

Meat and Poultry Products with Added Solutions

Objectives

After completing this module, the students will be able to:

1. Recognize relevant resources associated with meat and poultry products with added solutions.
2. Identify the enzyme tenderizers that are approved for use on meat or poultry cuts.
3. Identify the regulatory limit for tenderizing solutions added to meat and poultry cuts.
4. Describe how to perform the X percent (%) solution task.
5. Identify the specific labeling requirements for meat and poultry products treated with solutions.
6. Determine when there is noncompliance with the added solution regulatory requirements.
7. Given an example problem, accurately calculate the maximum amount of moisture allowed when meat or poultry cuts are treated with a solution of water and an approved proteolytic enzyme.
8. Given example problems, calculate the amount of a water-based solution (e.g. curing, marinating, or flavoring) added to both raw and cooked products to verify the percentage of solution in the product name designation is accurate and truthful.

Reference Materials

- 9 CFR Parts 317, 319, 381 Subpart N and P, and 424
- [FSIS Directive 7000.1, "Verification of Non-Food Safety Consumer Protection Regulatory Requirements"](#)
- FSIS Directive 7120.1, "Safe and Suitable Ingredients Used in the Production of Meat, Poultry, and Egg Products."
<https://www.fsis.usda.gov/wps/wcm/connect/bab10e09-aefa-483b-8be8-809a1f051d4c/7120.1.pdf?MOD=AJPERES>
- Policy Memo 057A: Labeling Turkey Ham Products Containing Added Water
https://www.fsis.usda.gov/OPPDE/larc/Policies/Policy_Memos_082005.pdf
- Policy Memo 084A: Cooked Red Meat Products Containing Added Substances
https://www.fsis.usda.gov/OPPDE/larc/Policies/Policy_Memos_082005.pdf

- Policy Memo 109: Labeling Prominence Guidelines for Cured, Cooked Products with Added Substances That Do Not Return to Green Weight
https://www.fsis.usda.gov/OPPDE/larc/Policies/Policy_Memos_082005.pdf
- Food Standards and Labeling Policy Book
<https://www.fsis.usda.gov/wps/wcm/connect/7c48be3e-e516-4ccf-a2d5-b95a128f04ae/Labeling-Policy-Book.pdf?MOD=AJPERES>
- Processing Inspectors' Calculations Handbook
- A Guide to Food Labeling Requirements for Meat, Poultry and Egg Products
- https://www.fsis.usda.gov/wps/wcm/connect/f4af7c74-2b9f-4484-bb16-fd8f9820012d/Labeling_Requirements_Guide.pdf?MOD=AJPERES
- FSIS Compliance Guide for Labelling
<https://www.fsis.usda.gov/wps/wcm/connect/bf170761-33e3-4a2d-8f86-940c2698e2c5/Label-Approval-Guide.pdf?MOD=AJPERES>
- Questions and Answers on Descriptive Designation for Raw Meat and Poultry Products with Added Solutions

Introduction

Water-based and oil based solutions (curing, tenderizing, marinating, basting and flavoring) are added to raw meat and poultry cuts for several purposes. These solutions are added by pumping (injecting), tumbling, massaging, dipping, or immersing to impart favorable quality and sensory characteristics and add weight to the finished product. For instance, enzyme tenderizing solutions are often added to raw beef cuts from no-roll carcasses (i.e., a carcass that did not grade as prime or choice) or raw poultry cuts from mature birds to reduce the toughness of connective tissue in the cut. The proteolytic enzymes degrade several tissue proteins, including collagen and elastin, which are major constituents of connective tissue to improve tenderness. Curing solutions are added to meat and poultry cuts to impart specific color and flavoring, but they also serve to preserve the product for food safety and quality purposes. Marinating and basting solutions add unique flavors to the meat or poultry cut and also improve the texture of the cut.

In accordance with 9 CFR 320.1(b)(11) and 381.175(b)(6), establishments must have records of all labeling and product formulas, written processing procedures and any other documentation to ensure the label applied to meat and poultry products meets all of FSIS regulatory requirements and is not false or misleading.

Raw Meat and Poultry Products

Water-based and/or oil-based solutions may be added to raw bone-in or boneless meat and poultry cuts at various amounts unless such use is not allowed or otherwise restricted by FSIS policy or regulation. Some meat and poultry products have a standard of identity which identifies the amount of solution allowed in the product. **Raw** (not heated or cooked) meat and poultry products with added solutions that **do not** meet their standard of identity **and raw** meat or poultry products with added solutions that **do not** have a standard of identity are subject to the Descriptive Designation for Raw Meat and Poultry Products Containing Added Solutions final rule.

The rule established specific labeling requirements in 9 CFR 317.2(e)2 and 381.117(h) for **raw** meat and poultry products treated with added solutions. Since addition of solutions to meat or poultry products changes the nature of the product, the label needs to identify the percentage and composition of the solution. These regulations require establishments to inform the consumer that the raw product contains an added solution and make them aware of the ingredients in the solution. The standardized or common and usual name with a truthful descriptive designation distinguishes the product with the added solution from the standardized product.

In accordance with 9 CFR 317.2(e)2 and 381.117(h), establishments must ensure the product name (standardized or common and usual) on the label contains a descriptive designation that includes: 1) the percentage of added solution (which must appear as a number and the percent symbol (%), 2), a declaration that may use the words “containing” or “contains” (such as, “contains 15% added solution of water and salt,” or “containing 15% added solution of water and teriyaki sauce”), and 3) the common or usual name of all individual ingredients or multi-ingredient components in the solution listed in descending order of predominance by weight. The product name and descriptive designation must be printed in a single easy-to-read type style and color, and must appear on a single-color contrasting background. The print may appear in upper or lower case letters with the lower case letters not smaller than 1/3 the size of the largest letter. The product name may not include the word “enhanced.”

Raw corned beef products, cured beef tongues, and corned beef briskets with standards of identity in 9 CFR 319.101-103 may contain up to 10% or 20% curing solution, respectively, without the presence of the solution being declared on the label. When these beef products are treated with a solution at levels that **exceed the regulatory limit**, the presence and amount of the ingredients **must** be declared as part of the product name. The percentage of solution declared in the product name is the percentage of added solution above the green weight of the beef cut or part. “Corned

Beef Contains Up to 35% of a Solution of Water, Salt, Natural Flavorings, Sodium Erythorbate, Garlic and Sodium Nitrite” would be an acceptable product name.

