Acceptance Guidelines for Raw Materials in a Feed Factory

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Reception raw materials

Sampling process

Raw materials sampling in the feed factory is a critical phase for anyone, serving as the first line of defence in ensuring food and feed safety.

This essential process involves **collecting small, representative samples** from larger raw materials batches to assess their overall condition. It's a fundamental step for identifying potential issues such as moisture content, pests, and contaminants, which could compromise the integrity of the raw material.

Sampling is not just about meeting regulatory requirements; it's about **safeguarding the reputation of their produce** and ensuring the highest possible market value.

It **provides vital data** that inform decisions on unloading, storage, processing, and distribution, helping to maintain the quality of the feed produced, to obtain optimum performance from layers hens, and improve the profitability for egg producer.

How to sample materials

Raw materials samples provide a powerful record of quality when are taken and stored correctly. If you take just one sample from a single point in a raw material batch, its characteristics are unlikely to be representative of the total batch. Best practice is to take a series of incremental samples (relatively small sample), from different parts of any given lot, blend them thoroughly and then take a subsample for analysis.

Raw materials sampling stages are:

1. Take various serial samples.
2. To combine serial samples and mixed them to form a large aggregate sample.
3. Make representative samples. There are several methods (of varying complexity) that produce optimally mixed grain. A simple method is coning and quartering (figure 1):

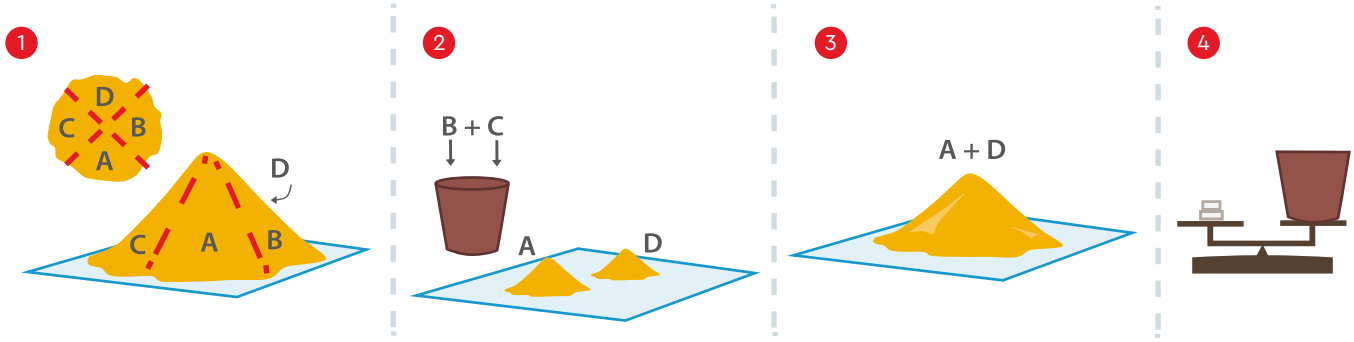


Figure 1: Sampling using coning and quartering method. (Source: grain sampling guide 2022)

1. A heap of tipped grain will take the rough form of a cone – it can be described as having four quarters (e.g. A, B, C and D).
2. Select two opposite corners (e.g. A+D). Remove the other two quarters (e.g. B+C) and return them to the original aggregate container.
3. Mix the selected samples (e.g. A+D) to form a new cone of grain.
4. Repeat until the size of one of the quarters is the equivalent weight of the final sample required (e.g. 1 kg).

Chart flow during reception raw materials

Visual inspection of carried raw material in the trailer.

Take representative **samples from different points** of the trailer using automatic or manual sampler.

Store 1 sample in sample library.

Make **representative sub-samples** (see figure 1)

To compare results vs contract specifications and/or **quality** manual **parameters**

Examine documentation of the **truck**. (truck and trailer cleaning certificate, previous cargo information, and analytical certificate)

Data collection available (supplier, matriculation number, batch, quantity received, origin of the merchandise, etc...)

Visual inspection of the **sample** (damaged kernels, impurity, foreign material, colour, and presence of insects)

To use **1 representative sample** for analysis (moisture analyser, NIRS, instantanés kits, etc...)

To decline | To unload | To claim

Evaluation of feed ingredients for quality

The feed ingredients are usually subject to the following types of tests:

Physical evaluation of the raw materials is the first analysis we do on the raw materials enter in the feed factory. This requires to be highly trained to identify the changes in the nature of the raw materials. **The most important physical parameters to evaluate in the raw materials are:**

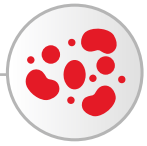
Colour

Will reveal the quality of the ingredients. Any change in the colour of the feed ingredients give an indication of the maturity of the grain, storage conditions, presence of toxins, contamination due to sand, possible use of insecticides/ fungicides which gives dull and dusty appearance. Browning or blackening due to heat on improper storage reduces nutritive value.

Size

Size is related to energy content of the grains. Generally, smaller grains, lower will be the metabolizable energy value due to more proportion of coater hulls. To evaluate the cereals, weight of a fixed number of grains is taken, usually 100 grains or fixed volume. Higher weight indicates a higher ME value. This technique is called Test Weight.

Homogeneity



The presence of contaminants like other grains, broken grains, husk, weed, or infected seeds is viewed.

