A POCKET GUIDE TO

AUSTRALIAN RENDERED ANIMAL PRODUCTS

Australian Renderers Association

2024

AUSTRALIAN RENDERED ANIMAL PRODUCTS WORLD-CLASS SAFETY & SUSTAINABILITY

Australian Renderers are globally recognised for producing the safest, highest quality, sustainable rendered products.

Governed by strict regulations and subject to rigorous external audits, our products are guaranteed to be free from transmissible animal diseases.

The entire rendering process is closely monitored, ensuring a clean, green output that reflects Australia's commitment and reputation for biosecurity, quality, and Sustainability.

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Australian Renderers Association Inc.

The ARA Member Directory is available on our website
www.ausrenderers.com.au

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THE AUSTRALIAN RENDERERS ASSOCIATION INC.

The Australian Renderers Association Inc. (ARA) is the national body in Australia representing the interests of producers and traders of rendered animal products at State and Federal Government levels and in various forums where industry representation is needed. While the ARA does not engage in commercial issues, it plays a crucial role in facilitating trade in rendered products both domestically and internationally.

Australian Renderers Association

History and Development:

Formation: The ARA began as the Australian Meat & Bone Meal Shippers and Producers Association, initiated by Mr. Brian Bartlett (the first National President) in early 1976. Initial concerns included shipping freight rates, and restrictive Federal Government controls on the export of meat and bone meal, which were successfully addressed over time.

Name Change: In 1989, the Association was renamed to its current title to better reflect its role. This change coincided with the emergence of Bovine Spongiform Encephalopathy (BSE) in the UK. The ARA responded proactively by introducing Accreditation Workshops for the Hygienic Production of Rendered Products and developing a Code of Practice for the Hygienic Rendering of Animal Products.

- **Educational Initiatives:** The first International Symposium was held in August 1991, and such symposia have been conducted bi-annually since. These efforts have significantly contributed to education within the industry.

Accreditation and Standards:

- **Code of Practice:** The ARA accredits rendering establishments that comply with the Code of Practice for Hygienic Rendering. Accredited plants must meet compliance levels exceeding those required by the Australian Standard for Hygienic Rendering of Animal Products (AS 5008), incorporating HACCP protocols. These plants undergo independent audits to ensure adherence to the Code of Practice.
- **Recycling Standards:** Plants recycling fats and oils for animal feed must comply with the ARA Code of Practice for the Recycling of Used Cooking Fats and Oils.
- **Purchasing Assurance:** Buyers can be assured that products from accredited suppliers meet rigorous hygienic standards.

Global Recognition and Activities:

- **BSE Risk Category:** The World Organisation for Animal Health (OIE) has recognised Australia as having the lowest possible risk category for Bovine Spongiform Encephalopathy (BSE), known as "negligible BSE risk." This designation reflects the country's stringent biosecurity measures, robust surveillance programs, and strict hygienic practices in managing and preventing the disease.
- **International Leadership:** Australia is recognised for leading the way in hygienic rendering practices, supported by the ARA's initiatives.
- **Workshops in Asia:** The ARA conducts workshops in Asia to educate animal feed manufacturers on the benefits of using safe Australian rendered products.

A list of accredited plants, including their country registrations, and copies of the ARA Code of Practice are available on the ARA website: **www.ausrenderers.com.au**

WHAT IS THE RENDERING PROCESS

Rendering is the process of separating lipids (fats) from meat tissue and water using heat and sometimes pressure. This process is crucial in producing valuable by-products from animal tissues. There are two principal methods of rendering: wet rendering and dry rendering.

Wet Rendering Process Steps:

- **Grinding:** The tissue is ground to a small particle size of about 12mm.
- **Preheating:** The ground tissue is preheated at around 95°C for a duration of 5 to 60 minutes, depending on the specific system in use.
- **Separation:** The heated slurry is then separated into liquid and solid phases through pressing or centrifugal separation.
- **Liquid Separation:** The liquid, composed of lipids and water, is further separated into distinct streams through centrifugal force.
- **Drying and Milling:** The wet solids are dried and then milled into a free-flowing meal.

Dry Rendering Process Steps:

- **Grinding:** The tissue is ground to a particle size of about 30~40mm.
- **Heating:** The ground tissue is heated in a jacketed container with mechanical agitation, which helps evaporate the water. This can be done either at atmospheric pressure or under increased pressure.
- **Separation:** The fat and solids are separated using a screen.
- **Refining:** The fat is refined to remove any remaining fine particles of solids.
- **Pressing and Milling:** The solids are pressed to remove excess fat and then milled into a free-flowing meal.