For raw meat and poultry products, the percent added ingredients for the descriptive designation is determined by subtracting the fresh (green) weight of the article from the weight of the finished product, (e.g., after injecting or marinating), dividing by the fresh (green) weight, and multiplying by 100.

Note: With the removal of 9 CFR 381.169 from the regulations for raw bone-in poultry carcasses and parts and with the removal of Policy Memoranda 042, 044A, and 066C, there is no longer a limitation to the amount of added solution associated with the use of the words “marinated” or “basted” in meat or poultry products. These changes took effect when 9 CFR 317.2(e)2 and 381.117(h) was finalized in January 2016.

Tenderized Raw Meat and Poultry Products

In some establishments, enzyme tenderizers are used on meat and poultry cuts to degrade connective tissue proteins and improve the tenderness of the cut. They are applied to muscle tissue by injection into the animal’s (e.g., cattle) circulatory system a few minutes before slaughter, or by direct application to the surface of the cut by injection, dipping or immersion. The enzymes are activated when the meat or poultry cut is heated during cooking by the consumer. As the temperature rises, the enzymes are denatured and become inactive.

Tenderizing agents that may be applied to **raw** meat and poultry cuts and their regulatory limits are identified in 9 CFR 424.21(c) and in FSIS Directive 7120.1. The regulation states that a solution consisting of water and a proteolytic enzyme (e.g., papain) applied or injected into the tissue of a raw meat or poultry cut shall not result in a weight gain (solution pick-up or pump) of more than 3% above the weight of the untreated cut (green weight). When proteolytic enzymes are used on raw meat and poultry cuts, the qualifying statement “Tenderized with (Approved Enzyme)” must prominently appear on the label in compliance with 9 CFR 317.8(b)(25) and 381.120.

If an establishment produces a tenderized product with more than 3% added solution, it must have a descriptive designation for the amount above 3%. The percent solution reflected on the label for tenderizers is the actual percentage minus the 3% which is already allowed. For example, if the establishment added 20% of a flavoring and proteolytic enzyme solution to a meat or poultry cut, the name of the product must show

that the product contains 17% added solution in a descriptive designation that meets the requirements in 9 CFR 317.2(e)2 and 381.117(h). When a descriptive designation and the “Tenderized with (Approved Enzyme)” qualifying statement appear on the label, the “Tenderized with (Approved Enzyme)” may not intervene between the product name and descriptive designation. The product name may read: “Beef Skirt Steak, Contains Up To 17% Solution of Water, Natural Flavor, Salt, Spice, Sugar, Hydrolyzed Corn Protein, Spice Extract, Citric Acid, Sodium Lactate, Sodium Phosphate, Soybean oil, and Yeast Extract - Tenderized with Bromelin.” The “tenderized” qualifying statement may be incorporated into the descriptive designation, for example, “Beef Skirt Steak Tenderized and Flavored with 17% Solution of Water, Natural Flavor, Salt, Spice, Sugar, Hydrolyzed Corn protein, Spice Extract, Citric Acid, Sodium Lactate, Sodium Phosphate, Soybean Oil, and Yeast Extract.”

When a descriptive designation and a product name qualifier (e.g., “Tenderized with Papain”) appear on the label, the Tenderized with Papain may not intervene between the product name and descriptive designation. The qualifying statement and descriptive designation can be combined. For example, “Beef Skirt Steak Tenderized and Flavored with 7% Solution of water, salt, spices, and papain.”

Cooked or Raw Cured Pork Products

Cooked and raw cured pork products covered by the cured pork products regulations (9 CFR 319.104 and 105) have labeling schemes for indicating the presence of added solutions in these products listed in the regulation. For example, the presence and amount of added ingredients must be declared, as part of the product name, e.g., “Ham and Water Product-- X% of Weight is Added Ingredients.” The **percent** of added ingredients in the **finished product** is inserted as the “X” value.

Cooked Poultry Products

Poultry rolls also have a standard of identity in 9 CFR 381.159 that specifies the remaining liquid when the product is heat processed. Turkey ham cured and cooked has a standard of identity in 9 CFR 381.171 that requires the finished product weight to be no more than the original weight of the turkey thigh meat prior to curing. In accordance with Policy Memorandum 57A, turkey ham weighing more than the original weight of the turkey thigh meat used prior to curing shall be descriptively labeled as “Turkey Ham,” with words that specify the amount of the additional ingredients, e.g., “and X% Water,” “With X% Water Added” or “Turkey Ham and Water Product X% of Weight is Added Ingredients”. The ingredients of the added solution may be incorporated into the product name, e.g., “Turkey Ham and Water Product X% of

Weight is Added Water, Salt, Dextrose, Sodium Phosphate, and Sodium Nitrite." The X is filled in with a percent determined by subtracting the original weight of the turkey thigh meat from the weight of the cooked finished product. "Turkey Ham, Cured Turkey Thigh Meat, 12% Water Added" is an example product name.

Cooked Cured Meat Products

Per Policy Memorandum 84A, **cooked** cured beef products and **cooked** cured pork products not addressed by the cured pork products regulation (9 CFR 319.104), that weigh more than the weight of the fresh uncured article (green weight), may be prepared if they are descriptively labeled to indicate the presence and amount of the added solution. Acceptable product names include: "Corned Beef and X% Water" or "Cured Pork and Water Product, X% of Weight is Added Ingredients," and "Beef Pastrami Contains Up to X% of a Solution." The ingredients of the solution may accompany the product name or appear in locations prescribed for ingredient statements. If product name qualifiers, such as "X% of Weight is Added Ingredients," are used, the labeling prominence guidelines used for cured pork products as found in 9 CFR 319.104(b) apply.

Cooked Uncured Meat Products

Policy Memorandum 84A also addresses labeling requirements for **uncured meat** products to which solutions are added to impart flavor and other sensory characteristics then are subsequently **cooked**. It does not apply to solutions containing ingredients used to extend a product, such as isolated soy protein (ISP) and carrageenan.

These products must be labeled to identify the amount and composition of solutions added to them. For a product to be truthfully labeled, a differentiation must be made from a cooked product (e.g., Cooked Beef) that has had **no** solution added to it from a cooked product labeled with the same name (e.g., Cooked Beef) that has had 20 percent of a solution added and cooked back to green weight.