Smell

Good indicator. Just standing near the stock itself will immediately indicate any difference in the normal smell. Any change in the normal smell of the ingredients should be viewed with suspicion.

Taste

Each ingredient has a different taste, any change in the taste like bitterness could indicates the presence of contaminants like mycotoxins.

Touch

Icy raw materials could indicate high moisture content. Also, high moisture content, may be formed clumps due to improper storage, packing of fresh warm solvent extracted meal, which crumbles on application of light pressure. Clumps can be detected by inserting a hand inside the bag. Clumps formed due to excess of moisture will be very hard.

Reception of raw materials

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Barley grain

General description

The grain of *Hordeum vulgare L.*, and *Hordeum districhum L.*

General aspect

Grain is a pale yellow colour, without impurity content such as other seed, sand, or foreign material. Delivery product must present as a healthy and uniform cereal, with absence of moisture, rancid or acidic smell (absence of heating and fermentation).

Observation

In the feed factory, if the grain is properly dried, storage in silos doesn't present difficulties. In batches with high humidity, it is advisable to add fungicides while in storage. The mill's performance can be significantly affected by the specific weight of the grains. Also, due to the presence of the glumes, barley grains are more effectively ground using hammer mills compared to roller mills. It does not pose any issues for the granulation process. A representative sample should be stored for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Parameter to analyse	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	10–11		>14
Bulk density (kg/Hl)			62	<62	<58
Damaged kernels and foreign material (%)			<5	>5	>9
Insects and plague			Absence		Presence
Temperature[1] (˚C)					>10

[1]*In relation to the environmental temperature*

Maize grain

General description

The grain of *Zea Mays*. Maize breeders have created many cultivars that correspond to specific climatic or agronomic conditions and uses. "Dent corn" maize is the most widely grown type of maize and the one typically used for feed.

Other name: Corn (USA)

General aspect

Colour of maize is yellow. Delivered product must present as a healthy and uniform cereal, with absence of moisture, rancid or acidic smell, no presence of impurities such as other seeds, or foreign material as sand, metal objects, insects, and plagues.

Observation

Pay attention to batches with warm grains. Depending on the growing season and storage conditions, mold and associated mycotoxins can be a problem. In the case of suspected products, is recommended to analyse mycotoxins before purchase, directly in the sample taken at the supplier's warehouse. To store a representative sample for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Parameter to analyse	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	13	>13	>15
Damaged kernels and foreign material (%)			<5	>5	>8
Insects and plague			Absence		Presence
Temperature[1] (˚C)					>10
Aflatoxins B1[2] (µg/kg)	After unloading	Extended			>20

[1]*respect environmental temperature*

[2]*zearalenone > 2000 µg/kg.*

Sorghum

General description

The grain of the *Sorghum bicolour*. White sorghum is the most widely used variety in animal feed.

Others name: Sorghum, broomcorn, grain sorghum, milo, great millet, durra, dourah.

General aspect

The colour of sorghum grain varies from blonde to brownish and must appear as a healthy and uniform cereal, free from musty, damp, rancid, or acidic odors and without the presence of impurities such as other seeds, or foreign material as sand, insects, and plagues.

Observation

In the feed factory, grains properly dried can be stored without any problem. For batches with high humidity, it is convenient to add fungicides in the silos during the storage. Excessive grinding of grains could cause high pulverulent feed. Pay attention to batches with dark, orange or red grains of sorghum as this is highly associated with high tannin content. In the case of suspected batches, it is recommended to analyse mycotoxins and tannins before purchase with a sample taken directly from the supplier's warehouse. A representative sample should be stored for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Parameter to analyse	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	12	>13	>14
Bulk density (kg/Hl)			>75		<70
Damaged kernels and foreign material (%)			<5	>5	>8
Insects and plague			Absence		Presence
Temperature[1] (˚C)					>10
Tannins (%)			<0.2		>0.3
Aflatoxins B1[2] (µg/kg)	After unloading	Extended			>20

[1]*respect environmental temperature.*
[2]*zearalenone > 2000 µg/kg.*

Wheat

General description

The grain of the *Triticum sp.*

General aspect

The colour of wheat grain is dark beige, and it must appear as a healthy and uniform cereal, free from musty, damp, rancid, or acidic odors of impurities such as other seeds, or foreign material as sand, metal objects or insects and plagues.

Observation

In the feed factory, grains properly dried can be stored without any problem. For batches with high humidity, it is convenient to add fungicides in the silos during the storage. Excessive grinding of grains can lead to the accumulation of fine particles in poultry beaks, resulting in problems. Wheat grain presents good propensity to grinding by hammer mills or at granulation process. Its inclusion in feed improves pellet durability compared to corn. Before unloading wheat, it is highly recommended that humidity and bulk density are first checked.

General controls and acceptance requirements

Parameter to analyse	When	Parameter to analyse	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	12	>13	>15
Bulk density (kg/Hl)			>72		<70
Damaged kernels and foreign material (%)			<5	>5	>8
Insects and plague			Absence		Presence
Temperature[1] (˚C)					>10

[1]*respect environmental temperature.*

Cereals

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Bakery by-product

General description

The by-product of bread manufacture, consisting of bread, cookies and other bakery products unfit for human consumption. Usually, its main component is wheat flour.

