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Meat Technology

Salting and curing

Salting : means using of dry salt.

Curing : using of salt solution

Ingredients of salt mixture

Salt : is the basic for all curing mixtures

Salt act by dehydration and altering of osmotic pressure, so it inhibit bacterial growth

Only food – grade salt must be used

Reducing of salt in meat products in view of its relationship to hypertension in about 20% of the population

- Sodium chloride : potassium chloride
- 1 : 1

- High levels of potassium chloride have unacceptable bitter taste

Sugar

- For flavor
- Sugar soften the product
- Counteract saltiness effect of salt and hardening effect of salt petre

Nitrate and nitrite (saltpeter)

- Stabilize the colour of cured meat
- Characteristic flavor
- Inhibit growth of food poisoning bacteria (*Cl. botulinum*)
- Retard development of rancidity

Phosphates

- To increase the water-binding capacity
- Improve the water retention
- Cause unfold of muscle protein
- Phosphate also chelate trace metal ions
- Phosphate retard development of rancidity in meat products
- Because of the corrosive action of phosphates the equipments must be made of stainless steel or plastic.

Potassium sorbate

- Antimicrobial agent
- Used as preservative
- Inhibit mold growth
- Potent inhibitor of *Cl. botulinum* when used in combination with nitrite

Monosodium glutamate

- To enhance flavor

Hydrolyzed vegetable protein (HVP)

- Improve flavor efficiency .
- Increased protein content

Smoking

Smoking

- Purposes of smoking:
- 1- development of flavor
- 2- preservation
- 3- creation of new product
- 4- development of colour
- 5- protection from oxidation (antioxidant)

- One of the most important properties of smoke is its effect on bacterial population
- This is due to bactericidal and bacteriostatic effect
- These properties are attributed to certain components in smoke in the smoke such as phenols and acids.
- Removable of moisture from the surface of meat during smoking also retard and reduce bacterial growth.

Composition of smoke

- Phenols :
- Phenols plays three fold role in the smoking of meat and other food :-

1- They act as antioxidants

2-They contribute to the color and flavor of smoked products.

3-They have bacteriostatic effect that contribute preservation.

Colour development

- Is caused by the interaction of carbonyl in the vapor phase of the smoke with the amino group on the surface of the food

The characteristic flavor of smoked meat

- Is primarily due to the phenolic compounds in the vapor phase

The bacteriostatic action of smoking meat

- Is due to the combined effects of heating , drying and the chemical components in the smoke

Alcohols

- The most common and simplest of alcohols is methanol or wood alcohol
- The role of alcohol in wood smoke :-

1- carrier for other volatile components

2- Minor bactericidal effect

Organic acids

- As formic acid , acetic , propionic , butyric ……
- Organic acids have little or no direct influence on the flavor of smoked products
- Organic acids have minor preservative action
- Coagulation of the surface protein is enhanced by heat but acids also seem to be essential for good skin formation

Carbonyls

- Important to smoke colour , flavor and aroma

Hydrocarbons

- Carcinogenic

Gases

- Co2 and Co are readily absorbed on the surface of meat

Nature of smoke

- Although smoke at the point of generation exists in gaseous state it rapidly partions into vapor and particle state .

Vapor phase

- Contains the more volatile components and largely responsible for the characteristic flavor and aroma of smoke .

Particle phase

- Removal of particle phase by precipitation also greatly reduces the contents of tars and polycyclic hydrocarbons all of which are undesirable in smoke

Liquid smoke

- Advantage

1-doesnot require the installation of smoke generation.

2-composition of liquid smoke is more constant.

3-liqid smoke can be prepared with the particle phase can be removed and the possible problems from carcinogens can be avoided.

4- Liqid smoke application creates little atmospheric pollution.

- 5-liquid smoke application is faster than convential smoking.

Liquid smoke preparation

- Liquid smoke is prepared by pyrolysis of hardwood sawdust .
- The smoke captured in water by drawing counter current to water through an absorption tower .
- The smoke is recycled until the desired concentration is reached.
- The solution is then aged to allow time for polymerization and tar precipitation .
- It is then filtered through a cellulose pulp filter which filter any dissolved any dissolved hydrocarbons that are present in the liquid smoke

- The final product is composed primarly of vapor phase and contains mainly phenols, organic acids . Alcohols and carbonyl compounds
- They donot cntain polycyclic hydrocarbones espically benz (a) pyrene.
- All carcinogenic substances in the smoke are removed during production of liquid smoke

Application of liquid smoke

- There are a number of ways of adding liquid smoke to food products:-

1-adding it directly to the meat emulsion

2-dipping the product directly into the smoke solution .