There are two methods of providing descriptive labeling necessary to distinguish cooked meat products with added solutions from the traditional products without added solutions. These methods are given below:

Labeling Method 1

When uncured cooked **meat** products containing added solutions prior to cooking are cooked back to or below the weight of the fresh (green weight) article, words, such as

"seasoned" or "flavored," are to be used to reflect the addition of the added solutions, e.g., "Seasoned Cooked Beef."

Labeling Method 2

Uncured **meat** products that weigh more than the weight of the fresh article after cooking must be labeled with a product name qualifying statement indicating the amount of solution remaining after cooking, e.g., "Contains X% of a Solution." The ingredients of the solution may accompany the qualifying statement or appear in locations prescribed for ingredient statements, e.g., "After cooking, Contains X% of a Seasoning Solution of Water...." The qualifying statement must be one-fourth the size of the largest letter in the product name. If the ingredients of the solution accompany the qualifier, they must appear in print one-eighth the size of the most prominent letter in the product name.

For cooked products, the percent added solution for the label statement is determined by subtracting the fresh (green) weight of the article from the weight of the finished cooked product, (e.g., after injecting or marinating **and cooking**), dividing by the weight of the finished product, and multiplying by 100.

Note: Meat and poultry products with added solutions that are **heat treated or cooked**, are not subject to Descriptive Designation for Raw Meat and Poultry Products Containing Added Solutions final rule. The raw added solution regulation does not apply to red meat products with binders in the solution, for example, a product named, "beef water and binder product."

NFSCP PHIS Tasks

Performing the General Labeling Task

Inspection program personnel perform this task to verify general labeling regulatory requirements and determine if the label accurately reflects the finished product.

- **General Labeling Requirements**

Verifying that the general labeling requirements have been met involves :

- observing the application of the label or labeling,
- selecting labels and labeling for review, and

- reviewing the establishment's labeling records.

When IPP observe the packaging and labeling operations, they ensure that immediate containers of meat and poultry products have a label attached to them and that shipping containers bear the required information.

When IPP select and review the label/labeling being applied to the container or package, they determine if:

- the label contains the mandatory features and other required information such as a qualifying statement or descriptive designation, and
- any printing or colors on the label and packaging material gives a false impression or does not meet specific formatting criteria.

Product is misbranded if its label is missing a required feature, qualifying statement, or descriptive designation or is anyway false or misleading.

When IPP review the establishment's labeling file, they determine if the:

- label is on file and either met the generic approval requirements or was sketch approved by LPDS,
- label required sketch approval by LPDS and, if so, the sketch is attached to the final label,
- label is being used beyond the expiration date if it has been granted a temporary approval by LPDS, and
- product's formulation (if applicable) and processing procedures are attached to or accompany the label/labeling.

If IPP find noncompliance, they issue an NR and take the appropriate action necessary to ensure misbranded product does not enter commerce.

- **Label Accurately Reflects the Product**

Determining that the label accurately reflects the finished product involves reviewing the product's formulation record and observing its actual preparation and in some cases performing formula calculations.

When IPP perform this task, they should select one or more batches of product at formulation and verify ingredient amounts comply with the formula on file and that no undeclared ingredients are added or declared ingredients are omitted.

The verification may involve:

- observing pre-weighed ingredients for proper identification and weights, or
- observing establishment employees weighing ingredients or
- actually weighing pre-weighed ingredients to determine if the weight on the container is accurate.

An ingredient added at a different level than indicated in the product formula could affect the ingredient order of predominance on the label. The product is misbranded if a declared ingredient is omitted, an ingredient is added but not declared on the label, or the ingredient order of predominance is not accurate. Depending on the type of undeclared ingredient (e.g., an allergen) that is added to the product, it may be either adulterated or misbranded or both.

The regulations and many product standards of identity allow the establishment to add various ingredients to the formulae of certain meat and poultry products. Some meat and poultry components used in the formulation may have regulatory limits. Some nonmeat ingredients have a specified maximum amount or percentage allowed in the product. These nonmeat ingredients are called **restricted** ingredients. The establishment **MAY** add the component or ingredient in any amount up to its permitted limit.

If the product is formulated with a meat or poultry component with a regulatory limit or with a restricted ingredient, the IPP should select one or more batches of product during formulation. They should determine the amount or percentage of the meat or poultry component and/or the amount one or more restricted ingredients used in the formula. The IPP verifies that the:

- percentage of meat or poultry component meets the regulatory limit,
- restricted ingredient is allowed in the product, and
- the amount of the restricted ingredient added to the product does not exceed the regulatory limit.

Verifying meat and poultry components or restricted ingredients are in compliance with regulatory limits usually requires the IPP to perform a formula calculation.

When meat or poultry components or restricted ingredients are added at levels in excess of their maximum regulatory limit, they become **economic adulterants**.

If IPP find noncompliance, they issue an NR and take the appropriate action necessary to ensure adulterated or misbranded product does not enter commerce.

Performing the % Yield/Shrink Task

*Inspection program personnel (IPP) perform the percent yield/shrink task in establishments that are preparing meat or poultry cuts, parts and products with added solutions at levels that **do not** require the product's name to be qualified with a statement to indicate the percent of the solution and ingredients added to the product.*

When performing this task, IPP select an appropriate product and verify compliance with regulatory requirements by reviewing establishment records and labels, calculating the % added solution, yield or shrink, and comparing the result with the appropriate regulatory requirement and product label.

The percent added solution, product shrink, and yield verification determinations are performed on one or more **subgroups** (samples) of product or on entire batches of product. To calculate the % yield, shrink or added solution, IPP have the establishment weigh a subgroup (sample) of product before and after the appropriate step in the process (pumping, injecting, dipping, cooking, chilling, or drying). There is not a specified number of pieces of product that must make up a subgroup. The number of pieces selected and weighed should be representative of the lot size. For example, the IPP may select 20 or 30 pieces of meat or poultry and have them weighed before the solution is applied (green weight) and 20 or 30 pieces after the appropriate processing step, e.g., pumping, immersion, or cooking and chilling, and have them weighed (finished weight). After IPP obtain the subgroup or batch weights (green and finished weights), they are to perform a calculation to verify that the added solution or the product's yield complies with the product's standard of identity or regulatory requirement.

To accurately determine the percent of the solution and the amount of each ingredient added to a product via the solution, IPP have to differentiate between an **actual** or **effective** percent pump or pickup.

