Introduction

Casings have been utilized throughout the years in the production of sausage and processed meat products. Casings have been referred to as the oldest form of packaging materials for sausage. Casings determine the final size and shape of the sausage product. Casings serve as processing molds, containers during handling and shipping, and as merchandising units for display.

In years past, sausage production was limited to the amount of available animal intestines. With the development of collagen, fibrous and cellulose casings the production of sausage is only limited by the availability of raw materials. Sausage casings have evolved from old world innovation and applied to today’s high paced processed meat production.

Casings are made of two basic materials, cellulose or collagen. Five specific casings are generally used in the production of sausage products - animal, regenerated collagen, cellulose, fibrous, and plastic casings.

Natural Casing

Natural casings come from the gastrointestinal tract of animals. Natural casings are made from the submucosa, a largely collagen layer of the intestine. The fat and the inner mucosa lining are removed.

Natural casings have the advantages of traditional appearance, traditional texture and cooking performance that is expected of sausage. A few disadvantages are noted as decreased machinability, reduced uniform weight or length, and cost. Natural casings produced from the intestines of cattle, hogs, and sheep.

Beef Casings

The three most used beef casings are: beef bung caps, beef rounds, and beef middles.

Figure 1 displays the location of the casing in the intestinal tract of cattle.

Beef bladders can also be used in the production of large diameter sausages such as specialty sausage (souse or head cheese). Bladders are the largest diameter of casings from cattle and are oval in shape.

Hog Casings

Hog casings are used for smaller diameter (30-44 mm) sausages. These casings can be used for fresh sausage as well as fully cooked smoked sausage. Figure 2 displays the location of the casing in the intestinal tract of hogs.
After cleaning hog casings are measured/sized to ensure a more uniform size and shape and achieve uniform portion control of the final product. The casings can be trimmed to be sold as “whisker free,” which increases the consumer eye appeal. They are transparent so that the consumer can see the particle definition of the meat and the ingredients used in the sausage.

Regular hog bungs are also sold as individual pieces and are used primarily for liver sausage and braunschweiger. Sewn hog bungs are available in double-walled and single-walled varieties to obtain a larger, more uniform finished product.

Sheep Casings
Sheep casings (Figure 3) are the smallest (16-28 mm) of the natural casings that are commercially available. Sheep casings are the most tender and the most adaptable to fresh pork sausage, which are sold fresh. These casings can also be used in the production of high quality frankfurters. Depending on the county of origin of the sheep casings, the color may range from white to gray.

Manufacturing of Natural Casings
Casings are produced by first removing the mucosa and any undesirable elements such as fat, threads, and animal fluids. This removal is facilitated by a series of both hot and cold water soaks. The fully cleaned casings are then placed in a saturated salt environment to prepare the casings for further processing. The casings are then sorted into various grades and diameters.

Measuring the Casings
All casings are carefully measured either by a machine or by hand. The measuring of casings is important and must be accurate since the measured unit becomes the criteria by which prices are determined. Hog casings and sheep casings are prepared in 91-meter (100 yard) hanks or bundles. Beef casings are sold in meter bundles or by the piece.

Quality of Casings
The quality of natural casings is determined in several labor-intensive procedures. Quality “A” casings are defined as casings with no holes or weakness. Quality “B” casings are of acceptable strength and quality for coarse ground sausage. Another quality characteristic used to sort casings is color. Some casings will be white or virtually transparent / clear, while others may be darker and more opaque.

Shipping of Casings
Casings can be shipped in a variety forms. The three common forms of shipping are: dry salt packed, slush or pre-flushed packed, and pre-tube packed.

Dry salt packed: Excess moisture is removed from the casings and packed in a semi-dry state. This type of packaging is usually appropriate for long distance travel and/or prolonged storage at ambient temperatures.
Slush or pre-flushed packed: Casings are packaged in a water/salt mixture. The casings are very soft and flexible and do not require flushing prior to stuffing sausage.

Pre-tube packed: Each strand of natural casing is shirred on a tube to allow one-step loading of the casings directly onto the stuffing horn.

Casings should be stored in a controlled, cool environment. A neutral temperature of 4-10 °C (40-50 °F) is ideal.

Production using Natural Casings

During production and thermal processing steps can be taken to produce a final product with a tender bite and eye appealing color. Prior to stuffing, hog casings can be soaked in a mixture of phosphate, salt, and water overnight. This mixture makes the casings more pliable during processing and seems to increase tenderness after reheating. It has also been absorbed that sodium erythorbate in the water mixture helps the casings develop better color during thermal processing.

To obtain good smoke penetration to the sausage, a drying step is included in the thermal processing schedule. Once the smoke is applied and the desired smoke color is applied and concentration attained, further drying will render the casing virtually impermeable to moisture. The sausage is usually cooked by steam without injuring the final product. Furthermore, at the final step in thermal processing, if the relative humidity of the smokehouse is high (75-85%), the casings have increased tenderness.

Regenerated Collagen Casings

Regenerated collagen casings have many of the physical properties of animal casings. Collagen casings are being used to simulate natural animal casings. Collagen casings are essentially produced from the same material "chemically" as natural casings, this material being collagen. The collagen originates for the corium layer of the hide of beef animals (Figure 4).

Figure 4. The raw material used in the production of collagen casings.