3-spraying the smoke solution over the product

4-atomizing the liquid smoke into a dens fog and injecting it into the smoke house

- 5-vaporizing the liquid smoke by putting it on a hot surface.
- The latter three methods are commonly used for smoking meats with the spray method most frequently being utilized for continuous meat processing
- Liquid smoke preparations are usually diluted before applying to meat.

- Commercially prepared liquid smoke solutions are diluted with water or frequently with vinegar or citric acid.

20-30 parts liquid smoke

+ 5 parts citric acid or vinegar (to enhance skin formation on skinless frankfurter and other small sausage products)

+ 65-75 parts water

Raw materials

Raw materials

- For sausage and canned meat

For manufacturing of sausage and canned meat

- Lean skeletal beef and pork are the most desirable raw meat materials.
- Veal and mutton are less used in much smaller quantities.
- If used in excessive quantities mutton imparts an undesirable flavor to the finished product .

Federal meat inspection regulations

- Classified animal tissues used for preparation of comminuted meat products either:-
- 1- Meat : tissues must must be of skeletal origin and for purpose of labeling need only be referred to as beef , pork , veal or mutton.
- 2- Meat by products : non skeletal or smooth muscle tissue such as lips, pork stomach and cardiac muscle and must be listed separately in the ingredient statement printed on the package

In the trade sausage ingredients are classified as :

- 1- binder meat are further subdivided into high , medium and low categories depending on their ability to bind water and emulsifying fat .
- Meat with high binding properties are lean skeletal tissues such as whole carcase bull and cow meat, beef and pork cheek meat
- Veal are medium value as binder.
- Low binding meat contain alarge proportion of fat , smooth muscle or cardiac muscle tissue .

- 2- filler meat : meats with very poor binding properties . Their use in comminuted meat products should be limited if overall quality of sausage or canned meat products is to be maintained

Moisture protein ratio

- Of various tissues are important in preparing sausage formula

Fat content

- Of meat used for comminuted meat products is influenced primarily by carcase grade and particular cut or type of trimmings from the carcase.

Beef

- The following cuts of boneless processing beef
- Whole carcase bull meat
- Whole carcase cow meat
- Boneless beef (90 % lean)

Pork

- 1- boned primal cuts from heavy hogs
- 2- trimmings obtained during preparation of primal cuts for curing

Veal

- Either

1- whole carcass

2- veal trimmings

Mutton

- Usually in form of whole carcase meat is usued in processed meat products
- Mutton is usually dark in colour and contributes desirable pigment to comminuted sausage or canned meat formulation .
- Mutton has good binding properties but because of pronounced flavor its usage is usually restricted to 20% or less of total meat block.

Variety meats

- Variety meats are used in many comminuted processed meat products are tongue , liver , heart , tripe and pork stomach .

Mechanically deboned meat

- It is most commonly used in sausage . The level used should be carefully controlled however as too much can cause structural and flavor problems .
- In sausage the best levels appear to be from 5 to 10 %with amounts above 20 % having adverse effects .
- It can be originated from any of the species including beef , pork , lambs and poultry

- Meat inspection regulations requiring labelling to indicate that the products contain mechanically deboned meat

Poultry meat

- Use of poultry meat for producing processed meat has become increasing important in recent years with both chicken and turkey meat being widely used .
- Bone – in or boneless chicken and turkey breast and thighs .

Partially defatted tissue

- Partially defatted beef and pork tissues are subjected to low temperature rendering to remove fat without denaturation of the protein .
- Two types of partially defatted tissues

1- chopped tissues can be used in meat sausage in unrestricted amounts

2- fatty tissues : limited to 15%

Storage of raw materials

- The life of any raw material is related to :

1- sanitation : all raw materials should be handled under the most sanitary conditions possible.

2- refrigeration : meats should be chilled as rapidly as possible to approximately 30 F and maintained at this temperature until used .if trimmings are not be used within 5 days they should be frozen immediately and held at 0 F or below.

Undesirable conditions

- 1- PSE (pale soft exudative pork)

Pale soft watery pork

2- DFD (dark firm and dry pork)

3- PSS (porcine stress syndrome)

4- Two Toning

Is associated with muscular tissues of swine .