- **Actual Percent Pump or Pick-up** is the amount (pounds) of a water-based or oil-based solution (curing, tenderizing, marinating, etc.) pumped or injected into or picked up by a piece of meat or poultry that **is not** held for a period of time and allowed to drain prior to being further processed. This is expressed as a percentage of the weight of the meat or poultry before it is pumped with the solution.
- **Effective Percent Pump or Pick-up** is the weight gained (expressed as a percent) by the meat or poultry after draining for the specified amount of time in

the establishment's written procedure, and represents the amount of reactive solution that remains in the product. Any reactive ingredients (nitrites, phosphates, enzymes, flavors, etc.) in the solution are thought to remain in solution during the drain time after pumping, rather than reacting immediately with the meat or poultry protein. Therefore, using the effective percent pump in calculations more accurately reflects the ingoing amount of solution and reactive ingredients.

When verifying added solution compliance, IPP may have the **SAME** pieces of meat or poultry weighed before (actual green weight) and after the application of the curing, tenderizing or flavoring solution (treated or pumped weight). Identification of the pieces of meat or poultry should be maintained. This method is the most accurate way to determine the percent added solution.

IPP may use another method to determine the percent added solution under certain circumstances, e.g., the scale and pumping or injecting apparatus are not in the same area or room. In this situation, IPP **may** select and have pumped or treated pieces of meat or poultry weighed before selecting fresh unpumped or untreated pieces **provided** that the pieces **are uniform** in size and weight (e.g., lotted into 2-to-3 lb weight ranges). The green weight is determined from different pieces of meat or poultry. All pieces selected must be in the same weight range.

Performing the X Percent (%) Solution Task

Inspection program personnel (IPP) perform the X percent (%) solution task in establishments that are producing meat or poultry cuts, parts, and products containing added solutions that are required to have the percent (X) of the solution identified in the product's name to be truthfully labeled.

When performing this task, IPP select an appropriate product and verify compliance with regulatory requirements by reviewing establishment records and labels, calculating amount of solution added to the product and comparing the result with the appropriate regulatory requirement and/or the X% declaration in the product's name.

Added solution determinations are performed on one or more **subgroups** (samples) of product or on entire batches of product. To calculate the amount solution (percent) that is reflected as the "X" for the X% declaration in the product's name, IPP have the establishment weigh a subgroup (sample) or batch of product before and after the appropriate step in the process (pumping, injecting, dipping, or cooking and chilling). There is not a specified number of pieces of product that must make up a subgroup.

The number of pieces selected and weighed should be representative of the lot size. For example, the IPP may select 20 or 30 pieces of meat or poultry and have them weighed before the solution is applied (green weight) and 20 or 30 pieces after the appropriate processing step, e.g., pumping, dipping or cooking and chilling, and have them weighed (finished weight). After IPP obtain the subgroup or batch weights (green and finished weights), they are to perform a calculation to verify the percentage of solution (the value for the “X”) in the product name is accurate and truthful.

To accurately determine the percent of the solution added to a **raw** products, IPP have to differentiate between an **actual** or **effective** percent pump or pickup.

- **Actual Percent Pump or Pick-up** is the amount (pounds) of a water-based or oil-based solution (curing, tenderizing, marinating, etc.) pumped or injected into or picked up by a piece of meat or poultry that **is not** held for a period of time and allowed to drain prior to being further processed. This is expressed as a percentage of the weight of the meat or poultry before it is pumped with the solution.
- **Effective Percent Pump or Pick-up** is the weight gained (expressed as a percent) by the meat or poultry after draining for the specified amount of time in the establishment’s written procedure, and represents the amount of reactive solution that remains in the product. Any reactive ingredients (nitrites, phosphates, enzymes, flavors, etc.) in the solution are thought to remain in solution during the drain time after pumping, rather than reacting immediately with the meat or poultry protein. Therefore, using the effective percent pump in calculations more accurately reflects the ingoing amount of solution and reactive ingredients.

When verifying added solution compliance, IPP may have the **SAME** pieces of meat or poultry weighed before (actual green weight) and after the application of the curing, tenderizing or flavoring solution (treated or pumped weight). Identification of the pieces of meat or poultry should be maintained. This method is the most accurate way to determine the percent added solution.

IPP may use another method to determine the percent added solution under certain circumstances, e.g., the scale and pumping or injecting apparatus are not in the same area or room. In this situation, IPP **may** select and have the pumped or treated pieces of meat or poultry weighed before selecting fresh unpumped or untreated pieces **provided** that the pieces **are uniform** in size and weight (e.g., lotted into 2-to-3 lb

weight ranges). The green weight is determined from different pieces of meat or poultry. All pieces selected must be in the same weight range.

Note: FSIS allows the added solution to be 20% above the X% solution declaration in product name, before there is noncompliance provided that the establishment does not have a history of (or is routinely) adding the solution above the percentage declared in the product name. For cured products with X% solution declarations, the establishment is allowed up to 20% solution above the percent declared in the product name, provided the establishment is not routinely adding solution above the percentage declared in the product name **AND** the added solution does not result in any restricted ingredient (e.g., cure agent) regulatory limit being exceeded. ***The 20% solution allowance relates to the truthfulness of the product name and not for other regulatory limits or product standards of identity.***

Note: Both methods of determining compliance above (i.e., weighing product) also apply to **cooked** products, except that the percentage of solution remaining in the product after cooking and chilling (finished weight) is used rather than the actual or effective % pump in the IPP's calculation.

Noncompliance

After performing the tasks, IPP are to use the GAD thought process to determine compliance.

Examples of Noncompliance:

- Label, solution formula or processing procedure is not on file
- LPDS temporary approved label is used beyond the expiration date
- Label requiring sketch approval by LPDS has not received sketch approval by LPDS
- Missing mandatory label feature, e.g., safe handling instructions or handling statement
- Missing product name qualifying statement
- Solution ingredients not listed in the descriptive designation
- Ingredients not listed in descending order of predominance in either the descriptive designation and/or ingredients statement
- Inaccurate ingredients statement
- Any false or misleading information
- A RI ingredient, e.g., nitrite exceeds the maximum amount allowed
- The % solution declaration (X%) listed on the label is false or misleading (not truthful)

Supplemental Information

- TITLE:** Meat and Poultry with Added Solutions
- RESOURCES:** FSIS Regulations
FSIS Directive 7620.3, Processing Inspectors' Calculations Handbook
Questions and Answers on Descriptive Designation for Raw Meat and Poultry Products with Added Solutions on FSIS's website
Policy Memos 57A, 84A and 109
Meat and Poultry with Added Solutions Module
- SUPPLEMENTS:** Each supplement introduction highlights the information for that supplement.
- PURPOSE:** These calculations and references will provide inspection program personnel with sufficient knowledge to accurately determine compliance, and initiate appropriate actions during their verification of various products that have an X% solution declaration in the name of the product.

