ANIQUEST – LPT CHAPTER 4.5. (SLAUGHTER HOUSE BY-PRODUCTS TECHNOLOGY)

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ANIMAL BYPRODUCTS

'Animal byproducts' are any byproducts from the slaughterhouse, butcher shop, or abattoir that aren't sold directly to consumers as food.

'Offal' is the term for by-products from the butchering of meat that comprises every portion of the animal that is not part of the carcass.

Meat Inspection Service-inspected wholesale edible by-products that are separated, refrigerated, and processed under hygienic circumstances are known as **'Variety meats'.**

Classification of animal byproducts:

1. **According to use as food:**

a. **Edible byproducts:** Those that are used for human consumption. Eg. Liver, kidney, heart, brain, etc.,

b. **Inedible byproducts:** Animals which die at slaughter house before slaughter or those parts which failed to pass meat inspection. Eg. Skin, ears, lips, horns etc

2. **According to origin:**

a. **Principal (Primary) by-product:** Those that are directly harvested from the animals immediately after slaughter. Eg. Skin, horn and hooves, blood etc

b. **Secondary byproduct:** Those that are derived from the principal byproducts. Eg. Blood meal, plasma, serum, leather, shoes etc

3. **According to the end use:**

a. **Agricultural byproduct:** Bone meal, meat meal, fertilizer.

b. **Industrial byproduct:** Glue, gelatin and casings.

c. **Pharmaceutical byproducts:** Pepsin, insulin and hormones.

BLOOD

- The blood meal yield amounts to approximately 1/5th of the original blood weight.
- With lysine making up 6-8% of the mix, it's a great supply of important amino acids.

- During bleeding around 50% blood is collected, remaining retained in capillary system
- Improperly bled animal carcass discolors quickly and keeping quality reduces.
- For human utilization blood is collected through a hollow knife, in sterilized container.
- If clotting of blood is not needed anticoagulant is used viz., sodium citrate, citric acid, sodium or potassium oxalate etc.
- Collected blood stored between 0-2º C temp.

Table 5.1. Blood yield from different species.

Species	Yield
Buffalo/cattle	10-12 kg
Goat/ sheep	1-1.5 kg
Pigs	2-3 kg
Poultry	30-50 g
Calves	1.5 kg

Table 5.2. Uses of blood

Feed	Lysine supplement and milk substitute
Food	Color additive, emulsifier, stabilizer, clarifier and nutritional component
Fertilizer	Soil pH stabilizer, seed coating and mineral components
Laboratory	Tissue culture media, albumin, blood agar, globulin
Medicine	Immunoglobulin, blood clotting factors, fibrinogen, serotonin, plasma extender
Industry	Adhesive, finisher for leather & textile, foam fire extinguisher, egg albumin substitute, plastic and ceramics

UTILIZATION OF BONE

- Bone constitutes almost 15 of the weight of dressed carcass
- In bone organic and inorganic mater remain in 1: 2 ratio
- Bone collagen is main organic constituent of bone
- Major inorganic matter contains

Calcium - 33%

Phosphorus - 15%

TYPES OF BONE

Green bone:

- Freshly acquired bone from slaughter house
- Heavy and contains high moisture, fat and protein
- Composition

Moisture: 50%

Bone marrow: 15%

Organic matter: 12%

Inorganic matter: 23%

Desert bone:

- Decomposed bone
- Exposed to bacterial and other atmospheric action for long time
- Devoid of meat, fat and tendon
- Light in weight and contains dried ossein, and lesser minerals

BONE MEAL

- Contains bone pieces less than 2 mm diameter
- Good source of phosphorus supplement to livestock
- Conversion of desert bone to bone meal is economically viable
- Yield of bone meal is 1:3
- Quality depends upon the Ca: P ratio which should be 2:1.

GELATIN AND GLUE

(Chemically no difference, lower grade gelatin called glue)

- It is derived from albuminoid class of protein
- Pure form is amorphous and transparent
- It can absorb water 5 10 times
- Brittle when dry, soften when heated then decomposes
- Hide skin trimming, ear pieces, tendon use for glue preparation, called glue stock

Use

- Gelatin is used in chocolate, jellies, ice cream as foaming agent, capsule coating, binders in tablets, blood extender etc.
- Sizing agent in leather and textile industry
- Glue is used as adhesive for plywood, furniture etc.

UTILIZATION OF HOOFS (SHIN BONE)

- Shin bone separated from hoof can be used for neat foot oil (NFO) preparation
- Pure NFO is pale yellow liquid substance
- Does not solidify and dry at freezing temperature

Use

- Lubricant for delicate machinery in aeroplane, ship, watch etc.