Process Types

- **Continuous Process:** The rendering process runs continuously, with materials being added and processed without interruption.
- **Batch Process:** The rendering process is performed in discrete batches, with each batch being completed before the next one begins.

Both wet and dry rendering methods produce valuable by-products, such as fats and protein meals, which are used in various industries, including animal feed, cosmetics, and biofuels. The choice of method depends on the specific requirements and the type of raw materials being processed.

HYGENIC RENDERING

Hygiene concerns have significantly impacted the global use of rendered products. Issues such as the spread of BSE (Bovine Spongiform Encephalopathy) and Salmonella in animal feeds, along with heat treatment requirements for international trade, have necessitated stringent hygiene practices. The Australian Renderers Association (ARA) has played a proactive role in supporting its members in producing safe, hygienic products.

ARA's Initiatives and Contributions

Control of Salmonella: The ARA has been instrumental in developing programs to help members control Salmonella in meat meals. Compliance with Heat Treatment: The ARA has worked to ensure that members comply with the heat treatment requirements of importing countries. This involves negotiating these requirements and ensuring they are met.

TSE Freedom-Assurance Program (TSEFAP): The ARA actively participates in Australia's TSE freedom-assurance program, contributing to maintaining the country's status regarding Transmissible Spongiform Encephalopathies (TSEs).

Training and Accreditation

Workshops on Hygienic Rendering

- **Introduction:** In 1991, the ARA introduced a workshop on the hygienic rendering of animal products, which provides accreditation to individuals who successfully complete the training.
- **Accreditation:** 50 workshops have been conducted since its inception, and over 1220 individuals have been accredited.
- **Workshop Focus Areas:**
    - Growth and survival characteristics of micro-organisms relevant to rendering.
    - HACCP-based quality assurance for rendering.
    - Elimination of unwanted foreign matter in rendered products.
    - ARA Code of Practice and the revised Australian Standard for Rendering.
    - Domestic and international requirements to produce rendered products.
    - Heat transfer in rendering systems.
    - Hygienic design of rendering equipment.

Code of Practice

Development and Implementation

- **First Code of Practice:** Introduced in 1994 following the launch of the training workshop.
- **Audits and Accreditation:** The Code includes provisions for rendering plants to be audited by third-party auditors and accredited by the ARA. AUS-MEAT, an internationally recognised certification body, manages the audit program and recommends compliant plants to the Department of Agriculture and Water Resources for export listings. Establishments began receiving accreditation in January 1995.

Current Status

Accredited Establishments: The ARA has accredited establishments since 1995, and all accredited establishments are subject to annual audits.

Revisions and Updates:

- The Code of Practice was reviewed and reissued in December 1996 and again in 2006, with a new edition published in 2007.
- Further review and update in 2011, 2017 and 2024.
- New editions of the Code of Practice are determined on an as needs basis and is accessible on the ARA website.

Through ARA's rigorous standards, training programs, and proactive measures, the ARA ensures that Australian rendered products meet high hygienic standards, address global concerns, and maintain the safety and quality of these products in international trade.

Research

The ARA initiatives to assist members in improving the hygiene of rendered products were implemented in conjunction with the CSIRO Division of Food Processing. CSIRO personnel helped to implement the ARA training workshop and developed a manual for the hygienic construction of rendering equipment. CSIRO staff also conducted extensive microbiological testing programs at rendering plants and reported substantial improvements in the hygienic status of rendered product after the introduction of the training program and Code of Practice.

It has been demonstrated that Salmonella and other pathogens in raw material are effectively eliminated in the rendering heat treatment process, but post-processing contamination may occur. This view is backed up by extensive tracking of Salmonella serotypes, which show that the serotypes associated with meat and bone meal are not the common serotypes isolated from animal materials.

Heat treatment and market access

The ARA acknowledges that rendered products may be associated with biological hazards other than Salmonella. Biological hazards that are more heat resistant than Salmonella could be associated with rendered product. Scientific and regulatory authorities in Australia have identified Bacillus anthracis as a heat-resistant potential biological hazard, and the ARA Code of Practice includes requirements to comply with biological performance standards that validate that heat treatments can eliminate Bacillus anthracis.