Other names: Bakery waste, stale bread, breadcrumbs.

General aspect

The colour of bakery by-product varies from light to dark brown. It must appear as a healthy and uniform powder, scentless of and absent of plastics and packaging waste or parts of the product in compact form.

Observation

The composition of bakery by-product varies depending on the supplier and the original raw material used. Upon delivery, it is highly recommended to analyse aspects such as smell, humidity, and the ash content. Due to its high capacity for oxidative rancidity of the lipid fraction and microbiological contamination, it is recommended to avoid long storage periods. Particular attention must be paid to potential adulterations to the flour such as talc or other minerals, used to enhance flowability and facilitate handing of the product. A representative sample should be stored for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Parameter to analyse	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	12		>14
Insects and plague			Absence		Presence
Temperature[1] (°C)					>10
Ash (%)	Before Unloading	Basic	2–6%		>7%
Calcium (%)			0.10–0.20		>0.5
Chlorine (%)			0.9–1.2		>1.4
Sodium (%)			0.30–0.45		>0.7

[1]*respect environmental temperature.*

Corn DDGS

General description

The corn dried distillers' grain is the main by-product of ethanol production from maize grain.

Other names: dried distiller's grains with soluble, maize DDGS, corn DDGS, maize distillers' grains, maize distiller's grains, corn distillers.

General aspect

The colour of corn DDGS varying from cream to dark brown. Commercial product is sold as powder or pellets. In both of cases, the product must present a characteristic fermentation smell, without any damp or musty, rancid or acidic odours.

Observation

During reception, it is recommended to evaluate the colour, smell, and uniformity of each batch. For example, darker colour grain is considered an indication of badly preserved batches. In such cases, the batch may have suffered heat damage due to uncontrolled high temperatures and humidity, which could cause Maillard reaction and consequently reduce amino acid availability. Also, inadequate transportation and storage conditions affect oil quality, primarily detected by a foul smell. The product is easy to store, to grind and to granulate. To store a representative sample for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Parameter to analyse	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	11		>13
Colour			Yellowish brown		Dark brown
Temperature[1] (°C)					>10
Protein (%)			27–28		Contract
Fiber (%)	After Unloading		8		
Fat (%)			>6		
Ash (%)			<3%		
Aflatoxins B (µg/kg)		Extended			>20

[1]*respect environmental temperature.*

Wheat DDGS

General description

The by-product of alcohol (ethanol) manufacture, obtained from the distillery of wheat grains consisting of spent grains and steepwater soluble in variable proportions.

Other names: wheat DDGS, wheat distillers' grains, wheat distiller's grains.

General aspect

The characteristic colour of wheat DDGS is brown. Commercial product is sold as powder or pellets. In both of cases, the product must present a characteristic fermentation smell, scentless of moisture, and absence of rancid or acidic odour.

Observation

During reception, it is recommended to evaluation the colour, smell, and uniformity of each batch. For example, darker colour grain is considered an indication of badly preserved batches. In such cases, the batch may have suffered heat damage due to uncontrolled high temperatures and humidity, which could cause Maillard reaction and reduce acid availability. The product is easy to store and to grind. Due to the high fat and fibre contents, wheat DDGS could negatively affect pellet and pelleting performance. Batches exposed to high humidity and long storage periods tend to present mycotoxins problems. To store a representative sample for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Type of analysis	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	10		>13
Colour			Yellowish brown		Dark brown
Temperature[1] (°C)					>10
Protein (%)			27–28		Contract
Fiber (%)	After Unloading		7		
Fat (%)			>5		
Ash (%)			<7%		
Aflatoxins B (µg/kg)		Extended			>20

[1]*respect environmental temperature.*

Corn Gluten Feed

General description

The by-product of the manufacture of starch obtained from maize grain (*Zea mays L.*) by wet milling.

Other names: corn gluten, maize gluten feed.

General aspect

The colour of corn gluten feed varies from brown to dark brown depending on the heat treatment it received. Commercial product is sold as powder or pellets. In both of cases, the product must present a characteristic fermentation smell, scentless of moisture, and absence of rancid or acidic odour.

Observation

Corn gluten feed exhibits quality variation between batches based on the origin quality of the original corn grains used or in function of the production technology, the conditions of processing, transportation, and storage applied. During the reception, it is recommended to evaluate the colour of the product and the presence of insects. Pay attention to the humidity of the batches. The product results easy to store, and to grind. High inclusion during the granulate process could affect negatively pellet quality and pelleting performance. To store a representative sample for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Type of analysis	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	12		>13
Colour			Brown		Dark brown
Insects			Absence		Presence
Temperature[1] (°C)					>10
Protein (%)	After Unloading		19		<16
Fiber (%)			<10		>12
Starch (%)					
Fat (%)		Extended	2.6		

[1]*respect environmental temperature.*

Corn Gluten Meal

General description

ThThe by-product obtained from the wet-milling process of maize starch production (and occasionally ethanol). It consists principally of gluten obtained during the separation of starch.

Other names: maize gluten meal, corn gluten, maize gluten, gluten 60, prairie meal.

General aspect

The colour of corn gluten meal is yellow orange. Usually, the commercial product is sold as a powder without bran particles.