The corium is extracted with alkaline solution to remove the soluble components and washed with potable water. The collagen is then swollen with acid to give a viscous mass of acid collagen that is pushed through an annular die to form a tube. The tube is fixed by moving it through an alkaline bath, and the neutralized collagen returns to its original state. The tube is dried and cut to size. The casings can be shirred into sticks for faster production.

The advantages of utilizing collagen casings relates to the availability of these casings in a variety of sizes. The collagen casings work well when machine handled because they can produced uniform diameters to reduce the "give-away" of sausage, which in turn affects final profits. Collagen casings are edible which means that the sausages do not need to be peeled after thermal processing.

Collagen casings are available in a variety of sizes. Many of the collagen casings available simulate animal casings. Some collagen casings are designed to have curves that mimic the curves of natural casings. Collagen casing have also been produced with built-in string to give an "old world" appearance to the finished product.

Collagen casings lend themselves to machine handling because they can be produced with uniform sizes.
Cellulose Casings

Cellulose casings include those made from cotton bags and those derived from processed cotton linters. The cloth bags give a high degree of uniformity to the encased sausage product. Cotton linters are a fine fuzz-like material that is removed from cottonseed after the cotton fiber and seed have been separated at the cotton gin.

Linters are cleaned mechanically, cooked in dilute alkali to remove soluble components, and washed to remove any traces of salts. This chemical cotton is treated with caustic to produce alkali cellulose, a moist, granular white material. Mixing this with carbon disulfide results in the formation of a yellow-orange viscous mass called cellulose xanthate. The xanthate is mixed with a dilute caustic solution and filtered; the resulting liquid is a viscose solution. The viscose is extruded through nozzles into an acid solution and the cellulose is regenerated as the carbon disulfide is split from the complex. Wall thickness and tubular diameter can be controlled by the extruder. These finished tubes or casings are composed of pure cellulose, food grade glycerine, and water.

Cellulose casing have the ability to be permeable to smoke, which gives the final product good consumer eye appeal. The casings are also permeable to moisture to some extent. Cellulose casing are impermeable to organic molecules such as meat emulsion.

Cellulose casings come in a variety of sizes, but are generally divided into two categories – small diameter and large diameter.

**Small diameter**: These casings are most often supplied as shirred sticks varying from 40 to 160 ft in length. These casings work well with existing stuffing equipment. After processing, the cellulose casings are removed from the sausage at the manufacturing plant as a convenience for the consumer.

**Large diameter**: These casings are chemically identical with small casings tubes. These casings must be soaked in water prior to use. A variety of bologna and large sausage products are prepared using these casings. Furthermore, the casings may be removed at the retail sale level.

Fibrous Casings

Fibrous casings, also known as large diameter cellulose casings, are made by impregnating a strong paper like material with cellulose. Fibrous casings have good machinability and uniformity which adapts well to high speed operations. Fibrous casings are manufactured in such a manner that they adhere to the sausage surface, which is important in the production of dry and semi-dry sausage. There are a variety of fibrous casing sizes which give processed meat processors a great number of choices to fit market preferences.

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Plastic Casings

In some processed meat applications, a moisture impermeable casing is best suited. The recognized product made using plastic casings is braunschweiger. The impermeable material used to produce plastic casings is PVDC.

Any casing which is impermeable to moisture is also impermeable to smoke. Therefore, any smoke flavoring must be incorporated directly into the product during manufacturing. Plastic casing can also be produced in a variety of sizes. Plastic casings can be made in a variety of colors to increase the eye appeal to the consumers.

COFFI Film

COFFI film is an edible film that becomes an integral part of the product during heat processing. The film surface consistency creates an upscale high-sheen appearance with advantages both on the shelf and at the table. The film helps the product retain the natural moisture of the meat during and after thermal processing.

COFFI film is highly permeable to smoke and is virtually impermeable to liquids and fats. The film is designed to enhance smoke uptake and provide a uniform smoked color and flavor. Furthermore, COFFI film facilitates better slicing and portion control.
USDA Regulations on Casings

The Food Safety and Inspection Service (FSIS) published the final rule regarding the labeling of sausage casings in the Federal Register on August 6th, 2001 (9 CFR Parts 317 and 381). A subsequent notice was released on February 22nd of 2002 to clarify the final rule by publishing a list of frequently asked questions and answers regarding the new regulations concerning the use of natural or regenerated collagen sausage casings.

The notice states that collagen casings on sausage products need to be identified on the label if the collagen is derived from a species other than that which is in the product or if the source of the collagen is unknown. This final rule also applies to sausage-like products (i.e. meat sticks), co-extrusion technology, as well as natural casings.

If the type of casing is placed on the ingredient statement, it does not have to be in the proper order of predominance. The type of casing can be placed at the end of the ingredient statement. For example, the statement could read “packed in sheep casing,” “encased in collagen casing,” “in hog casing,” or “formed in collagen casings.”

The overall reasoning behind the new labeling protocol is to notify the consumer of specie content in the sausage product (i.e. beef sausage stuffed in natural hog casings).

Conclusion

Although casings have been utilized in the production of processed meat products for many years, each casing has various properties which need to be understood prior to manufacturing. Prior to processed meat production, I would suggest accumulating as much information as possible concerning the casing being utilized. Furthermore, contact your suppliers and distributors for specific information about the casings.

Reference

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