Heat treatments and the biosecurity of rendering processes are conditions for the export of animal protein meals to certain markets. The ARA has been involved with the Department of Agriculture, Fisheries and Forestry (DAFF) in preparing cases to justify that biological performance standards used by ARA members are equivalent to the heat treatments required by importing countries. As a result, DAFF has negotiated market access based on ARA accreditation and compliance with the Australian Standard for the Hygienic Rendering of Animal Products.

BSE

No case of BSE has been identified in Australia, and Australia is categorised as having negligible BSE risk by the OIE. The ARA supports the coordinated efforts of state and federal authorities to maintain the BSE-free status. The national activities designed to maintain Australia free from BSE are coordinated by the TSEFAP which is managed by Animal Health Australia. The ARA is a member of the TSEFAP and has contributed to TSEFAP activities that ensure that animal materials are not fed to ruminants and in taking part in programs that report results of audits of compliance with state regulations.

Impact of ARA hygienic rendering programs

All ARA accredited rendering plants test their products for Salmonella according to the requirements of the ARA Code of Practice and Australian Standard for the Hygienic Rendering of Animal Products. Results of testing are reported to the ARA on an annual basis. These reports have shown significant reductions in the incidence of Salmonella in meat meals since training and the accreditation of establishments were introduced. While most of the reduction in the incidence of Salmonella in meat meal was achieved in the first few years of operation of the ARA programs, the reductions have been maintained, and further improvements have been achieved consistently.

Chapter 1 - Products available from the rendering industry

ANIMAL PROTEIN MEALS

Introduction

Proteins are compounds of large molecular weight and contain carbon, hydrogen, nitrogen and, with a few exceptions, sulphur. Amino acids are the fundamental structural units of proteins and are the result of the complete hydrolysis of proteins. It is these amino acids that animals require in their diet, not the protein itself. There are 23 or more different amino acids. Essential amino acids are the amino acids that cannot be made in the body from other substances. The most limiting of these are lysine, tryptophan, threonine, methionine and cystine.

Animal protein meals are produced from the solid material remaining after being separated and sterilised from the fat portion of animal tissues. The solid material is dried and then finely ground to produce a free-flowing meal. Rendered animal protein meals are moderate to rich sources of protein, amino acids, energy, calcium, Phosphorus, essential fatty acids and other vital nutrients.

These materials contain restricted animal material and may not be fed to cattle, sheep, goats, deer and other ruminants but may be fed to monogastric animals such as pigs, poultry, dogs and cats and in aquaculture diets for some fish and prawns.

Major benefits of using animal protein meals are:

- they contain moderate to high levels of amino acids like lysine, methionine and threonine.
- If processed correctly, the amino acids are highly available.
- they are a rich source of available Phosphorus, calcium and trace minerals.
- assist the substance of animal agriculture by transforming waste animal tissues into valuable products for further economic use.
- They are palatable when used in diets that are balanced for amino acids, especially lysine, methionine and cystine, tryptophan, threonine and (for blood meal) isoleucine.

1.1 Critical Parameters for Protein Meals in Various Markets

Critical Parameter	Petfood	Aquaculture	Poultry feed	Pig Feed	Fertiliser
Crude Protein	✓	✓	✓	✓	✓
Crude Fat	✓	✓	✓	✓	
Moisture	✓				
Ash	✓		✓	✓	
Peroxide Value	✓				
Calcium	✓	✓	✓	✓	✓
Phosphorous	✓	✓	✓	✓	✓
Crude Fibre					
Amino Acid Profile		✓	✓	✓	

Note: Animal protein meals are purchased under a negotiated contract and sold on a commercial basis.

RENDERED PRODUCTS ANIMAL PROTEIN MEALS

Meat and Bone Meal (MBM)

Meat and Bone Meal (MBM) is the protein residue after the moisture and fat have been extracted in the rendering process described earlier. It includes bone and tissue. It is golden to dark brown in colour, with a fresh meaty odour and is manufactured throughout the year.

The quality and composition of the raw materials used will have some effect on the quality of the finished product. Raw materials will vary at each plant; consequently, the composition of MBM will vary plant by plant. MBM customers can manage this variability by identifying product from a particular plant or from several plants with MBM of similar composition for their purchases.