UTILIZATION OF HORN

- Good source of gelatin
- Production of meal mixing with bone
- Articles like buttons, comb, handles, decorative pieces

Hoof and horn meal

- In rendering unit, it is prepared
- Excellent nitrogenous fertilizer (never used as animal feed, its digestibility is very less)

UTILIZATION OF INTESTINE

Intestines of sheep, goat, pigs or cattle are a four layered structure:

a. Serous coat – outermost layer
b. Muscular coat – longitudinal and circular
c. Submucous coat (Tela submucosa) – composed of dense connective tissue (collagen) **used for casing preparation**
d. Mucous coat – innermost soft layer

Casings can be classified as one of the general types.

- Natural
- Artificial and
- Reconstituted collagen.

Natural

Edible use: The small intestines of sheep, goat, cattle and pigs, sometimes urinary bladder when used as food containers are called as Casings.

- The submucous layer of small intestines from sheep, pigs, and cattle is used to prepare the casings.
- The other three layers of intestines are removed.
- Casings are grouped and sorted on the basis of length, diameter and quality (holes, workmanship, and strength).
- Natural casings have the advantages of being edible, allowing greater smoke penetrations and conforming to the size of the sausage during cooking and drying.

Non edible use: this may be in the form of catgut, strings for racket and musical instruments.

Artificial Casings

- Cellulose
- Inedible collagen
- Edible collagens and
- Plastic.

Steps in casings preparation

The essential steps in preparation of casings are associated with the removal of the intestinal tract at the slaughtering plant are:

a. Removal of intestines,

b. Running or pulling – Detachment of intestines from loose mesentery
c. Chilling at 10ºC,
d. Stripping – Squeezing out of intestinal contents,
e. Flushing with water
f. Fatting – fat removal,
g. Fermentation for 1-2 days by immersion at 20ºC,
h. Turning – For cattle and buffalo only,
i. Sliming – Removal of tissue layers with sliming stick or plastic knife at an angle of 30º,
j. Measuring
k. Inspection and grading
l. Preservation

Table. 5.3. Different terminologies of casings

Casings	Generally, refers to sheep and goat intestine alone
Rounds	Casings from small intestine mainly of cattle but also from sheep, goat or pig
Runner	Casings from small intestine of cattle
Middle	Casings from large intestine of cattle or sometimes pig
Weasand	Casings from oesophagus of all species
Bung	Casings from the caecum
Bladder	Casings from urinary bladder of cattle or pig
Maws or stomachs	Casings from cleaned pig stomach
Chitterlings	Casings from part of large intestine of pigs
Hank	Set of sheep, goat, hog casing of 91.4 m long
Bundle	Set of beef casing of 18 m long

Table 5.4. Factors effecting casing quality

Cleanliness	Clean & sound, stain free, devoid of fat, parasite nodules, ulcer, defects
Strength	Strong enough to withstand pressure during filling, stuffing & processing
Length	Standardized (sheep & hog-91.4 m, beef round-18 m)
Caliber (thickness)	Sheep-14 mm, hog-35 mm, beef- 35 mm
Curing	Two types, salted & cleaned, some time it may be dried
Packaging	Mainly wooden and plastic container

Table 5.5. Comparison of different casings from different sources

Characteristics of casings	**Natural**	**Collagen**	**Cellulose**
Refrigeration storage	Yes	Yes	No
Break during processing	Most likely	Less likely	Least likely
Degree of tenderness	Most tender	Less tender	Peeled
Casing preparation cost	Most expensive	None	None
Ease of penetration	Most	Less	Least
Soaking and flushing before use	Yes	No	Sometime Soaking
Cost of stuffing	Most	Less	Least
Best product yield	Least	Less	Best
Best machinability	Least	Less	Best
Smoke product penetration	Best	Very good	Good
Cost of casing removal	None	None	Most
Finished product uniformity	Less	Good	Good
Shelf life without overwrap	3-4 days	6-8 days	7-10 days
Printability	None	Limited	Best
Ease of plant storage	Least storage	Less storage	Best storage
Old-world appearance	Best	Less	None

RENDERING

The term rendering refers to extraction of fat or oil by heat. (Or) It is the procedure of removing fat from animal tissues by heating the cells to a point where the melted fat is released from the cells.

It involves two classes:

Edible rendering: to provide materials suitable for human consumption.

Inedible rendering: to provide materials suitable for animal feed and other inedible purposes.