Supplement 1

Proteolytic Enzyme Treatment of Meat and Poultry Cuts

This section of the handout includes information on proteolytic enzymes and their limit when applied to meat and poultry cuts. It provides IPP with background necessary to determine compliance when proteolytic enzymes are added to meat and poultry cuts through a water based solution. It covers mathematical calculations for verifying that the water based solution containing proteolytic enzymes is in compliance with the regulatory requirement.

In some establishments, enzyme tenderizers, such as papain, bromelin, and *Aspergillus oryzae* (a mold) are used on meat and poultry cuts to reduce the toughness of connective tissue. See 9 CFR 424.21 and FSIS Directive 7120.1 for other approved tenderizers.

When IPP perform the General Labeling task, they verify that the:

- enzymes used by the establishment are approved for tenderizing meat and poultry cuts,
- raw meat and poultry product's name has, in a prominent manner, without any intervening text, the qualifying statement "Tenderized with (Approved Enzyme)", and
- other labeling requirements identified in the task's description in this handout are met.

When performing the % Shrink/Yield or X Percent (%) Solution tasks, IPP verify that the amount of moisture pick-up from a solution consisting of water and an approved proteolytic enzyme *does not exceed 3%*.

There are several methods IPP can use to determine compliance with the added enzyme solution regulation.

To determine the maximum amount of tenderizing solution pick-up allowed, IPP:

- Select a subgroup of product. (**Note:** There is no specified number of sample units required to verify compliance. The number 10 is used in the following example problems only for ease of calculations.)
- Weigh, before the tenderizing solution is applied, and calculate the maximum amount of added solution allowed.
- Collect the 10 units after the tenderizing solution is applied and weigh them and then compare the total treated product weight to the total maximum treated product weight allowed.

Calculation Equations:

Green weight of the meat or poultry to be treated + maximum solution weight = total maximum weight of the treated product

OR

Green weight of the meat or poultry to be tenderized or treated × percentage of solution allowed = maximum solution weight

Enzyme Example Problem 1

Given: 200 oz represents the green weight of the beef flank steak to be treated

Step 1: Determine the maximum solution weight.

$$200 \text{ oz} \times 0.03 \text{ (3\% solution allowed)} = 6.0 \text{ oz (maximum solution weight)}$$

Step 2: To determine the total maximum weight of the flank steak, add the green weight of the flank steak to be treated to the maximum solution weight.

$$200 \text{ oz (green weight of flank steak to be treated)} + 6.0 \text{ oz (maximum solution weight)} = 206 \text{ oz (total maximum weight of the treated flank steak)}$$

Enzyme Example Problem 2

Given: Weight of 10 beef ribeye steaks (untreated or green weight) = 150 oz.

Step 1: 150 oz (green weight of untreated meat) × 0.03 (3% solution allowed) = 4.5 oz maximum solution weight)

Step 2: 150 oz (weight of untreated meat) + 4.5 oz (maximum solution weight) = 154.5 oz (total treated product weight)

Therefore, these 10 ribeye steaks may weigh up to 154.5 oz. When treated with an enzyme tenderizing solution, the 150 oz of ribeye steaks can have no more than 4.5 oz of enzyme tenderizing solution.

To determine the actual percentage of the added solution (pick-up):

- Select 10 sample units before the tenderizing solution is applied. Weigh as a group.
- Allow these 10 units to be treated with the tenderizing solution while maintaining identification.
- Collect the same 10 units after the tenderizing solution is applied and weigh; calculate the percent added solution (pick-up).

Calculation Equation

$$\frac{\text{Treated (finished) weight} - \text{Untreated (Green) Weight}}{\text{Untreated (Green) Weight}} \times 100 = \% \text{ pick-up}$$

Enzyme Example Problem 3

Step 1: Weight of 10 ribeye steaks before treating with the tenderizing solution = 120 oz

Step 2: Weight of 10 ribeye steaks after treating with the tenderizing solution = 123.4 oz.

Step 3: Solution:

$$\frac{123.4 \text{ oz} - 120 \text{ oz}}{120 \text{ oz}} = 0.0283 \text{ or } 2.83\% \text{ pick-up (added solution)}$$

Since the moisture pick-up from the tenderizing solution is less the 3%, the product is in compliance!

Note: When the IPP's added solution or pick-up test reveals that the product has gained more than 3% tenderizing solution and there is no descriptive designation indicating the percent above 3% in the product name, he or she needs to determine if the establishment has data that demonstrates it is producing tenderized product in compliance with the regulatory limit. For instance, the establishment may be implementing a written program that includes conducting pick-up tests and the records show the process is still under control even though the IPP's pick-up test is over the regulatory limit. Normal variation in the process of tenderizing meat and poultry cuts may occasionally result in a solution pick-up test being over 3%. When the establishment does not have data that demonstrate control over the process of tenderizing meat and poultry cuts and the IPP's pick-up test exceeds the regulatory limit, the IPP should retain all of the product on hand from that shift's production.

Meat and Poultry Products Treated with Added Enzyme Solutions Workshop

1. Which of the following enzyme *is not* approved for tenderizing meat and poultry cuts?
 - a. protozoa
 - b. *Aspergillus oryzae*
 - c. bromelin
 - d. papain
2. Which of the following products may not be tenderized with proteolytic enzymes?
 - a. lamb shoulder chops
 - b. beef and pork frankfurters
 - c. beef T-bone steaks
 - d. chicken drumsticks
3. The maximum pick-up of solution used for tenderizing purposes is:
 - a. 1%
 - b. 2%
 - c. 3%
 - d. 5%
4. The regulations do not require that proteolytic enzymes be approved if they tenderize the product.
 - a. TRUE
 - b. FALSE
5. Untreated boneless chicken breasts weigh 160 lb. How much can the boneless chicken breasts weigh after being treated with a tenderizing solution?
 - a. 160 lb
 - b. 164.8 lb
 - c. 170.2 lb
 - d. 174.6 lb

6. An establishment produces a product labeled “Beef T-Bone Steak, Tenderized with Papain.” While performing the % Shrink/Yield task, the IPP randomly selected 10 beef T-bone steaks to conduct an added solution or pick-up test. The untreated steaks weigh 12 oz each. After the steaks are dipped in the enzyme solution, the same 10 steaks weigh 123.9 oz. The establishment does not implement a procedure for monitoring the amount moisture the meat and poultry cuts it tenderizes picks up. The percent solution pick-up is:
- 3.15%
 - 3.25%
 - Less than 3%
7. Based on the answer to the previous question, the IPP would:
- Attach a U.S. Retained tag to all tenderized Beef T-Bone Steaks produced on the shift until the establishment takes corrective action.
 - Weigh additional sample units as another verification pick-up test.
 - Warn the establishment that the test is in violation.
 - Allow product to move freely.