Processing temperatures and methods have the greatest effect on amino acid digestibility. Australian MBM is available in various categories, Pure Beef / Bovine, Pure Sheep / Ovine, Pure Pig / Porcine, or mixed species and may include goat and deer.

Physical Properties

- **Colour and Appearance:** Light grey to medium brown fine powder.
- **Odour:** Typical of MBM with a fresh, meaty odour.

Specialised Protein Blends are blends of any of the meals described here and may also include fish meal. They are available from specialist blenders contactable from the ARA website.

Bone Meal is available from specialist renderers who may be located on the ARA website.

Typical Analysis of MBM & Ovine / Lamb Meal

	MBM	Ovine / Lamb Meal
Crude Protein	50% (or as specified)	50% (or as specified)
Crude Fat	13%	12%
Crude Fibre	3%	< 3%
Ash	35%	26%
Calcium	2.2 times Phosphorus level	2.2 times Phosphorus level
Phosphorus	4%	4%
Moisture	10%	10%
Pepsin Digestibility	86%	86%

Amino Acid	% Dry Matter Basis	% Dry Matter Basis
Aspartic Acid	4.1	3.8
Threonine	2.2	1.9
Serine	3.1	2.3
Glutamic Acid	6.7	6.4
Proline	4.4	4.1
Glycine	6.2	6.3
Alanine	3.9	3.5
Valine	2.7	2.4
Methionine	0.7	0.7
Isoleucine	1.7	1.6
Leucine	3.6	3.5
Tyrosine	1.3	1.2
Phenylalanine	2.0	1.9
Lysine	2.6	2.7
Histidine	1.0	0.9
Arginine	3.9	3.6
Cystine & Cysteine	0.9	1.0
Tryptophan	0.4	0.6

Feather Meal (FM)

Feather Meal, also known as Hydrolysed Feather Meal, is produced by cooking clean, fresh feathers from slaughtered poultry under pressure or using other hydrolysis methods to break cysteine bonds. This process yields a meal with a minimum of 75% pepsin digestibility.

Factors Influencing Quality

Degree of Hydrolysis:

- **Optimal Hydrolysis:** Essential for breaking cysteine bonds effectively, ensuring amino acids are available and digestible.
- **Over-hydrolysis:** Results in overcooked meal, reducing amino acid digestibility.
- **Under-hydrolysis:** Leads to insufficient breaking of cysteine bonds, reducing amino acid availability.

Physical Properties

- **Colour and appearance:** Fine light to dark brown powder. Colour variance is based on the type of feathers used.
    - Light Feathers: Produce a light golden-brown meal.
    - Dark Feathers: Produce dark brown meal.
- **Odour:** Typical of feather meal odour.

Hydrolysed Feather Meal is a valuable protein source in animal feed, especially when the hydrolysis process is optimised to ensure high digestibility and amino acid availability. The quality and physical characteristics of the meal depend on the degree of hydrolysis and the type of feathers used.

Typical Analysis of Feather Meal

Crude Protein	80% (or as specified)
Crude Fat	8%
Crude Fibre	4%
Ash	4%
Moisture	10%
Pepsin Digestibility	75%

Amino Acid	% Dry Matter Basis
Aspartic Acid	5.2
Threonine	4.4
Serine	9.6
Glutamic Acid	8.6
Proline	8.6
Glycine	5.7
Alanine	3.7
Valine	6
Methionine	0.6
Isoleucine	4
Leucine	6.4
Tyrosine	2.4
Phenylalanine	4
Lysine	1.7
Histidine	0.6
Arginine	5.9
Cystine & Cysteine	2.4
Tryptophan	0.6

Poultry Meal (PM)

Poultry Meal is produced from clean tissues of slaughtered poultry, including bones after moisture and fat have been extracted through the rendering process. It may include whole birds, excluding feathers, except for small amounts unavoidable in good manufacturing processes. The product should be treated with an antioxidant immediately after processing to ensure fat stability.

Poultry Meal is a high-protein product derived from the clean tissues and bones of slaughtered poultry, processed to remove moisture and fat. Treated with antioxidants for fat stability, it is suitable for use in pet food, offering a high-quality, nutrient-rich ingredient with a fresh poultry odour.

Physical Properties

- **Colour and appearance:** Golden to medium fine brown powder.
- **Odour:** Fresh poultry odour.

