Ministry of Food Processing Industries
Government of India

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Reading Manual for Oats Processing

Under PMFME Scheme

National Institute of Food Technology Entrepreneurship and Management
Ministry of Food Processing Industries
Plot No.97, Sector-56, HSIIDC, Industrial Estate, Kundli, Sonipat, Haryana-131028

Website: http://www.niftem.ac.in
Email: pmfmecell@niftem.ac.in
Call: 0130-2281089

CONTENTS

ABBREVIATIONS & ACRONYMS

Sr: No.	Abbreviations &Acronyms	Full Forms
1.	APEDA	Agricultural and Processed Food Products Export Development Authority
2.	FAO	Food and Agriculture Organization
3.	FBO	Food Business Operator
4.	FLRS	Food Licensing and Registration System
5.	FPOs	Farmer Producer Organizations
6.	FSSAI	Food Safety and Standards Authority of India
7.	kcal	kilocalorie
8.	MoFPI	Ministry of Food Processing Industries
9.	PA	Polyamide
10.	PET	Polyesters
11.	PFA	Prevention of Food Adulteration
12.	SHGs	Self Help Groups
13.	UAE	United Arab Emirates
14.	UK	United Kingdom
15.	US	United States
16.	WVTR	water vapor transmission rate

CHAPTER 1
INTRODUCTION

1.1. Industrial Overview:

The word cereal is derived from the Latin word "cerealis" which means 'grain,' a type of fruit known as the caryopsis bot, consisting of endosperm, germ, and bran. The grains are annuals of the grass family (monocot family Poaceae, also known as Gramineae). Their cereals are mostly long and thin stalks such as rice, wheat, sorghum, millet, maize, rye etc. and are used as food for starchy grains. Not only these grains are classified as cereals, but they also mean food made from the stubborn cereal grains of flours, bread, Dalia, and pasta.

The amazing fact is the foods human beings eat most are grasses all around the world. The great truth is the foods that people consume most are worldwide grasses. Cereal grains were an early human farming experiment and still, due to where they live and what grows well there, people still enjoy them. The grain is cultivated more than any other form of crop and hence it provides more nutrition for food worldwide; food crops are therefore stapled. They are a rich source of vitamins, nutrients, carbohydrates, fats, proteins, and protein in their normal state (as in whole grain). The residual endosperm, though, is primarily carbohydrate and loses any other nutrients until refined by the elimination of bran and germ. Cereals are typically sold as human food in raw grain or as food additives or as animal feed.

A whole grain consists of 3 main parts:

- **Bran**: The outer, rough coating of the grain. It includes minerals, fiber, and antioxidants.

- **Germ**: a nutrient-rich core of carbohydrates, proteins, fats, minerals, vitamins, antioxidants, and various phytonutrients. The germ is the embryo of the plant, the portion which germinates and grows as a new plant.
- **Endosperm:** The endosperm contains carbohydrates (in the form of starch) and protein. it is the biggest part of the grains. When the bran and germ removed, leaving just the endosperm called refined grains.

1.1.1. Types of Cereal Grains

Image	Name	Description
	**Rice (*Oryza sativa*).**	Rice is an ideal source of calories due to its starch quality. It contains 75-80 per cent starch, 7 per cent protein, 0.4-0.8 per cent lipids and 12 per cent water. Rice oat protein is of high digestible consistency and contains 4.1mg/100g lysine of protein more than wheat.
	**Wheat**	Wheat is produced in different parts of the world; India is the second-largest producer of wheat after China. Wheat the becoming an essential part of the everyday diet. Wheat is used for the cooking of cereals, flour, noodles, pasta, cakes, and porridge. Wheat is normally milled, but grains may also be puffed, flaked, or steamed.
	**Barley**	Barley is a quite healthy crop. it is widely used in stews, bread, soups, and health items, although it is mostly grown as animal feed and as

		a source of malt for alcoholic beverages, particularly beer.
	**Sorghum**	Very nutritious course grain seed Sorghum is commercially used for food, feed, and alcoholic beverage processing
	**Millet**	Mostly grown in Asia and Africa, Porridge millet is popular in China, Russia, and Germany. It can also be used to produce alcoholic drinks, such as animal feed and bird feed.
	**Oats**	Oats are the cereal and staple food in European countries and also used as breakfast cereals in more than half of the world. Due to the high fiber content, it is common to reduce weight and lower blood sugar levels.
	**Rye**	Rye is also known as a grain of cold climates used to make pizza, beer, whiskeys, and sometimes used as animal feed.
	**Maize**	Corn is a staple cereal in continents such as South America and Africa being consumed directly by humans and is used as animal feed worldwide.