Supplement 2

X% Solution Labeled Meat and Poultry Products

This section of the handout includes information on products with X% solution declarations in the product name. It provides IPP with background necessary to determine compliance when a percentage of added solution is declared in the name of the product. IPP are responsible for verifying that the value inserted into the “X” for products labeled with a descriptive designation or qualifying statement such as “Contains (Marinated or Injected with) Up to X% solution,” is accurate. This supplement includes the mathematical calculations for verifying that the percentage of solution declared in the product name is truthful and not false and misleading.

IPP verify compliance by either weighing a sample of product before and after the appropriate step in the process (e.g., pumping, massaging, dipping, cooking and chilling) or weighing a sample of product before the solution is added and determining weight the solution, calculating the actual % of added solution, and comparing the result with the percentage of solution declared in the product name while performing the X Percent (%) Solution task.

Calculation Equations for Raw Products

IPP can use the following equations to verify that **raw** (cured or uncured) meat and poultry products and **raw** PFF-controlled pork products listed in 9 CFR 319.104 and 105 complies with the X% solution label declaration.

$$\frac{(\text{pumped or treated}) \text{ weight} - \text{green weight}}{\text{green weight}} \times 100 = \% \text{ added solution (ingredients)}$$

Note: Pumped weight or treated weight could be inserted into the above equation, depending upon the processing procedures performed at the establishment, e.g., **treated weight** is used when the product is dipped or submerged in the solution; **pumped weight** is used when the solution is injected into the product.

OR

$$\frac{\text{green weight} + \text{solution weight}}{\text{green weight}} \times 100 = \% \text{ yield}$$

Note: This equation can be used when the entire weight of the solution is picked up by the meat or poultry product. Mechanical agitation, i.e., tumbling and massaging, facilitates the binding of the added water and ingredients by the meat or poultry proteins.

IPP can use the steps in the table below to determine the percentage of solution added to **raw** (cured or uncured) meat and poultry products.

STEP		EXAMPLE
1	Determine the green weight of a given number of pieces of meat or poultry (cured or uncured) or an amount of meat or poultry (cured or uncured) that will represent the lot.	<p style="text-align: center;">Corned Beef Brisket Contains Up to 25% of a Solution of Water, Salt, Sodium Phosphate, Sodium Erythorbate, and Sodium Nitrite.</p> <p>A stainless steel tub of fresh uncured beef briskets weighs (less the tare) 127.8 lb.</p>
2	Determine the weight of the same pieces or container of meat or poultry after pumping or immersing in the solution. If a drain time is listed in the establishment's written procedure, allow the pumped or treated product to drain for the specified time period and then weigh. If no drain is listed, take the weight directly after pumping, etc. Note: <i>If the product is trimmed after pumping or immersing, the weight of the trimmings must be added back to the pumped or immersed weight.</i>	After pumping the same tub of beef briskets weighs (less the tare) 159.6 lb.
3	Subtract the green weight of the meat or poultry from the pumped weight.	$159.6 \text{ lb} - 127.8 \text{ lb} = 31.8 \text{ lb}$
4	Divide this weight by the green weight of the meat or poultry.	$31.8 \text{ lb} \div 127.8 \text{ lb} = 0.2488$
5	Convert the decimal answer into the percent of added solution (ingredients) by multiplying by 100.	$0.2488 \times 100 = 24.88\%$ is the amount of added solution. Since 25% added solution is declared in the descriptive designation in the product name, this product is in compliance.

Comment

If the IPP determined the amount of curing solution added to the raw beef briskets in the example above was above 25% (i.e., above the percentage of solution declared in the product name), there may be regulatory noncompliance. FSIS *allows up to 20% above* the percentage of solution declared in the product name before action is required (i.e., $25 \times .20$ (20%) = 5 + 25 = 30%). If the establishment can demonstrate with records (e.g., its own added solution tests during the shift and previous shifts) that the added solution is consistently below 25%, then there is no noncompliance. On the other hand, if the establishment has a history of (or is routinely) adding the solution above 25% (e.g., either documented in establishment records or from previous IPP solution pickup tests), then the IPP would retain the lot of beef briskets until the briskets either drain to 25% percent added solution or the establishment takes action to properly label the corned beef briskets. The IPP would document this noncompliance.

Note: The ingoing regulatory limit for the restricted ingredients, e.g., nitrite (200 ppm) and sodium erythorbate (547 ppm), cannot be exceeded even when the added solution is within the 20% solution allowance. See the Cured Meat and Poultry Product Operations module.

IPP can use the steps in the table below to determine the percentage of solution added to raw (cured or uncured) meat and poultry products when the meat or poultry absorbs the entire amount of added solution.

STEP		EXAMPLE
1	Determine the green weight of a given number of pieces of meat or poultry (cured or uncured) or an amount of meat or poultry (cured or uncured) that will represent the lot.	Boneless Skinless Chicken Thighs Contains Up To 15% Chicken Broth, Salt, Natural Flavorings Two stainless steel vats of fresh chicken thighs weighs (less the tare) 200 lb.
2	Determine the weight of the solution added to the fresh pieces of meat or poultry after massaging or tumbling.	Two gray plastic totes of flavoring solution weighs (less the tare) 30 lb
3	Add the green weight of the pieces of meat or poultry and weight of the solution.	200 lb + 30 lb = 230 lb

4	Divide this weight by the green weight of the product.	$230 \text{ lb} \div 200 \text{ lb} = 1.15$
5	Convert the decimal answer into the percent yield by multiplying by 100.	$1.15 \times 100 = 115\%$. Since the green weight represents 100%, the added solution is 15% ($115\% - 100\%$). This product <i>is</i> in compliance because up to 15% added solution is declared in the descriptive designation on the product label.