Typical Analysis of Poultry Meal

Crude Protein	60-65% (or as specified)
Crude Fat	10-12%
Crude Fibre	2-4%
Ash	10-12%
Moisture	10%
Pepsin Digestibility	88%

Amino Acid	% Dry Matter Basis
Aspartic Acid	5.7
Threonine	2.9
Serine	3.1
Glutamic Acid	8.8
Proline	4.1
Glycine	5.9
Alanine	4.4
Valine	3.8
Methionine	1.4
Isoleucine	3
Leucine	5.3
Tyrosine	2
Phenylalanine	2.9
Lysine	4.3
Histidine	1.4
Arginine	4.5
Cystine & Cysteine	1.2
Tryptophan	1.6
Tryptophan	0.6

Blood Meal

Blood Meal is a finely ground protein residue obtained from fresh blood collected during the slaughtering process. The moisture is removed from the crude blood through dewatering, followed by drying methods such as ring drying, batch drying, or disc drying. The quality of the finished product is primarily influenced by the drying method, with ring drying producing the highest quality meal. Blood meal is a valuable source of essential amino acids for swine and poultry, offering high protein digestibility.

Physical Properties

- **Colour and appearance:** Reddish brown fine powder.
- **Odour:** Fresh odour.
- **Solubility:** Insoluble in water.

Typical Analysis of Blood Meal

Crude Protein	90% min
Crude Fat	1-3%
Crude Fibre	<1%
Ash	5-8%
Moisture	10%
Pepsin Digestibility	90% min

Amino Acid	% Dry Matter Basis
Aspartic Acid	8.9
Threonine	4.7
Serine	4.8
Glutamic Acid	8
Proline	3.2
Glycine	3.6
Alanine	6.7
Valine	7
Methionine	1.2
Isoleucine	1
Leucine	10.2
Tyrosine	2.7
Phenylalanine	5.9
Lysine	7.9
Histidine	5.3
Arginine	3.5
Cystine & Cysteine	2.5
Tryptophan	1.6
Tryptophan	0.6

Fish Meal

Fish Meal from Australian rendering plants is the protein residue remaining after moisture and oil have been extracted during the rendering process. This product may be produced from farmed fish, wild catch harvest or fish market raw materials, including whole fish, fish heads, fish bones, and offal, with occasional small amounts of crab, prawns, and lobsters. Fish Meal is an important ingredient in animal feeds, offering a rich source of protein and essential nutrients.

Physical Properties

- **Colour and appearance:** Fine powder with variable colour depending on the specific raw materials used.
- **Odour:** Distinctive fish odour.

Typical Analysis of Fish Meal

Crude Protein	60-72%
Crude Fat	8-12%
Crude Fibre	1-3%
Ash	12-20%
Moisture	10%
Calcium	7%
Pepsin Digestibility	90%
Sand and salt	3%
	8.9

Amino Acid	**% Dry Matter Basis**
Aspartic Acid	6.8
Threonine	2.7
Serine	3.3
Glutamic Acid	7.4
Proline	4.0
Glycine	5.6
Alanine	3.9
Valine	3.1
Methionine	1.3
Isoleucine	2.5
Leucine	4.2
Tyrosine	1.9
Phenylalanine	2.4
Lysine	3.7
Histidine	1.7
Arginine	4.3
Cystine & Cysteine	0.9
Tryptophan	0.5

1.2 QUALITY CONTROL & TESTS FOR ANIMAL PROTEIN MEALS

Quality control in animal protein meals, such as meat and bone meals, is crucial to ensure their nutritional value, safety, and suitability for various applications. The following specifications and standard test methods are used to assess different parameters of animal protein meals:

Crude Protein:
Meat and bone meals are sold on protein content. While the majority are sold as 50% protein, meals can be sold containing other protein levels. Standard test method AOAC 990.03 Dumas.

Crude Fat:
The fat content of meat and bone meal is the residual fat left in the product after centrifuging and pressing and usually averages 8 to 12 per cent. Standard test method AOAC 920.39.

Moisture:
The moisture content in meat and bone meal is the residual water after the raw material has been dried, and it usually varies between 5 and 8 per cent. Moisture content of meal is critical to meal quality. Standard test method AOAC 934.01.

Crude Fibre:
Fibre is a relatively insoluble carbohydrate, such as cellulose, due to remnants of vegetable material in the rendered offal. Standard test method AOAC 962.09.

Ash:
Ash is the percentage of residue (mineral matter) remaining after combustion at 600°C for two hours and reflects the ratio of bone to soft tissue in the raw material. Standard test method AOAC 942.05.