1.2. Product Description:

In most of the world's temperate regions, oats (Avena sativa) are grown, especially in the United States, Canada and northern Europe. In animal feed, most of the oats

produced are used, although they may also be processed for human consumption. Versatile oatmeal comes in several varieties, whether it's a bowl of overnight steel-cut, tons of oatmeal raisin muffins or slices of soothing oatmeal pie. (Avena Sativa) is cultivated year-round in fields such as wheat and barley. Crops sown in spring and harvested in August are called 'spring '. In September, crops sown and harvested in spring are called 'winter'. When you know how to look for their tell-tale husks hanging from the main stem, or the oat flowers that are a familiar sight in Scotland all year round, they are easy to find. Within is the groat or oat, covered by the husk. The grain is grown to ripen slowly and plump up in cool summer temperatures and abundant rain, so it's no surprise that the Scottish climate is ideal! In the Scottish Borders, farmers have been rising for decades.

Oat (Avena sativa L.) is normally grown for fodder purposes in India. But late, its significance as grain has been felt and efforts are now being made to grow oat varieties that could provide high fodder yield from the same crop as well as grain yield. In the world, the area of oats and production is around 27m ha and 40m tones, respectively. The Russian Federation, the USA, Canada, Poland, China, France and Australia are typically oat-growing countries. The increasing states of Oats are in India, Punjab, Haryana, UP and small areas in MP, Orissa, Bihar, West Bengal.

1.2.1. Value Added Product:

Oatmeal is a nutrient-dense whole grain (an ancient whole grain) that's readily available, inexpensive, and simple to cook, from rolled oats to steel-cut oats to Scottish oats. The styles of oats below are:

- Oatmeal- Oatmeal is a type of porridge produced from oat grains milled, steel-cut, or rolled. From rolled to instant oatmeal to whole oat gr, an ancient cereal grain comes in many types, but all originate as oat plant seeds. Oatmeal generally has a subtle, sweet flavour when cooked and a smooth, often chewy, texture.
- Whole Oat Grain- Also called whole oat kernels, whole oat grain is the purest, least processed type of oats. The husk is removed during processing, but the bran and the germ remain. The whole oat gr has a chewy texture similar to farro when cooked and a nutty, sweet flavour. This variety can take up to an hour to cook due to its limited processing. Simmer them in a slow-cooker overnight to make a simple and hearty morning meal.

- Steel-Cut-oats are toasted whole oat gr, steel cut oats, or Irish oats, that have been cut by a steel blade into smaller pieces. As a consequence, cook steel-cut oats with whole oat gr in approximately half the time. A chewy, smooth texture and subtle, sweet taste are packaged with steel-cut oatmeal. A great grab-and-go breakfast in the morning is overnight steel-cut oats in Mason jars, with fresh fruit, almonds, honey, and more.
- Scottish oats- Using the traditional Scottish process, this form of oatmeal is processed where oats are stone-ground rather than rolled or cut with steel. Uncooked Scottish oats are more finely ground compared to steel-cut oats, which resemble broken rice.
- Rolled - Also referred to as old-fashioned rolled oats, whole oat gr is made of steamed, rolled, and flattened rolled oats. As a result, they cook much quicker than Scottish or steel-cut oats. When cooked, rolling oats have a characteristic flat, disc shape and a smooth, fluffy texture. They're also the most popular variety at the grocery store that you'll find and are sometimes used in baking.
- Instant Oatmeal- You get instant oatmeal when you take rolled oats and steam them for much longer. Instant oatmeal cooks in seconds as the most processed sort of oat and has a smooth, creamy consistency and mild flavour.

