cm diameter) with the diced meat and vegetable mix. Add the proper amount of gelatin solution into the casings and remove all air bubbles prior to clipping. Cool in a cold water bath.