Rendering methods:

1. Wet rendering
2. Semi-continuous wet rendering
3. Dry rendering
4. Low temperature rendering (LTR system)

Yield of the product:

- Higher the moisture content lower will be the yield
- Moisture should not exceed 7 percent

The factors that influence the yield are:

1. Type of rendering
2. Speed of operation
3. Pressure used
4. Human factor

In general, the yield in Dry rendering process is **3:1**

Wet rendering process is **4:1**

Blood meal preparation is **5:1**

Hide and skin

- Most valuable animal by products. Constitute around **4-11%** of live animal weight. In tannery, the skin and hide are converted into leather.

- Small hides, defined as those weighing less than 13.62 kg (30 lb) after curing, are referred to as **"skin"** in cattle.
- The **grain side** of hides and skins is the part that has the oil and hair glands. The hide's or skin's **flesh side** is substantially softer and thicker.
- A **"native" hide** is one that is not branded, whereas a **"Colorado"** or **"Texas hide"** denotes that the hide is branded on the side or butt.
- **'Country'** or **'small-packer hides'** denote that the skins were removed by less trained labor, whilst **'big-packer hides'** allude to hides that were removed from the carcass by skilled labor.
- A hide that has been extracted from an animal that died for a reason other than slaughter is referred to as a **"renderer"** or **"murrain hide".**

FLAYING

- Removal of skin or hide
- Enough watering at antemortem facilitates flaying
- Hoisting of animal improves bleeding, good keeping quality of hide

Types:

- **Hide pulling** - Using hide puller
- **Knife skinning**
  - With conventional skinning knives
  - Air driven reciprocating skinning knives
- **Hide separation**- Pumping compressed air into carcass

CHARACTERS OF WELL FLAYED HIDE

- Rounded rump
- Medium length in the shank
- Equal width from center line of back to belly edge on each side
- Square outline
- Regular dewlap

TANNING

- The process of turning unfinished hides or skins into leather is called tanning.
- Tannic acid and other chemicals that stop decomposition, make hides and skins waterproof, and maintain their suppleness and durability can be absorbed by them.
- In essence, tanning is the result of the collagen fibers in the hide reacting with chemicals such as tannins, alum, chromium, or others. Trivalent chromium and vegetable tannins that are taken from particular tree barks are the most often used tanning agents.
- Additional tanning agents include formaldehyde, glutaraldehyde, alum, and synthetic compounds.
- Sheep, goats, and cattle produce the three kinds of hides and skins that are most frequently utilized in the production of leather.
- Some of the steps involved in tanning process are as follows:

i. Warehousing and sorting
ii. Soaking
iii. De-fleshing
iv. Liming
v. Bating, pickling, tanning
vi. Samming
vii. Splitting
viii. Skiving
ix. Neutralizing, dyeing and greasing
x. Drying
xi. Staking
xii. Finishing

TANNING PROCESS

i. **Warehousing and sorting:** Skins are preserved in salt and stored in controlled cool rooms. Before processing, they are pre-sorted based on quality and weight.

ii. **Soaking:** The skins are immersed in water to remove dirt and salt.

iii. **De-fleshing:** Tissue, flesh, and fat remnants are removed from the skins using a roller-mounted knife.

iv. **Liming:** Lime and sulfur compounds are added to remove hair from the skins.

v. **Bating, pickling, tanning:** Skins undergo treatment with acid and salt during bating and pickling to prepare for tanning. Tanning occurs when the skin fibers absorb tanning agents, transforming the skin into leather.

vi. **Samming:** Water is removed from the skins during this process.

vii. **Splitting:** Leather is reduced to a specified thickness to achieve evenness. The resulting split leather can be further processed.

viii. **Skiving:** Grain leather is leveled to an even thickness, irregularities are removed from the reverse side, and the leather is sorted into color batches.

ix. **Sorting:** Leather is sorted into various quality grades.

x. **Neutralizing, dyeing, and greasing:** The acidity resulting from tanning is neutralized, followed by dyeing using anilin dye stuffs. Greasing is then applied to achieve the desired softness.

xi. **Drying:** Two methods are used: vacuum drying, where moisture is removed by suction, and hanging drying, where leather is hung and passed through ovens.

xii. **Staking:** After drying, leather is mechanically softened through staking, followed by further processing in preparation for finishing.

xiii. **Finishing:** Leather undergoes final surface treatment and appearance enhancement through processes such as base coating, coloring, embossing, and ironing to achieve an attractive appearance.

COLLAGEN

- All tissues of multicellular creatures include collagen, which is the predominant protein in connective tissue and can be found in many forms.
- Collagen can easily be derived from slaughter by products
- The skin, tendons, cartilage, and bones are the primary sources of collagen found in slaughterhouse waste.
- Although collagen lacks necessary amino acids, which makes it extremely low in nutritional value, it is a great source of bioactive peptides.