Observation

No additional quality controls beyond the ordinary are required during reception of corn gluten meal. It is recommended to evaluate the general aspect and its colour because batches batches that exhibit a darker brown colour could be submitted an incorrect heat treatment. Also, pay attention on the presence of agglomerate particles, high humidity, or foreign material. Product with a humidity of less than 12% does not pose any problem during storage. Like other maize products, corn gluten meal can be contaminated with mycotoxins. Its inclusion in the feed doesn't negatively affect mill performance or granulate process. To store a representative sample for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Type of analysis	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	11		>12
Colour			Yellow/ Orange		Dark brown
Agglomerate particles			Absence		Presence
Temperature[1] (°C)					>10
Protein (%)	After Unloading		>55		<52
Xanthophylls (ppm)		Extended	≥200		

[1]*respect environmental temperature.*

Rice bran

General description

The by-product of the processing of rice grain (*Oryza sativa L.*), consisting of envelopes, germs, and fragments of endosperm. This product can be defatted or not.

Other names: Rice bran, full-fat rice bran (>5% oil), defatted rice bran (<5% oil), de-oiled rice bran, rice pollards, rice polishings, rice mill feed.

General aspect

The colour of rice bran is beige. Commercial product is sold as powder or pellets. In either form, product must present absence of rancidity smell, contaminations, pest, or presence of agglomerated particles.

Observation

Due to the high variability between lots of the rice bran, an accurate control of batches and suppliers is essential to categorize the product. Pay attention to the fibre content of the rice bran, to avoid adulteration with rice hulls. The oil content of rice bran can vary depending on its origin and can be prone to rancidity due to the high polyunsaturated oils and lipid content. Finally, the high content of fat could present a fluidity problem in the feed factory and consequently, it is very important to determine the products oil content during quality control. Pay attention to storage conditions (time, temperature, and humidity) and avoid long storage durations. High humidity content can result in mycotoxin contamination and heating of product.

General controls and acceptance requirements

Parameter to analyse	When	Type of analysis	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	<10		>13
Insects			Absence		Presence
Agglom. particles			Absence		Presence
Hulls			Absence		Presence
Temperature[1] (°C)					>10
Fiber[2] (%)			<9 or <12		>10 or >13
Fat (%)			>15 or >3		<12 or <2
Oleic acidity (%)					>50

[1]respect environmental temperature.
[2]full fat rice bran and defatted rice bran, respectively.

Wheat bran

General description

The by-product of wheat flour production obtained by milling of wheat grains, mainly formed from the fragments of the grain integument.

Other name: Wheat bran, fine wheat bran, coarse wheat bran, coarse wheat feed.

General aspect

The colour of wheat bran is light brown. Commercial product is sold as powder or pellets. In either form, the product must must be free from rancid odours, contaminations, insects or presence of agglomerated particles.

Observation

Due to the high variability between lots of wheat bran, an accurate control of batches and suppliers is essential to categorize the product. Pay attention to fungal and bacterial growth, as their presence could be due to the use of water during the production process. Consequently, strict quality control evaluating the moisture, temperature, and microbial contamination (particularly for Salmonella and Clostridium) of the product is recommend for each batch before delivery to the feed factory. Also, it is critical to monitor the fat for oxidative rancidity. Due to the very low density of wheat bran, high volume of the silos storage and mixer are required. The storage silos and mixer require a high volume to accommodate the product. is improved by the addition of wheat bran in the feed.

General controls and acceptance requirements

Parameter to analyse	When	Type of analysis	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	<12		>15
Insects			Absence		Presence
Agglom. particles			Absence		Presence
Smell					Rancid
Temperature[1] (°C)					>10
Ash (%9)		Extended	<6		>7
Insoluble ash (%)			<0.5		>0.7
Calcium carbonate	After Unloading				Presence

[1]*respect environmental temperature.*

Plant and animal proteins

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Coconut meal

General description

The by-product of the oil extraction from dried coconut kernels (copra)

Other names: Copra meal, copra cake, coconut meal, coconut cake, expeller copra meal, expeller copra cake.

General aspect

Good quality coconut meal is described as white to pale yellow meal, well dried and clean. It should be free from rancid or undesirable odours, impurities, molds, insects, and other contaminants.

Observation

During the reception, analysis of the moisture content of the coconut meal is essential to avoid aflatoxin contamination. Products that exhibit high moisture content or smoky, burnt, moldy, or rubbery flavor or odour should be rejected. Rising temperature in the meal may indicate microbial growth and/or insect infestation. The high oil content of copra meal renders it susceptible to rancidity and the product should not be used after prolonged storage. Coconut meal should be kept in a well-ventilated store.

General controls and acceptance requirements

Parameter to analyse	When	Parameter to analyse	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	<8		>13
Insects			Absence		Presence
Agglom. particles			Absence		Presence
Colour			White to pale yellow		Brown to dark brown
Smell					Rancid
Temperature[1] (°C)					>10
Impurity (%, max)			0.25		1
Aflatoxin levels (ppm, max)			5		20
Oil[2]			3.5–7		

[1]*respect environmental temperature.*
[2]*for defatted coconut meal and expeller cake, respectively.*

Palm kernel meal

General description

A by-product of oil production derived from the extraction of palm fruit kernels.

Other names: p.k. cake, expeller p.k. meal, solvent-extracted p.k. meal.