1.3. Market Potential:

For many people worldwide, oatmeal is the ideal alternative for breakfast cereal. It is eaten because of its high content of nutrients, including high protein, carbohydrates from starches, dietary fibre, vitamins, and minerals. Fruit, barriers, nuts, and milk are typically enjoyed with the oatmeal. Oatmeal, which contains over 26 bioactive substances and is rich in antioxidants, allows the body to defend against chronic diseases, such as heart disease, diabetes, and cancer. Oatmeal is an ideal food for a hectic lifestyle because it is easy to prepare and satisfies the body's everyday nutritional needs. India's oats and cornflakes market has shown very tough competition over the course of the year. In the breakfast cereal segment, which has risen at a healthy CAGR of about 24 percent over the last five years, the hot cereal market consisting of oat meal has been the fastest growing. According to the recently published report "India Breakfast Cereal Market Outlook, 2021" by bonafide Study, the market for oats is set to rise at a CAGR of 21% between 2015 and 2021. Oats have already emerged as a popular breakfast cereal, owing to the rising demand for healthy food in metros and big cities. Perhaps the biggest trigger for their adoption by Indians would be health

benefits. As oats are typically cooked by boiling them in milk, Indians are also pleased with their choice for hot breakfasts.
[i]

1.4. Raw Material Description:

The single ingredient in oatmeal is oat grain. In the fall, the seeds of the Avena herbs are harvested. As they have high protein content without being overly starchy, the thinner-skinned grains are preferable. In addition, thin-skinned oats will produce 60 percent oatmeal, while thick-skinned oats will yield 50 percent. Keep in mind when selecting oatmeal that are less processed varieties such as steel-cut oatmeal, which will nutritionally give you the most bang oats for your buck. This does not mean, however, that a poor option is more processed types such as instant oats. All oatmeal varieties are whole grains, and calories, fat, carbohydrates, fibre, sugar, and protein have relatively small deviations.

Oats have many distinctive properties that differentiate their milling from other cereal grains- their hull is not linked to the endosperm, they have a higher fat content than most cereal grains, and they contain high soluble dietary fibre amounts. They are a whole grain that is gluten-free and a fantastic source of substantial vitamins, minerals, fibre and antioxidants. Whole oats are rich in polyphenols called antioxidants and beneficial plant compounds. A special group of antioxidants called avenanthramides, which are almost exclusively present in oats, is most noteworthy. Oats contain large quantities of a form of soluble fibre called beta-glucan. Beta-glucan partially dissolves in water and forms a solution in the gut that is dense, gel-like. The beta-glucan fibre in oats has been shown to be effective in lowering both total and LDL cholesterol levels in several studies. Lower levels of blood sugar, particularly in individuals who are overweight or have type 2 diabetes, can help. Filling foods can help you consume less calories and lose weight. Back in 2003, the FDA approved colloidal oatmeal as a skin-protective material. In fact, however, oats have a long history of use in various skin conditions in the treatment of itching and irritation.

1.5. Types of Raw Material:

Oats is a significant crop just as grain crop. Development of Oat is comparable as wheat crop. It is predominantly filled in Calm and Subtropical environments. It can likewise flourish well in high-elevation jungles. They are exceptionally well known because of their medical advantages. Oat dinner is exceptionally celebrated food. Oats is wealthy in proteins and fibre. They likewise help in weight reduction, controlling pulse and for building solid invulnerable framework.