- Approximately 35% of collagen is made up of glycine (Gly), 11% Alanine (ALA), 21% Proline (Pro), and Hydroxyproline (Hyp)
- One distinctive quality of collagen is its high hydroxyproline content, which accounts for approximately 14% of its dry weight. As a result, it is straightforward for chemical techniques to identify collagen in tissues by measuring the amount of hydroxyproline attached to proteins in those tissues.

Uses

The food business has a high need for gelatin and collagen due to their;

- High protein content
- Functional characteristics, such as the capacity to absorb water, produce gels, and create and maintain emulsions
- Source of bioactive substances having antibacterial, antihypertensive, and antioxidant qualities.

EXTRACTION OF COLLAGEN

- Acid or alkali pretreatment
- Chemical hydrolysis and enzymatic hydrolysis. Commonly used chemical methods are
- Salting out method,
- Acid hydrolysis,
- Alkaline hydrolysis

BYPRODUCTS OF GLANDULAR SOURCES

- Constitutes Approx. 0.28% of animal's live weight and used in medicine for healing power
- Potent sources of antidiabetics, endocrines, adrenaline & sympathmimetics. Enzymes, food supplements, biological chemicals & vitamins are obtained.
- Can be consume directly (pancreas)

Gland collection

- Collected from healthy animals and excised from animal within 15-20 mins where it should be chilled immediately in metal container

- Fat & connective tissue is trimmed off and contact with water is avoided and frozen at -18 to -20ºC
- Immediately packed devoid of air whereas acetone dried powder may be alternative way of storage

Table 5.6. Some glandular byproducts.

S.No.	Primary Byproducts	Secondary Byproducts
1	Pancreas	Insulin, Glucagon
2	Lung	Heparin
3	Calf stomach	Rennin
4	Adrenal gland	Adrenalin
5	Pig stomach	Pepsin
6	Brain	Cholesterol
7	Thymus	Deoxyribonuclic acid
8	Thyroid gland	Thyroxine
9	Parathyroid gland	Parathormone
10	Testes	Hyaluronidase enzyme, Androgen
11	Ovaries	Estrogen, Progesterone and relaxin
12	Gall	Cholic acid , deoxycholic acid

References:

1. **Animal By-Products Processing – H. W. Ockerman & C. L. Hansen**
2. **Outlines of meat science and technology – B.D. Sharma**

QUESTION BANK

ANIQUEST – LPT CHAPTER 4.5. (SLAUGHTER HOUSE BY-PRODUCTS TECHNOLOGY)

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1. **……** refers to meat-slaughter by-products that includes all of the animal which is not a part of the carcass whereas **…….** are the wholesale edible by-products that are segregated, chilled and processed under sanitary conditions and which are inspected by the Meat Inspection Service.
2. The yield of edible by-products from meat animals ranges from ……..(sometimes higher for fat animals) of the live weight for beef, pork and lamb and from ……..of the live weight for chickens.
3. The left side of the carcass is termed the ……side and usually contains less kidney suet (fat) than the right side (……) that contains an elliptical kidney which is fixed to the abdomen.
4. Choose the correct statements:
   a) Sweetbreads are obtained from calves, lambs and young cattle.
   b) Three different tissue locations (cervical, thorax and gut) in these animals are sometimes labelled 'sweetbreads'.
   c) Different names are neck sweetbread (cervical), heart sweetbread (thorax) and gut sweetbread (pancreas)
   d) Low in color values and high in collagen content.
      i) A, b, c are correct ii) Only b & d are correct
      ii) All statements are correct iv) Only a & b are correct
5. **……** is produced from the first (rumen) and second stomachs (reticulum) of cattle.

6. The ash obtained by complete burning of bones with free access to air at 600 - 800º C for 4-5 hours is called **……..**

7. Which byproduct is produced through the hydrolysis of animal collagen?

   a) Tallow b) Keratin c) Gelatin d) Elastin

8. Which process involves the extraction of fats from animal byproducts?

   a) Coagulation b) Emulsification c) Rendering d) Hydrolysis

9. A) Poultry giblets include the heart, liver and gizzard

   B) It can be stored in parchment paper or aluminium foil.

   a) Both A & B are wrong b) Both A & B are Correct

   c) A is wrong & B is correct d) A is correct & B is wrong

10. A) Proteinaceous by-products would yield nitrogen fertilizer

B) Bone produce phosphate fertilizer.

a) Both A & B are wrong b) Both A & B are Correct

c) A is wrong & B is correct d) A is correct & B is wrong

11. A) Tallow is referred to as the rendered fat of cattle and sheep

B) Lard is the rendered fat of the hog.

a) Both A & B are wrong b) Both A & B are Correct

c) A is wrong & B is correct d) A is correct & B is wrong

12**. ……** refers to the softness or hardness of animal fats expressed as the temperature at which the free fatty acids of the given fat solidify.