It refers to light and dark colour in the same surface or muscle . It is undesirable condition .

Both pale and dark colours are associated with pH and the content of myoglobin.

High pH meats are dark in colour and have good water binding and emulisifying properties .

Low pH meats are pale in colour and have poor water – binding and emulsifying properties.

Its effect is primarily from visual or aesthetic view point.

5- Dark Cutting Beef

- Dark cutters Have dark appearing lean muscle that failed to brighten on exposure to the oxygen in air .
- This condition occures in about 1-5% of all steer and heifer carcasses
- 6-10% of all cows
- 11-15% of young bulls

- This condition characterized by

A-having low glycogen reservoir

B – high pH 5.8 or above

C – low oxidation reduction potential .

D – it is more susceptible to spoilage and microbial growth.

6- Sex odour

- Sex odour refers to the objectionable odour which emanates pork when heated
- This odour refers to as boar odour
- Meat with pronounced sexual odour must be condemned and can not be used for food production
- Raw materials suspected of having sex odour can be checked by heating a small sample and sniffing the odour emanating during cooking

7- Mutton flavor

- Although mutton usually contributes highly desirable lean to processed meat formulations use should be limited to no more than approximately 20-25%of total meat block to avoid significant contribution to product flavor.
- Mutton flesh tend to be dark red .
- Cause of mutton flavor is not known definitely

But is related to the age of the sheep.

Sausage

Classification

- 1- according to degree of chopping
- A-coarsely ground
- B- emulsion or finely chopped
- 2-according to amount of cooking
- A-uncooked
- B-cooked
- 3-amount of smoking
- A-unsmoked
- B-smoked

- 4-amount of water added
- A- no water added B- water added
- 5- amount of curing
- A-uncured B-cured
- 6-amount of fermentation
- A-unfermented B-fermented

- 7-amount of moisture in final product
- A-fresh unsmoked or smoked
- B-smoked fresh and cured
- C-cooked fresh and cured smoked and unsmoked
- D-cured: smoked and unsmoked
- E- meat loaves and speciality items
- F-dried : smidry and dry

Classifying using USDA meat inspection system

- 1-fresh sausage : made of fresh uncured meat . Generally cuts of fresh pork and sometimes beef . Their taste texture , tenderness and colour are directly related to the ratio of fat to lean .

A-fresh pork sausage : made from fresh or frozen pork.

B- fresh beef sausage : made from beef

C- break fast sausage : may be made from fresh or frozen pork and / or beef and meat by products

- 2- uncooked smoked sausage : these products have all the characteristics of fresh sausage except they are smoked to give the product a different flavor and colour and they must be cooked before eating .

- 3- cooked sausage : frankfurter prepared from one or more kinds of raw skeletal meat and / or poultry meat.

They should not contain more than 35%fat and no more than 10% added water. May be either smoked or unsmoked. Poultry meat not more than 15%.

Liver sausage : made from fresh and or frozen pork and / or beef and pork livers and / or veal livers .

Liver not less than 30%of the fresh weight.

- 4-dry and semidry sausage : these products are produced by fermentation.
- After mixing the meat ingredients with the spices , cure and cultures the meat is held in a curing cooler until the desired acidity achieved .
- Then the meat is stuffed into casings and air dried under carefully controlled drying conditions.

- A-semidry sausage : they are generally have yield of 70-80 % of original weight.
- B- dry sausage : have a yield 60-70 % of original weight , are drier firmer and higher in price than semidry sausage

- 5-Luncheon meat , loaves

Cured cooked products is made from comminuted meat and may contain mechanically de boned meat . Water or ice may be added up to 3 % of total ingredients.

Steps in processing of sausage

- 1- grinding : meat chunks of variable size and shape and with variable fat contents are ground to uniform cylinders of fat and lean.
- 2- mixing : cylinders of fat and lean obtained by grinding are tumbled in a mixer to give a uniform distribution of fat and lean particles, and with addition of required ingredients to obtain the desired texture and uniformity of composition .

- 3- chopping : a chopper is often used as a means of batching the sausage mix. The mixed patch being transferred to an emulsifier for acquiring the desired texture.
- 4- emulsifying : it has the principles of grinding and chopping . Emulsifiers handle large volumes of meat rapidly to produce desired texture

- 5- stuffing : the sausage emulsion (mix , sausage dough or batter) it is transferred to stuffers for extruding into casings . At this point the size and shape of the product is determined .
- 6- linking and tying : after the emulsion is stuffed into casings , the encased mass is tied with thread or fastened with metal clips or mechanical device.