General aspect

The colour of palm kernel is dark brown. Commercial product is sold as powder, well dried and clean, with a typical sweet flavour and odour like soap.

Observation

Due to the high variability in the oil extraction process of the palm kernel meal, an accurate control of the batches and suppliers is essential to categorize the product. Special attention Special attention must be given to monitoring the oil, fibre, humidity, and mycotoxin levels of the product.

General controls and acceptance requirements

Parameter to analyse	When	Parameter to analyse	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	<12		>13
Insects			Absence		Presence
Agglom. particles			Absence		Presence
Smell					Rancid
Temperature[1] (°C)					>10
Aflatoxin levels (ppm, max)			5		20
Fiber (%)			20		>26
Protein + Fat (%)			>22		<20

[1]*respect environmental temperature.*

Rapeseed meal

General description

The by-product of oil extraction from rapeseed (*Brassica napus L., Brassica rapa L. and Brassica juncea L.*, and their crosses).

Other names: full-fat rapeseed, full-fat canola seed, rapeseed oil meal, canola meal, canola seed meal.

General aspect

The colour of rapeseed meal is yellowish brown and the commercial product is sold as powder or pellets. In both forms the product must be be absent of rancid odours or agglomerated particles.

Observation

Temperature is one of the main factors affecting the quality of rapeseed meal. It is recommended to analyse the general presentation, smell, humidity, and check for overcooked particles at reception. Handling of rapeseed products is generally easy for the feed mill, except when batches contain excess moisture. To store a representative sample for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Type of analysis	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	<12		>14
Insects			Absence		Presence
Colour			Yellowish brown		
Agglom. particles			Absence		Presence
Smell					Rancid
Temperature[1] (°C)					>10
Protein (%)			35		<33
Fiber (%)			12		>14
Hexane (ppm)	After Unloading	Extended			>100
Glucosinolates (ppm)			20		>26

[1]*respect environmental temperature.*

Soybean meal

General description

A by-product of oil production derived from the extraction of soybean seeds., with partial reintroduction of part of the hulls.

Other names: soyabean meal, soybean cake, soybean oil meal, soybean oil cake.

General aspect

The colour of soybeans meal should be light beige, but it can vary from yellow to dark brown, depending on the level of heat treatment applied. The product must be absent of any rancid smell and agglomerated particles.

Observation

During reception, attention must be given to the temperature and colour of the product. Warms batches that exhibit dark-coloured grain may have been overcooked during heat treatment. To avoid possible contamination, pay attention to the bulk density of the batches. Due to the product's high agglomerate capacity, vaults may form in the silo. Also, the fat content of soybean meal means that oxidation may also be a risk during storage. Consequently, long storage times are not recommended. To store a representative sample for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Type of analysis	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	<12	>13	>14
Insects			Absence		Presence
Colour			Light beig		Yellow and dark brown
Overcooked part.			Absence		Presence
Agglom. particles			Absence		Presence
Smell					Rancid
Temperature[1] (°C)					>10
Protein (%)			Depending on the contract	0.5 point < contract	
Ash (%)	After Unloading	Extended	<7	>7	
Hexane (ppm)					>100
Urease activity (pH increase)			>0.3		>0.5
KOH solubility (%CP)			70–80%		

[1]*respect environmental temperature.*

Peas

General description

The seed of pea (*Pisum sativum L.*).

Other names: Pea, field pea, feed pea, protein pea.

General aspect

The colour of pea grain varies from yellowish green, to green, yellow, or pale green, brown or mottled. Hulled peas can be be thin or thick, smooth, or wrinkled, and the seed of pea can vary in shape and size.

Observation

In the feed factory, handling and storage of peas is very easy. The variability of peas chemical composition is relatively low. The main nutritional variation occurs in the levels of trypsin inhibitor and tannins, which are lower in the spring varieties as compared to winter varieties. It is occasionally possible to observe damage to the grain due to parasite infection (bore grain). The inclusion of the peas in the feed improves pellet quality. To store a representative sample for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Type of analysis	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	11		>14
Damage grain (%)			<5		>7
Insects			Absence		Presence
Temperature[1] (ºC)					>10
Protein (%)			18–24[2]	<18	
Tannins (%)	After Unloading	Extended	<7	>7	

[1]*respect environmental temperature.*

[2]*depends on the variety*

Sunflower meal

General description

The by-product of oil manufacture from sunflower seeds (*Helianthus annuus L.*).

Other names: sunflower oil meal or cake, sunflower seed meal cake, expeller sunflower meal, dehulled sunflower meal or cake, decorticated sunflower meal or cake.

General aspect

The colour of sunflower meal varies from grey to black. Commercial product is sold as powder or pellets. In both cases, the product must be free from rancid, damp, or musty odours and not exhibit agglomerated particles.