13. The quality of animal fat both edible and inedible is judged by

a) Titre b) free fatty acid (FFA)

c) FAC colour or Lovibond colour

d) Moisture impurities (insoluble) and unsaponifable matter (MIU)

i) a, b, c are correct ii) Only b & d are correct

iii) All statements are correct iv) All statements are wrong

14. The amount of …….in a tallow is an indication of the degree of spoilage which has taken place.

15. a. Water in tallow is undesirable because it acts as a medium for the growth of bacteria and the action of fat-splitting enzymes.

b. Moisture is expressed as parts per centum (parts per hundred by weight).

c. Moisture levels around 0.2% are desired.

i**)** a, b, c are correct ii) Only b & c are correct

iii) Only a & b are correct iv) All statements are wrong

16. a. the bleach test is a good indication of the temperatures and handling condition to which a tallow has been subjected.

b. The bleach test is a colour test using an activated clay and a Lovibond tintometer.

c. Only red readings are used because there is a direct relationship between red and yellow readings.

i**)** a, b, c are correct ii) Only b & c are correct

iii) Only a & b are correct iv) All statements are wrong

17. Fresh fats have a peroxide value of……, whereas rancid fats have a peroxide value of ……

18. ……. has a direct relationship with FFA and is the temperature to which the fat may be heated before it begins to smoke.

19. A major use of inedible tallow and grease (higher titre) of animal origin is as a high-energy additive to…….

20. Edible tallow and lard are used in

a) oleomargarine (margarine) b) shortenings c) cooking fats d) All the above

21. In continuous rendering system, size reduction is accomplished with rotating knives called ……. or with rotating hammer devices called …….

22. The modern continuous wet- rendering system is referred to as …….

23. Dry-rendered meal has a fat content of …… compared with meal from LTR systems where the fat level is …….

24. What is the proportion of hide in the weight of the live animal?

a) 4-11% b) 4-6% c) 4-15% d) 4-25%

25. What is the term used for small hides, and in cattle these are those weighing less than 13.62 kg (30 lb) after curing?

a) Packer hide b) Skin c) Pelt d) All the above

26. ……. is the skin of an animal with the fur or hair still on it.

a) Hide b) Skin c) Pelt d) All the above

27. The hide which is branded on the butt or on the side …….

a) Colorado hide b) Texas hide c) Both a & b d) None of the above

28. The hide which is unbranded is called as …….

a) Country hide b) Native hide c) Both a & b d) None of the above

29. The hides that were removed from the carcass by skilled labour is ……

a) Colorado hide b) Small packer hide c) Murrain hide d) Big packer hide

30. The hides that were removed from the carcass by unskilled labour is ……

a) Small packer hide b) Country hide c) Both a & b d) None of the above

31. The hides that were removed from the carcass of dead animal is ……

a) Renderer hide b) Murrain hide c) Both a & b d) b only

32. The hides that were removed from unborn calf is ……

a) Pelt b) Bush hide c) Murrain hide d) Slunk

33. In bovine animals the hair root extends about ……, but in swine the hair follicle ……..

34. Hair is composed almost entirely of the protein ……, which normally accounts for ……..of the total hide protein.

35. It takes …… knifemen approximately ……. seconds to remove one cattle hide manually.

36. Hide pulling technique increases carcass yield in cattle of approximately ……% when compared to the knife-skinning.

a) 2% b) 4% c) 6% d) 8%

37. Find the odd one out with regards to advantages of hide pulling technique:

a) less-skilled labour and less hide damage

b) lower manpower

c) higher carcass contamination risk

d) increase in carcass yield

38. After hide removal from any animal, the hide should be quickly …….in order to arrest bacterial and enzymatic decomposition or spoilage.