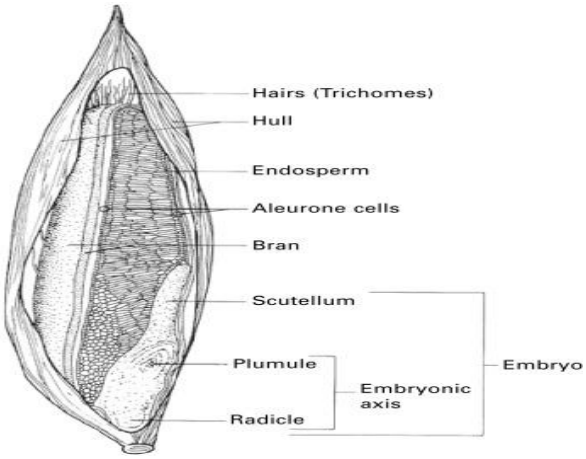
Sl. No.	Varieties	Description
1.	Weston-11	It has been released in 1978 for cultivation in Punjab. Plants have height of about 150 cm. Grains are long and amber in color.
2.	Kent	It is suitable for growing in all areas of India. Average plant height is 75-80 cm. This variety is resistant to rust, lodging and blight. It gives fodder yield of 210 qtl/acre.
3.	OL-10	Appropriate for development taking all things together watered territories of Punjab. Seeds are of medium size. Gives normal grain yield of 270 qtl/section of land.
4.	OL-9	Appropriate for development taking all things together watered territories of Punjab. Seeds are of medium size. Gives normal seed yield of 7 qtl/section of land and grain yield of 230 qtl/section of land.
5.	OL 11	Delivered in 2017. It gives a normal yield of 245qtl/section of land. The plants are verdant, long and wide leaf.
6.	Brunker-10	It is a fast-developing assortment having fine, restricted, smooth leaves. It is safe against dry spell. It very well may be developed in regions of Punjab, Delhi, Haryana and Uttar Pradesh.
7.	HFO-114	It is reasonable for developing on the whole oat developing regions. It was delivered in 1974 by HAU, Hisar. This assortment is tall and it is impervious to housing. It has strong seeds and has a normal yield of 7-8

		qtl/section of land of seed.
8.	Algerian	This assortment is reasonable for inundated zones. Normal plant stature is 100-120 cm. It has moderate early development and light green shading leaves.
9.	Operating system 6:	Reasonable for development on the whole zones of India. Gives normal green grub yield of 210 qtl/section of land.
10.	Bundel Jai 851	Appropriate for development altogether zones of India. It gives normal green grain yield of 188 qtl/section of land.[ii]

CHAPTER 2
PROCESS & MACHINERY REQUIREMENT

2.1. Raw Material Aspects:

The bran, germ, and endosperm are all in the oat kernel. Two floral bracts comprise the oat ground composed of the egg, endosperm, and outer layers (lemma and pale). These components become mature, dehydrated structures and are generally referred to as hulls. This oat grain is separated in order to consume humans but makes a huge contribution to the total weight of the kernel (30 percent). The hulls close the ground in order to provide security during the growth of the oat kernel. During kernel growth and maturity, the hulls are structurally and compositionally very different. During the production of the kernel, huls contain various tissues, such as photosynthetic and vascular tissues, for the transport of nutrients. These ingredients contribute to grass nutrition. The hulls become dry and weak and lack any metabolic activity after the ground matures. The parallels with other morphologies in the cereal ground are noticeable once the hulls have been removed. In comparison with wheat and barley kernels a long, hairier oat kernel is nevertheless recognized. In the oat grout, the bran; germ, and starchy endosperm contain three separate morphological and chemical components.



2.2. Source of Raw Material

The oat is primarily grown for fodder but with time and is grown also for grain crops. The practices of cultivation are like wheat production. Oats are in the Poaceae family (alt. Gramineae). Oats originated from the Mediterranean area. Recently they became very popular due to their health benefits. Oats botanical name is *Avena sativa L*. and belongs to the tribe of Poaceae. Oat meal is the most famous food made out of oats. Oats cover an area of 27m hectares and production is 40 m tonnes around all over the world. The Oats countries are growing in India, Punjab, Haryana, UP, and in small regions in MP, Orissa, Bihar, and West Bengal. The oats as a raw material can be procured from the vendor or farmer. The availability of oats is limited so it is advisable to go for contract farming.

2.3. Technologies:

- **Grinding mill**

Electric motors are used in modern mills that use spinning millstones. Millstones do not touch when in operation. There is a distance between the rotating runner stone and the static bed stone that is defined by the grain scale. In the middle of the runner stone, the grain is fed from a chute into a cavity, referred to as the eye. The grain is spread over the millstone surface by a complex series of groves known as furrows, which help to ventilate and cool the millstones as well. The millstones' grinding surfaces are known as land and are separated into areas called harps. Once ground the flour passes along narrow groves called cracking and is expelled from the edge of the millstones.

❖ **Modern methods**

As the population grew and the need for more and better new milling method was invented. In modern technology all touching components are non-corrosive materials. These machines are using Low-temperature grinding technology so that the original ingredient cannot be lost. Ideal for dry crushing today improved production capacities These Dalia machines are widely used in the food industry and are known for their performance and economy.