Observation

In the feed factory, sunflower meal is easy to handle and to store. However, in powder form the product has a very low density and high silo capacity is required to store it. Pay attention to batches that exhibit high humidity and temperature beacuase these conditions could result in spontaneous auto combustion within the silo. Long storage times are not recommended, as particle agglomeration can result in vaults within the silo. The colour of sunflower meal varies depending on the degree of dehulling and on the extraction process of the oil. Consequently, the extraction process of the oil determines the protein and fat contents of the sunflower meal. It is recommended to check for adulteration by contaminants. To store a representative sample for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Type of analysis	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	12		>13
Colour			Grey to black		
Agglom. particles			Absence		Presence
Temperature[1] (ºC)					>10
Protein (%)			Depending on the contract	1.5 point < contract	
Fibre (%)		Extended	18–25[2]		>27
Hexane (ppm)	After Unloading				>100

[1]*respect environmental temperature.*
[2]*depends on the variety*

Fish meal

General description

An animal by-product obtained by cooking, pressing, drying, and milling fresh raw fish or fish trimmings.

Other names: white or brown fish meal, low-temperature (LT) fish meal, prime fish meal.

General aspect

The colour of fish meal is brown. The commercial product is sold in a course flour form and must be absent of acidic, rancid, or musty odours as well as free from agglomerated particles.

Observation

Fish meal characteristics depend on depends on the source of fish or fishery by-products used and on the processing technology involved. It is recommended to check the regulatory status of this product before using it for livestock feeding. Due to its high variability it is advised to check all deliveries. To avoid batches with uncommon colour, and/or unusual smell. Due to its high risk of fat rancidity, store in a dry place, avoiding excessive stacking of bags and prolonged storage. Extreme processing conditions, such as prolonged time or high temperature, during the production process can negatively affect the protein quality of fishmeal. In such cases, there is a risk of protein degradation along wiht the formation of toxic biogenic amines. To monitored Total Volatile Basic Nitrogen (TVBN) and Biogenic Amine Index are methods of analysis that quantifies the freshness of the product. The inclusion of fish meal in the feed improves granulation performance but its inclusion at high levels can affect the quality of the pellets. To store a representative sample for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Parameter to analyse	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	<8		>10
Smell					Ammonia
Agglom. particles			Absence		Presence
Foreign material			Absence		Presence
Temperature[1] (ºC)					>10
Protein (%)			60	1.5 point < contract	<58
Fat (%)		Extended	10		
Ash[2] (%)			<19		>12
Salmonella			Absence		Presence
Histamine (ppm)					>1000 ppm
B.A.I. (ppm)					250
B.N.V. (ppm)					>1500 ppm

[1]*respect environmental temperature.*

[2]*values for fish meal high protein.*

Hydrolysed feather meal

General description

An animal by-product obtained by hydrolysing, drying, and grinding poultry feathers.

Other names: Feather meal, poultry feather meal, hydrolysed poultry feather meal.

General aspect

The colour of hydrolysed feather meal is light to medium brown. Generally, the commercial product is sold as powder without agglomerated particles, without acidic, rancid, musty or damp odours.

Observation

Due to the different quality of the initial raw material used and the differences in the production process production process applied, a systematic analytic control of each batch and supplier's is recommended. Pepsin digestibility is used as a method of assessing the quality of feather meal. A minimum pepsin digestibility value of 75% indicates that the feather meal has been adequately processed. Long storage times should be avoided due to the risk of fat oxidation associated with the fat content of the product. Similarly, the high particle agglomerate capacity of hyrdolysed feather meal can result in vaults within the silo if stored for long periods. To store a representative sample for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Parameter to analyse	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	<7		>8
Smell					Rancid
Agglom. particles			Absence		Presence
Foreign material			Absence		Presence
Temperature[1] (ºC)					>10
Protein (%)			80		<75
Digestibility pepsin in HCL (%)	After Unloading	Extended	80		<75

[1]*respect environmental temperature.*

Meat and Bone Meal

General description

The animal by-product derived from the rendering process of animal tissues, primarily from slaughterhouse waste. The original product contains, in various proportions, viscera and digestive tract contents, bones, blood, heads, lean tissues and fat. Sometimes it may contain parts of the other tissues such as skin or, in the case of poultry, feathers. In the EU, "meat meals" are only produced using a specific process described in the method described in the European regulations and is referred to as processed animal protein (PAPs)

Other names: MBM, PAPs.

General aspect

The colour of MBM varies depending on factors like the raw material composition, rendering process, and fat content. Generally, MBM from poultry or low-ash MBM presents a colour varying from light brown to golden brown. Higher-fat MBM shows a dark brown colour. Greyish or dull brown is found in high-ash MBM, and reddish or dark red brown colour may appear in MBM with residual blood or from overheating during rendering. Generally, the commercial product is sold as powder with a mild, meaty and slightly toasted odour; no rancidity or putrid odours should be present.

Observation

Due to the diversity of the initial materials and fat extraction system, chemical composition of MBM is highly variable. Strict quality control of MBM (microbiological and chemical safety tests) are required to detect adulterations and to grade the supplier. The labels of the MBM should indicate the original animal species, the transformed raw material (for example, bones), and the treatment used. It is recommended to check the colour, smell, humidity, HCl insoluble ash, fat and protein level and quality (digestibility in pepsin) of the batches. High protein levels are indicative of more meat and less bone in the meal. Extreme processing condition, as overheating of the MBM can affect protein quality reducing the availability of their amino acids. It is also important to check hexane content in the MBM extracted with solvents, which may contain up to 0.1% hexane. Prolonged storage under improper conditions can lead to rancidity or musty/moldy smells. High fat and/or very finely ground meals may also create caking problems in silos. To store a representative sample for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Parameter to analyse	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	<6		>8
Smell			Slightly toasted		Rancid
Colour			See general aspect chapter		
Agglom. particles			Absence		Presence
Foreign material			Absence		Presence
Temperature[1] (ºC)					>10
Fat (%)			8–15		
Protein[2] (%)			45–65		1.5 point < contract
Ash (%)	After Unloading	Extended	20–30		
HCl insoluble ash (%)			0.5		>1.5%
Digestibility pepsin in HCL (%)			>90		<80
Hexane (ppm)			Absent or <10 ppm[3]		