39. …….. is the most common method of curing hides today

40. The term used for removal of hide is……

a) Rodding b) Evisceration c) Flaying d) Bunging

41. Choose the correct statement:

a) Glue and gelatine are physically and chemically similar.

b) The major difference is that gelatine is made from fresh, federally inspected raw materials in a sanitary manner which allows the product to remain in an edible condition

i) Both a & b are wrong ii) Both a & b are correct

iii) a only iv) b only

42. Crude form of gelatine is ……

a) collagen b) glue c) gelatin d) ossein

43. Pure protein from collagen is ……

a) Isinglass b) glue c) gelatin d) ossein

44. Gelatine obtained from fish bladder is ……

a) Isinglass b) glue c) gelatin d) ossein

45. Demineralized bone is ……

a) Isinglass b) glue c) gelatin d) ossein

46. The quantity of …… and …… amino acids is often used as an index of the quantity of collagen in a protein mixture.

a) Proline and glycine
b) Proline and hydroxyproline
c) Glycine and hydroxyproline
d) Glycine and tryptophan

47. The process of conversion of collagen to glue and gelatin consists of:

a) removal of non-collagenous compounds from the new material with as little alteration to the collagen as possible

b) controlled hydrolysis of collagen to gelatine

c) the recovery and drying of the finished product

i) a, b, c are correct ii) Only b & c are correct
iii) Only a & b are correct iv) All statements are wrong

48. Complete hydrolysis of collagen yields …….. whereas partial hydrolysis of collagen yields ……. .

49. Choose the correct statement:

a) The most widely used commercial system for the processing of collagen into glue and gelatine is the alkaline hydrolysis system.

b) The most widely used commercial system for the processing of collagen into glue and gelatine is the acid hydrolysis system.

c) Alkaline hydrolysis produces type B gelatin

d) Acid hydrolysis produces type A gelatin

i) a, b, c are correct b) a, b, d are correct c) a, c, d are correct d) b, c, d are correct

50. Uses of gelatine are …….

a) food thickening agent and emulsifying agent

b) Manufacturing pharmaceutical capsules

c) Moisturizing agent, gelatine foam powder and plasma extender

d) Photography and Smokeless gunpowder

i) a, b, c are correct b) a, b, c, d are correct c) a, c, d are correct d) b, c, d are correct

51. Choose the correct statement.

a) An acid-treated precursor (type A) which has an isoelectric point between pH 7 and 9.5

b) An alkali-treated precursor (type B) which has an isoelectric point between 4.7 and 5.5

c) The molecular size of gelatin does not influence their physical properties.

i) a, b, c are correct ii) a & b only iii) b & c only iv) a & c only

52. For human consumption, the USDA limits the calcium level of mechanically separated red meat to ……..%

a) 0.25 b) 0.50 c) 0.75 d) 1.00

53. The dicalcium phosphate yield is approximately ……% of the raw-bone weight and is used in animal feed.

a) 25 b) 50 c) 75 d) 100

54. Which is the ideal raw material for preparation of bone char?

a) Bone meal b) Bone sinews c) Bone grits d) None of the above

55. Blood meal is rich in ……

a) Methionine b) Lysine c) Leucine d) Proline and hydroxyproline

56. Choose the correct statement.

A) The bones obtained from freshly killed animals which still contain a high percentage of moisture, fat and proteins.

B) The bones obtained from fresh animals which are exposed to bacteria, atmosphere and insect action for long time and contain only calcium, phosphorus and dried ossein.

a) A only b) B only c) Both A & B d) None of the above

57. Technical fat is used for making……

a) Edible oil b) Candle c) Petrol d) Soap

58. Heparin can be produced from ……

a) Lungs b) Liver c) Intestinal mucosa d) All the above

59. Abomasum of milk fed and un-weaned large ruminants is source of ……

A) Rennet B) Rennin C) Renin D) Pepsin

a) A, B, C, D are correct b) A & B are correct c) A& C are correct d) B only

60. The enzyme extracted from mucosa of hog stomach is ……

a) Rennet b) Rennin c) Hcl d) Pepsin

61. Glands constitutes approx. ……% of animal's live weight and excised from animal within ……. Mins

a) 0.28 & 15-20 b) 0.28 & 5-10 c) 0.58 & 5-10 d) 0.58 & 15-20

62. The alternate way of storing glands is ……

a) Glycerol dried powder b) Acetone dried powder

c) Formalin dried powder d) Freeze dried powder

63. …….. is the process of converting raw hides or skins into leather.