Salmonella:
Salmonella are non-spore forming micro-organisms readily destroyed by the rendering process. However, post-process contamination during handling, storage and transport can still occur, just as it does with any feed ingredient. ARA accredited establishments abide by a code of practice to minimise postproduction contamination. Standard test method AOAC 989.13/966.08.

E. Coli:
E. Coli are non-spore-forming microorganisms readily destroyed by the rendering process. However, post-process contamination during handling, storage and transport can still occur, just as it does with any feed ingredient. ARA accredited establishments abide by a code of practice to minimise postproduction contamination. Standard test method AOAC 991.14.

Clostridium Perfringens:
Clostridium Perfringens is a spore-forming microorganism and is the micro-organism used in the Australian Standard to determine the ability of the rendering process to destroy spore-forming bacteria of concern. The tests are conducted on an annual basis at the plant level to validate the effectiveness of the rendering process. Standard test method AS1766.2.8

Pepsin Digestibility:
This is the percentage of feedstuff taken into the digestive tract that is absorbed into the body. Standard test method AOAC 971.09.

Calcium/Phosphorus:
The high Phosphorus availability of MBM is one of its major nutritional advantages over vegetable proteins. Standard test method AOAC 935.13/965.17 15th.

Mesh Screen Test:
This test is to determine whether the material has been satisfactorily ground following drying. The standard test method is that 98% of the MBM should pass through a 2.00mm (US #10) mesh screen, and 100% should pass through a 5.00mm mesh screen.

The specified AOAC and AS methods provide reliable and consistent measures for assessing these parameters.

1.3 CLAIM SETTLING RULES ANIMAL PROTEIN MEALS

Trade-specific rules are subject to negotiation between the buyer and seller. Gafta or Incoterms trade rules are commonly utilised in the trade of animal protein meals rules apply to settling claims for animal protein meals.

Chapter 2 - FATS

Animal tissue containing fat is converted to tallow and oils by the process of rendering as described at the beginning of this handbook.
Depending on the source and quality of raw materials used for the rendering process, the quality of the tallow and oil will vary.

2.1 Critical Parameters for Various Tallow Markets

Critical Parameter	Soap Specs	Oleo chemicals	Renewable Diesel & SAF	Feed Grade	Food Grade
Titre	✓				
Free Fatty Acid	✓	✓	✓	✓	✓
FAC	✓				✓
R&B Bleach	✓				
MIU %	✓	✓	✓	✓	✓
Fatty Acid Profile		✓		optional	
Nitrogen			✓		
Phosphorus			✓		
Chlorides			✓		
Chlorides			✓		

Note: Specifications are very plant specific.

Grades of Fats and Oils

- **Edible Tallow** is made exclusively from the highest quality edible fat and trimmings inspected by authorities and processed for human consumption. Edible tallow can be subjected to deodorising. Deodorised tallow does not alter the taste of foods, whereas un-deodorised tallow is used to enhance the flavour of foods.
- **Unrefined Edible Tallow** for further processing is used to manufacture shortening and margarine by the process of refining, deodorising, and bleaching.
- **Industrial Tallow** (top white, pure beef, good soap, prime and bleachable fancy) is commonly used in the oleo-chemical industry for use in the production of soaps and cosmetics. Industrial tallow is also extensively used as a feedstock in the manufacture of biodiesel and renewable diesel.
- **Yellow Grease** is usually made up of restaurant greases (fats and oils from cooking) and from some rendering plants lower quality fats.
- **Used Cooking Fats & Oils (UCO)** is usually made up of fats or oils of vegetable or animal origin that have been used to cook food for human consumption.
- **Feed Grade Fats** are often stabilised blends of animal and vegetable fats. They may also contain acidulated vegetable soap stock blended with the tallow and oils. Feed Grade fats must comply with M&I 2% max.
- **Fat for Fuel:** because of their chemical composition, fats contain concentrated amounts of energy when burned. This energy can be used as a heat source in industrial boilers and furnaces.
- **Renewable Fuel Feed Stock** rendered fats can be used as a feed stock to produce biodiesel.

2.2 QUALITY CONTROL SPECIFICATIONS AND TESTS FOR FATS AND OILS

Test methods referred to are from the American Oil Chemists Society.