[1]*respect environmental temperature.*
[2]*Dependent on the raw material used. Higher values are from poultry PAP than porcine PAP*
[3]*For solvent-extracted MBM*

By products of cereals & fibrous feed (sources)

Acceptance Guidelines for Raw Materials in a Feed Factory

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Dehydrated alfalfa

General description

The dehydrated aerial part of alfalfa (*Medicargo sativa L.*) used in monogastric feed

Other names: Alfalfa, lucerne.

General aspect

Dehydrated alfalfa is green in colour. The commercial product presents a characteristic forage smell and is sold as pellet. It should be well dried and clean, without contaminations and adulterations with other forages.

Observation

Dehydrated alfalfa requires systematic analytical control in the feed factory due to the high variability between batches, which mainly depends on the quality of the initial raw material, harvesting, preservation, and storage conditions. In pellet form, it is hard to verify to verify the quality of the final product and detect possible contaminations and adulterations with other forages, agricultural by-products, soil, sand, or metal objects. If alfalfa is grown in a traditional way, the second cut is preferred as it is of higher quality and less contaminated with other forages. Adulteration with non-protein nitrogen (urea, ammonium salts, and poultry manure) have been reported in some cases in an attempt to artificially increase protein content. Sometimes is possible to find adulteration with calcium carbonate or with other fibrous material such as corn stalk, olive, leaves, marc, carob pods, etc. As such, when the value of crude fibre is higher than expected. When the ash value is higher than normal, an additional analysis of HCL insoluble ash is necessary to check for contamination with soil or calcium carbonate. Colour intensity of alfalfa pellets vary relative to their freshness. B-carotenes and Xanthophyl concentrations may serve as an indicator of the quality of the production and preservation processes. In the feed factory, dehydrated alfalfa is easy to store. Agglomerate is recommended to increase pellet durability for feed with a high level of alfalfa inclusion.

General controls and acceptance requirements

Parameter to analyse	When	Parameter to analyse	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	<10		>13
Colour			Intense green		
Foreign material			Absence		Presence
Impurity			Absence		Presence
Temperature[1] (°C)					>10
Protein (%)			15	1.5 point < contract	<13
Fibre (%)		Extended	<27		>30
Ash (%)			8		>12
Insoluble ash (%)			<3		
Aflatoxin levels (ppm)			<5		>20
Carotenes (ppm)			>100		<80

[1]*respect environmental temperature*

Fats and oil & Minerals

Acceptance Guidelines for Raw Materials in a Feed Factory

H&N® INTERNATIONAL

Palm oil

General description

The oil extracted from the pulp of palm fruits (*Elaeis guineensis Jacq. or Elaeis melanococca auct.*). Crude palm oil is the most commonly used oil for feed production. In the industrial process, crude palm oil can be refined, bleached, and deodorized to obtain RBD palm oil.

Other names: red palm oil

General aspect

Crude palm oil is dark red in colour, and liquid a room temperature. It has a very strong taste and a smell like overripe mushrooms. Refined, bleached, and deodorized (RBD) palm oil is bland, odourless, light yellow in colour, and semisolid at room temperature.

Observation

Quality control of palm oil is essential to ensure the safety and purity of the product. Key parameters like homogeneity of the product, colour, smell, free fatty acid content, iodine value, or moisture, must be monitored to assess freshness and rancidity. The naturally reddish colour of crude palm oil is attributed to its high ß-carotene content, distinguishing it from palm kernel oil. However crude palm oil will lose its carotene content after undergoing the refining process into RBD palm oil. Palm oil is a rich source of vitamin E that provides natural stability against oxidative deterioration. To store a representative sample for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Type of analysis	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	<0.5		>1
Smell			Pungent		
Impurity			<0.15%		>0.5%
Peroxides (meq/kg)			<5		>14
Oleic acidity			<2%		>3%
Palmitic acid (%)	After Unloading	Extended	43%	<41%	<39%
NEM[1]			<7%		>10%

[1]*Non-elutable material*

Soybean oil

General description

The oil extracted from soybean seeds *(Glycine max)*.

General aspect

The colour of soybean oil is a typical yellow colour, liquid a room temperature.

Observation

Quality control of soybean oil is essential to ensure the safety and purity of the product. Soybean oil used by the feed industry is crude and contains gums very rich in choline, phospholipids, antioxidants, and vitamin E, which improves storage stability of the oil. Key parameters like homogeneity between batches, colour, smell, and free fatty acid content must be monitored to assess freshness and rancidity. To avoid corrosion of the equipment, moisture content is an important parameter to check during reception. Quality control of the impurities in soybean oil is necessary to prevent oxidative reactions, as well as to prevent blocked filters and injectors in the feed factory. The inclusion of soybean oil in the feed can improve pelleting process, but high levels of inclusion can be unfavourable for the durability of the granule.