2.4. Manufacturing Process:

Oats are the main staple food of the American diet used in oatmeal, bread, cereal, granola, and many other food items, but the oats are being taken from the ground to the table by a complex process. Various steps are taken to turn oats into a rabbit.

- **Cleaning**

Cleaning removes from the oats all undesirable content. Pass via a rotating screen under magnetic separators that remove scraps, sticks, pillars, maize, etc. In the end, a dry stoner removes hulls, lighter, low quality, steeps, and other grains. Oats go through a suction.

- **Hulling**

The hulls of the oats are indigestible and must be removed after cleaning. To remove the hull, spinning disks fly oats into rings which cause the hull not to damage the rest of the oat. The rest of the oat is named tall.

- **Kilning**

Drying or kilning is the next phase of the process. Because of the fat content, browning and desired taste must be achieved. Air and steam are injected to increase temperature and humidity. The oats are sent to the longer vertical cylinders. While the humidity helps to increase the enzyme content, it's bad for shelf stability and the product can be ruined. This excess humidity is removed by radiant heating. That step is important to develop the nutty flavor of the oat and also kills any bacteria or inactive yeast.

- **Rolling or cutting**

The oats are passed through a rasher sharp blade machine. Quick-cooking oats are rolled among the cylinders for a lighter and flatter flake. These processes are usually repeated several times to produce the desired type of oat flake. The hull is separated from the kernel in both processes. The hulls are tamed and utilized to other ends.

- **Roasting**

The cooked oats are then placed into a roaster and toasted for a predetermined period at a present temperature.

- **Packaging**

Pre-printed containers are filled with pre-measured amounts of oatmeal. A lid is vacuum-packed onto the top of the container. The containers are then loaded into cartons for shipment.

2.5. Flow Chart:

Steps	Machine	Uses	Picture
Grain Delivery	Unloading Bins	These are large bins designed for unloading of grains & similar product; they are equipped with large rod mess to prevent big impurities from entering system.	
Grain Storage	Silos	These Equipments are class of storage Equipments which are specifically designed for dry grain raw material of small granule composition. Usually used to store grains but can also be used to store cement & aggregate.	
Primary Cleaning	Vibro separator	Vibro separator is used to clean dust contained in the maize, dirt, and other foreign particle etc.	
Final cleaning	The gravity separator	this machine is used for separating grains that are of the same size but with a different specific weight	
DE hulling	De-huller	This machine is used for removing the outer layer of oats called de-hulling.	

Rolled Cutting	Rolling and Cutting Machine	The oats are run through a machine with razor-sharp knife blades. Quick-cooking oats are rolled between cylinders to produce a flatter, lighter flake.	
Roasting	Roasting Machine	The oats roasting machine are full of cutting-edge technologies and innovations that make industrial processes easy to execute.	
Filling	Packaging Machine:	It's a packing class machine, used to pack given efficiently. It's especially designed to handle with minimum wastage.	

2.6. Additional Machine & Equipment:

De-stoner	It's a machine which is used to remove stones from the given grain, widely used in various grain mills in cleaning section.	
Disc Separator	It's a separator class machine, generally used to remove foreign grains from required grain efficiently	
Magnetic Separator	It's a type of separator which is used to magnetic impurities from given product using powerful electromagnets, used in wide range of industries for separation.	

Aspirator	It's a more fine-tuned separator designed to remove finer impurities like remaining dirt, similar sized impurities, leaves etc.	
Food Grade Conveyor	These are conveyors with food grade belt to maintain food safety standards set by monitoring authorities.	

2.7. General Failures & Remedies:

S. No.	General Failures	Remedies
1.	Ball bearing failure of various machine	1. Proper periodic lubrication of all bearings in various machines. 2. Regular replacement of all bearing to prevent critical failures.
2.	Power Drive Overload	1. Ensure proper weighing & metering specially in case of semi-automatic plant. 2. Install warning sensor in buffer region of loading capacity to ensure efficient operation.
3.	Mechanical Key Failure	1. Ensure that mechanical keys are replaced as per there pre-defined operational life. 2. Prevent Overloading.
4.	Loss of Interface	1. This problem is dominant in newly established automatic plant, one must learn to maintain rules in plant & ensure no employee goes near transmission lines, unless authorised. 2. Provide proper physical shielding for the connections.