- **Titre** is the solidification point of the component fatty acids in degrees Celsius. A general classification for traded fats and oils, titre is related to physical hardness. Standard test method AOCS Cc 12-59.
- **FFA** is Free Fatty Acid, the percentage of titratable acid measured with standardised sodium hydroxide solution. These acids arise from the hydrolysis of fats and oils. For tallow, they are reported as oleic acid. Standard test method AOCS Ca 5a-40.
- **Lovibond Colour FAC** is a colour set for matching typical American fats. FAC is not a uniform or linear scale. Standard test method AOCS Cc 13a-43.
- **Bleach R&B colour** is colour after refining and bleaching and is expressed in terms of Red on a 5.25" (133mm) cell according to AOCS Cc8d-55. Bleached colour is a measure of the amount of pigmentation in the raw material.
- **Iodine Value,** IV, is a measure of the degree of unsaturation in tallow and is inversely related to titre. The IV may be determined by Gas Chromatography composition analysis or by titration methods. More saturated fats have lower values and are harder (higher slip melting points). Standard test method used is AOCS Cd 1d-92.
- **MIU** is the total results figure for moisture, insoluble impurities and unsaponifiable matter.
- **Lovibond colour** is an international, rational colour scale based on standard red and yellow units for comparison of fats and oils colour. Lovibond AOCS "(Wesson") or BSI (U.K.) colour standards may be used. Automatic instruments may be used. Standard test method AOCS Cc 13b-45.
- **PV** is the Peroxide Value and is a common way of assessing fat rancidity primarily caused by oxidation. Standard test method AOCS Cd 8b-90.
- **SV** is the Saponification Value and is an estimate of the mean molecular weight of the constituent fatty acids in a fat sample. Standard test method AOCS Cd 3-25.
- **PE** is the Polyethylene Test to determine polyethylene in tallow that may result from foreign matter in rendering raw material by items such as plastic bags and livestock ear tags. The level of polyethylene in tallow is a concern to biodiesel manufacturers, soap-makers, fatty acid distillers and other users. Standard test method AOCS Ca 16-75

- **Nitrogen and Sulphur** content is determined by combustion technology and has become the standard method to characterise biofuel feedstock, intermediate streams, and finished products.
- **Phosphorous** in tallow can indicate contamination or poor-quality raw materials. Testing is conducted to ensure low phosphorus content to comply with specific requirements for use in food products, animal feed industrial applications.

2.3 CLAIM SETTLING RULES FATS AND OILS

Trade specific rules are subject to negotiation between the buyer and seller.

FOSFA, AFOA, or Incoterms trade rules are commonly utilised in the trade of fats and oils, and rules apply to settling claims for fats and oils.

TEMPERATURE CONVERSION TABLE

°C	°F	°C	°F
0	32	100	212
10	50	110	230
20	68	120	248
30	86	130	266
40	104	140	284
50	122	150	302
60	140	160	320
70	158	170	338
80	176	180	356
90	194	190	374
		200	392

#Temperature Conversion formulae:
Deg C = (Deg F - 32) / 1.8; Deg F = (Deg C * 1.8) + 32

APPROXIMATE TALLOW DENSITY AT SELECTED TEMPERATURES

TEMP °C	DENSITY	TEMP °C	DENSITY	TEMP °C	DENSITY
45.0	0.8920	53.5	0.8862	61.5	0.8878
45.5	0.8917	54.0	0.8859	62.0	0.8804
46.0	0.8913	54.5	0.8855	62.5	0.8801
46.5	0.8910	55.0	0.8852	63.0	0.8798
47.0	0.8906	55.5	0.8849	63.5	0.8794
47.5	0.8903	56.0	0.8845	64.0	0.8791
48.0	0.8900	56.5	0.8842	64.5	0.8787
48.5	0.8896	57.0	0.8838	65.0	0.8784
49.0	0.8893	57.5	0.8835	65.5	0.8781
49.5	0.8889	58.0	0.8832	66.0	0.8777
50.0	0.8886	58.5	0.8828	66.5	0.8774
50.5	0.8883	59.0	0.8825	67.0	0.8770
51.0	0.8879	59.5	0.8821	67.5	0.8767
51.5	0.8876	60.0	0.8818	68.0	0.8764
52.0	0.8872	60.5	0.8815	68.5	0.8760
52.5	0.8869	61.0	0.8811	69.0	0.8757
53.0	0.8866				

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