64. The most common tanning agents used are …….. and …….. extracted from specific tree barks.

a) Trivalent chromium and vegetable tannins b) Trivalent chromium and alum

c) Trivalent chromium and syntans d) Vegetable tannins and formaldehyde

65. In casing preparation, 'Turning' step is carried out in which species?

A) Cattle B) Buffalo C) Sheep D) Goat

a) A & C only b) B & C only c) A & D only d) A & B only

66. Casings are obtained from which layer of intestine?

a) Serosa b) Sub-Mucosa c) Mucosa d) Muscular

67. The term used for squeezing the intestine to force out the contents is ……

a) Flushing b) Stripping c) Pulling d) Fatting

68. The removal of tissue layers with the help of plastic knife or shells is called as …… and is done with knife kept at an angle of…….

a) Sliming & 30º b) Sliming & 45º c) Stripping & 30º d) Stripping & 45º

69. The standard length of sheep and hog casings is …… meters per hank

a) 91.4 m b) 91.8 m c) 91.2 m d) 91.6 m

70. The standard length of beef rounds is …… meters per bundle

a) 12 m b) 14 m c) 16 m d) 18 m

71. Casings obtained from cleaning pig stomach is …….

a) Chitterlings b) Maws c) Bung d) Weasand

72. Casings obtained from caecum is …….

a) Chitterlings b) Maws c) Bung d) Weasand

73. Casings obtained from oesophagus of all species is …….

a) Chitterlings b) Maws c) Bung d) Weasand

74. Chitterlings and middles are the obtained from large intestines of …… and ……. species respectively.

a) Cattle & Pig b) Sheep and Cattle c) Cattle and Sheep d) Pig and Cattle

75. ……. is an important by-product obtained from cattle feet and by the process of ……

a) Neets foot oil & Wet rendering b) Neets foot oil & Dry rendering

c) Button & Wet rendering d) Button & Dry rendering

76. The process of extraction of fat or oil from animal tissues by the application of heat is……...

77. The yield in dry rendering process is ……

a) 2:1 b) 3:1 c) 4:1 d) 5:1

78. The yield in wet rendering process is ……

a) 2:1 b) 3:1 c) 4:1 d) 5:1

79. The yield in bone meal preparation is ……

a) 2:1 b) 3:1 c) 4:1 d) 5:1

80. …… is obtained by complete burning of granular bones without air at 600 - 800º C.

a) Bone sinews b) Bone Char c) Bone ash d) Bone china

81. Match the following:

Table – I	Table – II
1) Pluck	a) Diaphragm
2) Giblet	b) Lungs, trachea & heart
3) Maws	c) Gizzard, liver & heart
4) Skirt	d) Stomach

82. Match the following:

Table – I	Table – II
1) Rumen	a) Honeycomb
2) Reticulum	b) Bible
3) Omasum	c) Reed Tripe
4) Abomasum	d) Paunch

83. Match the following:

Table – I	Table – II
1) Tallow	a) Pig fat
2) Lard	b) Delicate machinery
3) Technical fat	c) Cattle fat
4) Neets foot oil	d) Soap industry

84. Match the following:

Table – I	Table – II
1) Heparin	a) Calf stomach
2) Rennin	b) Pig stomach
3) Pepsin	c) Testes
4) Hyaluronidase	d) Lungs

85. Match the following:

Table – I	Table – II
1) Casings	a) Oesophagus
2) Maws	b) Caecum
3) Weasand	c) Stomach
4) Bung	d) Sausage container

86. Match the following:

Table – I	Table – II
1) Gelatin	a) Alkali treatment
2) Collagen hydrolysate	b) Acid treatment
3) Type A gelatin	c) Partial hydrolysis of collagen
4) Type B gelatin	d) Complete hydrolysis of collagen

87. Match the following:

Table – I (Temperature of extraction)	Table – II (Gelatin quality)
1) 55-60 ºC	a) Low quality gelatin

2) 65-70 ºC b) Good quality gelatin
3) 80 ºC c) Glue
4) 100 ºC d) Medium quality gelatin

88. Match the following:

Table – I	Table – II
1) Glue	a) Fish bladder gelatine
2) Gelatin	b) Crude form of gelatine
3) Ossein	c) Pure protein from collagen
4) Isinglass	d) Demineralized bone

89. Match the following:

Table – I	Table – II
1) Bone grits	a) Bone grits
2) Bone meal	b) Resting on 2.5mm sieve
3) Bone sinews	c) Passes the 2.5mm sieve
4) Bone char	d) Fibrinous & tendinous portion

90. Match the following:

Table – I	Table – II
1) Green bones	a) Hide from fallen animals
2) Dessert bones	b) Leather
3) Tanning	c) Bones from fallen animals
4) Bush hide	d) Bones from freshly killed animals

91. Match the following:

Table – I	Table – II
1) Hide	a) Hairy side
2) Skin	b) Thick and softer side
3) Grain side	c) Cattle

4) Flesh side d) Sheep, Goat & Calf

92. Match the following:

Table – I	Table – II
1) Fleshing	a) Proteolytic enzymes
2) Bating	b) To adjust firmness or softness
3) Sammying	c) To remove excess moisture
4) Fat liquoring	d) To remove excess flesh