Calculation Equation for Cooked Products

IPP use the following equation to verify that **cooked** (cured or uncured) meat and poultry products including turkey ham and **cooked** PFF-controlled pork products listed in 9 CFR 319.104 and 105 complies with the X% solution label declaration.

$$\frac{\text{finished weight} - \text{green weight}}{\text{finished weight}} \times 100 = \% \text{ added solution}$$

STEP		EXAMPLE
1	Determine the green weight of a given number of pieces of fresh (unpumped or untreated) meat or poultry or an amount of fresh (unpumped or untreated) meat or poultry that will represent the lot.	<p>Beef Pastrami Contains up to 10% of a Solution</p> <p>A stainless steel vat of uncured beef top rounds weighs (less the tare) 161.4 lb.</p>
2	Determine the weight of the same meat and poultry after cooking and chilling. You will need to maintain control of the meat or poultry through pumping, massaging, or immersing, and the subsequent cooking and chilling processes.	After chilling , the same beef top rounds weigh (less any tare) 178.7 lb. This is the finished product weight.
3	Subtract the green weight from the finished product weight.	$178.7 \text{ lb} - 161.4 \text{ lb} = 17.3 \text{ lb}$
4	Divide this weight by the finished product weight.	$17.3 \text{ lb} \div 178.7 \text{ lb} = 0.0968$

5	Convert the decimal answer into the percent of added solution (ingredients) by multiplying by 100.	0.0968 × 100 = 9.68% is the amount of solution remaining after cooking and chilling. Since 10% added solution is declared in the qualifying statement on the label, this product <i>is</i> in compliance.
---	--	---

Comment




If the IPP determined the amount of curing solution remaining in the beef top rounds after cooking and chilling in the example above was above 10% (i.e., above the percentage of solution declared in the product name) there may be regulatory noncompliance. FSIS *allows up to 20% above* the percentage of solution declared in the product name before action is required (i.e., $10 \times .20$ (20%) = 2 + 10 = 12%). If the establishment can demonstrate with records (its own solution yield tests during the shift and previous shifts) that the solution remaining in the finished beef pastrami is consistently 10% or less, then there is no regulatory noncompliance. On the other hand, if the solution remaining in cooked beef top rounds is routinely above the percentage of solution (10%) declared on the beef pastrami label (e.g., either documented in the establishment records or from previous IPP solution pickup tests), then the IPP would retain the lot of cooked beef top rounds until the establishment takes action to properly label the beef pastrami. The IPP would document the noncompliance.

X% Solution Labeled Meat and Poultry Products Summary Workshop

Using the methods outlined in this handout, perform the required calculation to verify the value inserted into the X on a product with an X% solution label declaration is accurate and the product name is truthful and not false and misleading. If you need help, contact your instructor.

Scenario 1

You are a CSI assigned to an establishment that adds water-based tenderizing and flavoring solutions to raw meat and poultry products. When you arrive at the establishment, you log-on to your computer and bring up the task calendar in PHIS. The X Percent (%) Solution task is on the task calendar for today. You start the X Percent (%) Solution task by proceeding to the processing room. The establishment is applying a tenderizing and flavoring solution to beef skirt steaks. After the solution is added to the skirt steaks, the treated beef skirt steaks are moved to the packaging room and vacuum packaged in a plastic film with the pre-printed label below.

<p>BEEF SKIRT STEAK TENDERIZED WITH BROMELAIN</p> <p>Contains up to 17% solution of Water, Natural Flavor, Salt, Spice, Sugar, Hydrolyzed Corn Protein, Spice Extractive, Citric Acid, Sodium Lactate, Sodium Phosphate, Soybean Oil, Sodium Benzoate, Maltodextrin, Yeast Extract.</p> <p><i>-FOR-</i> FAJITAS <i>-SEASONED-</i></p>	
	
	<p>NET WT 16 OZ (1 LB) 453.5 g</p>

The establishment uses a tumbler to mechanically agitate the tenderizing and flavoring solution into the beef skirt steaks. The establishment's written processing procedure at the production station near the tumbler states that 200 lb of beef skirt steaks and 50 lb of a water based solution of bromelain and flavoring ingredients are added to the tumbler. The tumbler runs for 15 minutes. You notice beef skirt steaks in stainless steel containers and a plastic container of solution with the label staged next to the tumbler. You have the production supervisor move the stainless steel containers and plastic container with the tenderizing/flavoring solution to the scale. After removing the tare weight of the containers, the beef skirt steaks weigh 199.5 lb and the solution weighs 50 lb.

1. Calculate the percentage of solution added to the beef skirt steaks.
2. Is the X% solution label declaration accurate and the product truthfully labeled (not misbranded)?

Yes

NO

Scenario 2

You are a CSI assigned to an establishment that adds water-based flavoring solutions to raw meat and poultry products. When you arrive at the establishment, you log-on to your computer and bring up the task calendar in PHIS. The X Percent (%) Solution task is on the task calendar for today. You start the X Percent (%) Solution task by proceeding to the processing room. The establishment is applying flavoring solution to pork tenderloins. After the solution is added to the pork loins, the tenderloins are moved to the packaging room and vacuum packaged in a plastic film with the pre-printed label below.

JAMACIAN JERK STYLE

PORK TENDERLOIN WITH
JAMAICAN STYLE SPICES



CONTAINS UP TO A 12% SOLUTION OF WATER, SODIUM PHOSPHATES,
POTASSIUM ACETATE, SALT, POTASSIUM LACTATE



The establishment injects the flavoring solution into the pork tenderloins. The establishment's written processing procedure in the production office states that Jamaican Jerk Style pork tenderloins are injected or pumped with 12% of a solution containing water, sodium phosphates, potassium lactate, salt, and potassium lactate. It also indicates a 20 minute drain time. You notice unpumped pork tenderloins in a stainless steel vat near the injector. You have the production supervisor assist you in weighing 25 unpumped pork tenderloins. The 25 unpumped tenderloins (less the tare) weigh 27.5 lb. You have the 25 pork tenderloins you weighed run through the injector and placed in a gray plastic production tote to drain. You attach a U.S Retained tag to the gray plastic production tote and write pump test on the tag. Twenty minutes later

Scenario 3

You are a CSI assigned to an establishment that adds water-based flavoring solutions to raw beef cuts that are subsequently cooked to produce roast beef, cooked beef and beef pastrami. The cooked beef products do not return to green weight, thus the finished beef products have an X% solution qualifying statement in the product name. When you arrive at the establishment, you log-on to your computer and bring up the task calendar in PHIS. The X Percent (%) Solution task is on the task calendar for today. You start the X Percent (%) Solution task by proceeding to the processing room. The establishment is pumping beef top rounds with a seasoning solution today. After the top rounds are cooked, they are sliced in the RTE product packaging room and the slices are vacuum packaged in 7 oz plastic trays that have the following label.