General controls and acceptance requirements

Parameter to analyse	When	Type of analyse	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	<0.5		>1
Impurity			<0.15%		>0.5%
Hum + Impurity (%)			<1		>2
Peroxides (meq/kg)			<5		>14
Oleic acidity			<2%		>3%
Linoleic acid (%)	After Unloading	Extended	52%	<50%	<46%
NEM[1]			<7%		>10%

[1]*Non-elutable material*

Soybean acid oil

General description

The by-product of the soybean oil refining industry.

Other names: Soapstock, acidulated soapstock.

General aspect

The colour of soybean acid oil is dark brown and it is liquid a room temperature, with a typical pungent odour.

Observation

Due to the number of parameters to be evaluated, it is necessary to apply strict quality control measures to avoid potential undesirable mixture with other oils, and products with process deficiencies should be rejected at delivery. Generally, batches with light colour are associated with better quality product than batches with dark colour. During the chemical refining process, triglycerides are separated from the free fatty acids, which are responsible for the acidity, by adding NaOH. Due to the high value in free fatty acids, stabilization with an antioxidant is essential. Soybean acid oil can cause corrosion issues in metallic equipment in the feed factory. The homogeneity of the product is an important quality control to check at reception. It is recommended to take at least 3 samples during unloading of of the lot: at the beginning, the middle, and at the end of the truck unloading. To store a representative sample for complementary analysis.

General controls and acceptance requirements

Parameter to analyse	When	Type of analysis	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	<0.8		>1.2
Impurity			<1%		>2%
Hum + Impurity (%)			<2		>4
Peroxides (meq/kg)			<5		>14
Oleic acidity		Extended	56	>70	
Linoleic acid (%)	After Unloading		54	<50	<46%
NEM[1]			<15%		>20%

[1]*Non-elutable material*

Calcium carbonate

General description

Calcium carbonate ($CaCO_3$) is obtained directly from limestone quarries, dried and ground.

General aspect

Limestone occurs in fine, medium, medium, or large particles. The color depends on the original limestone quarries and varies from white to black colour.

Observation

Normally quarried stone is more than 95% pure $CaCO^3$ and in some cases, the percentage can be as high as 99%. To avoid eventual caking problems in the silos, moisture analysis is recommended to be included in the quality control checks. Calcium carbonate can contain various amounts of other minerals and impurities, depending on its origin and the purity of the source. Consequently, along with determining calcium content, HCl insoluble ash, Fe, and Mg content must also be determined. Analysis of product solubility in 0.2 N HCl may also be considered as an indirect measure of its in vivo digestibility. Handling calcium carbonate in the feed factory is very easy. Calcium carbonates present very demonstrates very high density and consequently it is necessary to store it in silos with a strong structure that will be able to tolerate the weight. To avoid the inconvenience of dust generation during the discharge of fine calcium carbonate, it is recommended to use pneumatic discharge in storage silos.

General controls and acceptance requirements

Parameter to analyse	When	Parameter to analyse	Values		
			Normal	Reclaims	Decline
Humidity (%)	Before Unloading	Basic	1		>3
Impurity (%)					2
Calcium (%)			38		<36
Magnesium (%)		Extended	0.3		
Lead (ppm)			<20		
Arsenic (ppm)			<15		
Iron (mg/kg)			620		
Fluorine (ppm)			<350		
Mercury (ppm)			<0.3		
Cadmium (ppm)			<2		
Solubility in HCl (%)			>98		<95

Mineral phosphate

General description

Mineral origin phosphorus is an additive to animal feed, which contains calcium and phosphorus from inorganic compounds. It comes from phosphate rock processed in different ways, directly or or indirectly, resulting in various products on the market.

Feed phosphates used in animal nutrition include Mono Calcium Phosphate (MCP), Mono Dicalcium Phosphate (MDCP), Dicalcium Phosphate (DCP), and Tricalcium Phosphate (TCP).

General aspect

Fine grained flowing powder of light grey colour.

Observation

Quality control of mineral phosphates include analysis of granulometry, humidity, colour, and impurities content. Rock phosphate can contain several heavy metals that may be detrimental to animals. Fluorine is probably the most common element that may negatively affect an animal. Heavy metals that should be constantly monitored are fluorine, cadmium, and arsenic. Rock phosphate can also contain vanadium which can impact eggshell quality. To reduce the dust and waste produced in the feed factory, phosphates should be managed using pneumatic transporting. Minerals phosphates are hygroscopic product and it must be stored in dry conditions dry conditions to avoid caking problems. Phosphates are detrimental to the pelleting process because they create significant friction at the pellet die.

General controls and acceptance requirements

Parameter to analyse	When	Parameter to analyse	Values				
			Normal			Reclaims	Decline
Humidity (%)	Before Unloading	Basic	<1				>2
Phosphorus[1] (%)			>20	>21	>22		
Calcium[1] (%)			27	21	17		
Fluorine (ppm)		Extended	<2000				
Cadmium (ppm)			<10				
Arsenic (ppm)			<10				
Vanadium (ppm)			<7				
Solubility in citric acid (%)			>93				<93

[1]*Values for DCP anhydrous, MDCP hydrated, and MCP hydrated.*