- 7- smoking and cooking : encased sausage at the time of introduction into the smoke house usually has an internal temperature of 60-70 F . During cooking this temperature rises to 155-160 F .

The important factors relating to the smoke house performance are as follows :

A- dimensions

B- time cycle

C- temperature range

D- thermal requirements

E- relative humidity

F- air flow

G- smoke density.

- 8- chilling : after smoking and cooking the product is showered with cold waterand chilled by refrigeration.
- 9- peeling and packaging : after proper chilling the product usually to an internal temperature of 35-40 F. the cellulosic casings on frankfurters are removed . This known as peeling operation and packaged.

Casings

- Casing are used to make most sausage as well as some other processed meat:
- They determine sausage sizes and shapes
- Casing must be sufficiently strong to contain the meat mass but have shrinkage and stretch characteristics that allow contraction and expansion of the meat mass during processing and storage.
- Must be able to withstand the forces produced during stuffing and the forces of linkage or closure.
- Years ago sausage production was limited by the amount of of avilable animal intestine . Since the advent of cellulosic casings , sausage production is limited only by the available meat supply.
- Casings for the meat industry are made of two basic materials cellulose and collagen

1- Animal casings

- The gastrointestinal tract is used for casings
- Bladders are used for special types of sausage.
- The structures are washed , scraped and treated with chemicals to remove soluble components.
- The vaious anatomical structures such as oesiphagus , stomach, small and large intestine . Appendix , and rectum are all separated , cleaned , salted and graded as to size , and conditions , and packaged in sutable containers for shipment and storage.

- Products in animal casings cost more
- Animal casings are usually edible so that consumers generally eats the casing along with the product.
- However the animal casings are less uniform in size , tends to be more fragile and require more care in stuffing.
- High quality products are put in animal casings because of their higher unit cost

2- Regenerated collagen casings

- Have many of the physical properties of animal casings and the uniformity and the cleanliness of cellulosic casings
- Are prepared from a suitable collagen source
- Are generally more uniform in size and strength than natural animal casing and are used for the same products.
- Their cost is higher than cellulosic casings so that products stuffed into collagen casings tend to be higher priced than those in cellulosic casings
- Since collagen casings are manufactured they can be made in a wide variety of sizes.

3- cellulosic casings

- Include those made from cotton bags and those derived from processed cotton linters.
- Advantages

1- their uniformity

2- cleanliness

3- ease of handling

4- they can be printed or pigmented to give attractive appearance for retail displays.

5-are avilable in many sizes and types

Additives

- The processing , handling , and storage of sausage for today's markets has required the use of additives to meet the demands of modern consumers
- Some of the common additives are water or ice , curing salts and chemical stabilizers such as antioxidants

1- ice or water

- Added to the meat mass provide considerable functional qualities
- The ice or water chills the meat during chopping or mixing operations which permits longer and more efficient churning of the meat mass without mechanical overheating
- Adding water aids in dissolving sodium chloride and curing salts to give better distribution in the mass
- Texture and tenderness of the finished sausage markedly affected by the added water content

2- salts

- Salts for sausage must be of food –grade quality
- Sodium chloride salt serves three functions in sausage

1- dissolve in water to form brine which acts to retard microbial growth .

2- it aids in solubilizing the myosin type protein of comminuted muscle for emulsifying the fat in emulsion sausage

3- it contributes to basic taste

Binders and extenders

- They are added to meat formulations for one or more of the following reasons

1- to reduce the formulation costs.
2- to improve cooking yield.
3- to improve slicing characteristics
4- to improve flavor.
5- to increase the protein content
6- to improve emulsion stability.
7- to improve fat binding
8- to increase water binding

- Cereals , starch, vegetables , flour ,soy flour , soy protein concentrate „ non fat dry milk and calcium –reduced non fat dry milkare permitted in finished sausage products .
- Non meat ingredients not more than 3-5 %.
- Soy protein not more than 2 %

Milk protein – dried extenders

- As non fat dry milk (NFDM)
- Calcium- reduced non fat dry milk
- Dried whey
- Whey protein concentrate
- Butter milk solids
- Casinate
- Are good food ingredients and are widely used as protein extenders in processed meat.
- Sodium and potassium casinate are widely used
- Skim milk

Yeast protein – dried extenders

- 1- dried yeast
- 2- yeast extract

Thank you