TRADITIONAL				
ROAST BEEF				
CONTAINS UP TO 20% OF A SOLUTION CAMEL COLOR ADDED				
				98% FAT FREE
PER 2 OZ SERVING			KEEP REFRIGERATED•FULLY COOKED•GLUTEN FREE DISTRIBUTED BY THE BEEF CO., NEWPORT, OHIO 45210	
60 CAL	0g SAT FAT 0%DV	490 mg SODIUM 20%DV	1g SUGARS	11g PROTEIN 22%DV
				NET WT 7 OZ (198g)
				

The establishment's processing procedures attached to the label indicates that the beef top rounds are weighed and grouped into 10 to 12 lb or 12 to 14 lb weight ranges. The top rounds are pumped with 30% of a flavoring/seasoning solution. The top rounds are cooked in an oven for 2 to 2.5 hours based on the weight range to an internal temperature 145°F for 3 minutes. The cook shrink is 8 to 9% and the chiller shrink is 2 to 3%.

You have the production supervisor assist you in weighing 15 unpumped (green) top rounds from lot A2456. The 15 unpumped tenderloins weigh 169.5 lb. The next day,

before the top rounds are moved from the cooler to the RTE product room for slicing, you have the production supervisor assist you in weighing 15 cooked top rounds from lot A2456. These top rounds weigh 214.6 lb. The establishment does not routinely monitor the amount of solution remaining (or the “X” % on the label) for its finished cooked beef product.

1. Calculate the percentage of solution remaining in the beef top rounds.

You review the MOIs for the establishment and find that the previous three added solution tests for this product were above the 20% declared on the product’s label but were within the 20% solution allowance. Each time the IPP’s added solution calculation was above the percentage declared in the product name (20%), the IPP discussed the added solution result with establishment management at the weekly meeting. Each time the establishment stated it would adjust the pumping procedure.

2. Based on the information you have gathered, is the X% solution label declaration accurate and the product truthfully labeled (not misbranded)?

Yes

NO

Attachment 1: Demonstrating the Use of the Calculation Aid

Accessing the Calculation Aid


Step 1: Click on the Start button (or Windows button) lower left corner computer screen

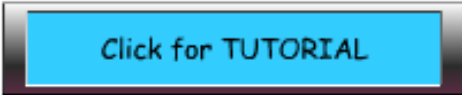
Step 2: Click on FSIS Applications

Step 3: Highlight and double click on Calculation aid in the menu

Calculation Aid Menu

Antioxidants	Net Weights
Batter/Breading	Percent Batter/Breading
Beef Cheek Meat (lb of beef cheek meat known)	Percent Proteinaceous Ingredients
Beef Cheek Meat (lb of beef known)	Projected Finished Weight
Binders and Extenders	Shrink
Cure Accelerators	Shrink (dry cured pork product)
Cure Agents	Volume of a Container
Fat Content	X % Solution (uncooked product)
Gain	X% Solution (cooked product)
Maximum Amount of Poultry	Yield
Minimum Meat or Poultry	







Version 2.0

Enzyme Example Problem 3-Added Solution (page 18)

Calculation Aid Menu

Antioxidants	Net Weights
Batter/Breading	Percent Batter/Breading
Beef Cheek Meat (lb of beef cheek meat known)	Percent Proteinaceous Ingredients
Beef Cheek Meat (lb of beef known)	Projected Finished Weight
Binders and Extenders	Shrink
Cure Accelerators	Shrink (dry cured pork product)
Cure Agents	Volume of a Container
Fat Content	X % Solution (uncooked product)
Gain	X% Solution (cooked product)
Maximum Amount of Poultry	Yield
Minimum Meat or Poultry	

 [Click for TUTORIAL](#) Version 2.0

 **04A01 - % Gain**


$$\frac{\text{pumped, treated, or massaged weight} - \text{green weight}}{\text{green weight}} \times 100 = \% \text{ gain}$$

pumped, treated, or massaged weight green weight

- X 100 = **2.83**

 % gain


green weight

Calculate  Reset

X% Solution Raw Product Example Problem (page 22)

Calculation Aid Menu

Antioxidants	Net Weights
Batter/Breading	Percent Batter/Breading
Beef Cheek Meat (lb of beef cheek meat known)	Percent Proteinaceous Ingredients
Beef Cheek Meat (lb of beef known)	Projected Finished Weight
Binders and Extenders	Shrink
Cure Accelerators	Shrink (dry cured pork product)
Cure Agents	Volume of a Container
Fat Content	X % Solution (uncooked product)
Gain	X% Solution (cooked product)
Maximum Amount of Poultry	Yield
Minimum Meat or Poultry	


 [Click for TUTORIAL](#) Version 2.0

04A02 - X% Solution (uncooked product)

$$\frac{\text{(pumped, treated, or massaged) weight} - \text{green weight}}{\text{green weight}} \times 100 = \% \text{ added ingredients}$$

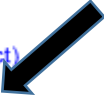
pumped, treated, or massaged weight green weight


159.6	-	127.8	X 100 =	24.88
127.8				% added ingredients
green weight				

Calculate  Reset

X% Solution Cooked Product Example Problem (page 24)

Calculation Aid Menu


Antioxidants	Net Weights
Batter/Breading	Percent Batter/Breading
Beef Cheek Meat (lb of beef cheek meat known)	Percent Proteinaceous Ingredients
Beef Cheek Meat (lb of beef known)	Projected Finished Weight
Binders and Extenders	Shrink
Cure Accelerators	Shrink (dry cured pork product)
Cure Agents	Volume of a Container
Fat Content	X % Solution (uncooked product)
Gain	X% Solution (cooked product) 
Maximum Amount of Poultry	Yield
Minimum Meat or Poultry	

 [Click for TUTORIAL](#) Version 2.0

04A02 - X% Solution (cooked product)

$$\frac{\text{finished weight} - \text{green weight}}{\text{finished weight}} \times 100 = \% \text{ added ingredients}$$

finished weight	-	green weight		
<input type="text" value="178.7"/>	-	<input type="text" value="161.4"/>		
<hr/>			X 100 =	9.68
		<input type="text" value="178.7"/>		% added ingredients
		finished weight		

Calculate  Reset