93. Match the following:

Table – I	Table – II
1) Bone ash	a) 3-4 hrs
2) Bone char	b) 1.5-2 hrs
3) Wet rendering	c) Presence of air
4) Dry rendering	d) Absence of air

94. Match the following:

Table – I	Table – II (Protein content)
1) Raw bone meal	a) less than 55%
2) Meat meal	b) 26%
3) Meat cum bone meal	c) more than 80%
4) Blood meal	d) not less than 50%

95. Match the following:

Table – I	Table – II
1) Hide	a) Brushes
2) Bristles	b) Neat's foot oil
3) Horns	c) Leather
4) Hoofs	d) Artifacts

96. Match the following:

Table – I	Table – II
1) Wool	a) Insulin

2) Intestine b) Lanolin
3) Pancreas c) Pet foods
4) Edible offal d) Casings

97. Match the following:

Table – I	Table – II
1) Adrenal gland	a) Cholesterol
2) Brain	b) Adrenalin
3) Thymus	c) Glue
4) Skin trimmings	d) Deoxyribonucleic acid

98. Match the following:

Table – I	Table – II
1) Caul fat	a) Kidney fat
2) Leaf fat	b) Back fat
3) Suet	c) Peritoneal fat
4) Cutting fat	d) Omental fat

99. Match the following:

Table – I	Table – II
1) Sweetbread	a) Testicles
2) Tripe	b) Thymus
3) Chitlings	c) Intestines
4) Fries	d) Stomach

100. Match the following:

Table – I	Table – II
1) Principal byproduct	a) Fibrin
2) Secondary byproduct	b) Blood
3) Industrial byproduct	c) Pepsin
4) Pharmaceutical byproduct	d) Casings

ANSWERS:

1) **Offal & Variety meats**
2) **20 to 30% & 5 to 6%**
3) **'raison' or 'open' & 'closed'**
4) **ii. All statements are correct**
5) **Tripe**
6) **Bone ash**
7) **c) Gelatin**
8) **c) Rendering**
9) **b) Both A & B are Correct**
10) **b) Both A & B are Correct**
11) **b) Both A & B are Correct**
12) **Titre**
13) **iii) All statements are correct**
14) **FFA (free fatty acid)**
15) **i) a, b, c are correct**
16) **i) a, b, c are correct**
17) **1-2 & 15-20**
18) **Smoke point**
19) **livestock and poultry feed**
20) **d) All the above**
21) **'hogors' & 'hammer mills'**
22) **low-temperature or mechanical rendering**
23) **10-16% & 3-8%**
24) **a) 4-11%**
25) **b) Skin**
26) **c) Pelt**
27) **c) Both a & b**
28) **b) Native hide**
29) **d) Big packer hide**
30) **c) Both a & b**
31) **c) Both a & b**
32) **d) Slunk**
33) **one-third the depth of the corium & penetrates the corium and extends down into the subcutis**
34) **Keratin & 6-10 %**
35) **3-5 & 120**
36) **a) 2%**
37) **c) higher carcass contamination risk**
38) **Cured**
39) **Raceway curing**
40) **c) Flaying**
41) **ii) Both a & b are correct**
42) **b) glue**

43) c) gelatin
44) a) Isinglass
45) d) ossein
46) b) Proline and hydroxyproline
47) i) a, b, c are correct
48) collagen hydrolysate & gelatin
49) c) a, c, d are correct
50) b) a, b, c, d are correct
51) ii) a & b only
52) c) 0.75 %
53) a) 25 %
54) c) Bone grits
55) b) Lysine
56) a) A only
57) d) Soap
58) d) All the above
59) b) A & B are correct
60) d) Pepsin
61) a) 0.28 & 15-20
62) b) Acetone dried powder
63) Tanning
64) a) Trivalent chromium and vegetable tannins
65) d) A & B only
66) b) Sub-Mucosa
67) b) Stripping
68) a) Sliming & 30º
69) a) 91.4 m
70) d) 18 m
71) b) Maws
72) c) Bung
73) d) Weasand
74) d) Pig and Cattle
75) a) Neets foot oil & Wet rendering
76) rendering
77) b) 3:1
78) c) 4:1
79) d) 5:1
80) b) Bone Char
81) b c d a
82) d a b c
83) c a d b
84) d a b c
85) d c a b
86) c d b a
87) b d a c
88) b c d a

89) b c d a
90) d c b a
91) c d a b
92) d a c b
93) c d a b
94) b d a c
95) c a d b
96) b d a c
97) b a d c
98) d c a b
99) b d c a
100) b a d c