2.8. Nutritional Information:

The oats contains nutrition given below:

Nutritional value per 100 g	
Energy	379 kcal (1,590 kJ)
Carbohydrates	67.70 g
Sugars	0.99 g
Dietary fiber	10.1 g
Fat	6.52 g
Protein	13.15 g
Vitamins	**Quantity% DV**†
Vitamin A equiv.	0%, 0 μg
Thiamine (B1)	40%, 0.460 mg
Riboflavin (B2)	13%, 0.155 mg
Niacin (B3)	8%, 1.125 mg
Pantothenic acid (B5)	22%, 1.120 mg
Vitamin B6	8%, 0.1 mg
Folate (B9)	8%, 32 μg
Vitamin B12	0%, 0.00 μg
Choline	8%, 40.4 mg
Vitamin C	0%, 0 mg
Vitamin D	0%, 0 μg
Vitamin E	3%, 0.42 mg
Vitamin K	2%, 2.0 μg
Minerals	**Quantity% DV**†
Calcium	5%, 52 mg

Iron	33%, 4.25 mg
Magnesium	39%, 138 mg
Manganese	173%, 3.630 mg
Phosphorus	59%, 410 mg
Potassium	8%, 362 mg
Sodium	0%, 6 mg
Zinc	38%[iii]

2.9. Export Potential & Sales Aspect:

Not only are people getting busier, but also they need to simplify their lifestyle through small changes like food processed/packaged and ready-to-eat, which have grown in recent years. Usually, Indian breakfast consumption used to be hot cooked food that used to be time-consuming and in the current scenario, the inclusion of packed cereal breakfast meals was both healthy and time-consuming, in order to make the families younger and people more occupied. There are two types of cereals on the cereal breakfast market. Hot grains and cold cereals ready to eat. Cereals prepared to eat (RTE), known as cold cereals, include flakes of corn, chocolate, wheat, muesli while most hot cereals are oats, rolling oats, bran oats, and porridges. In the course of the years, India's breakfast and cereal market is on the rise with a constant increase in the demand for cornflakes, muesli, and oats. South India dominated the market because in this region oats have a higher consumption range. At least one food in the South Indians is hard-core rice and oats are offered as a way to replace rice. The Tier 1 cities in the general market are regarded as the premium buyers and their large consumer base and growing awareness increase the competition with the Tier 2 cities. Throughout the year, the Indian oat and cornflake markets were extremely competitive. The hot cereal market made up of oats has grown as quickly as possible in the past five years to around 24 percent of a healthy CAGR. The manufacturers realized that the situation was necessary and with their oats brand started going into the hot breakfast segment. Now oats have access to more tables for the breakfast, as warm milk is preferable to Indians. Apart from oats, hot cereals also include porridges, oat brans, and wheat bran. The global market for Oatmeal was estimated at $10,475 million in 2017, with a projected CAGR growth of 1.3% from 2018 to 2027, of $11,907 million by 2027.

CHAPTER 3
PACKAGING

3.1. Shelf Life of Product:

Dry cereal goes on for a long time, simply watch for an adjustment in shading or surface. Try not to eat it in the event that it builds up a scent or tastes not the same of course. For the bundled and dry blend cereal, it ought to be put away in a cool dry climate not vulnerable to temperature change. At the point when things experience temperature changes of cool to warm and the other way around, the dampness noticeable all around watches out for condensate inside the bundles. This dampness permits shape to develop and your cereal to ruin. Additional to dried rice or pasta, industrially prepared and uncooked moved, snappy, or steel cut oats will normally last at any rate a year — and as long as 2 years if the bundle stays unopened or the oats are put away in a sealed shut compartment. For arranged oats, you may keep it new more by putting away it in your fridge underneath 40°F following use. Arranged cereal ought to be put away in impenetrable holders that assist keep with excursion dampness and different toxins. Moreover, you ought to consistently try to utilize clean flatware when serving oats to stay away from cross-tainting.

Shelf life of Oats depends on following

- Storage Conditions
- Storage –Temperature & Humidity
- Cross Contamination
- Unhygienic Conditions
- Cracks on the floors & walls
- Standing water near the stores
- Spillage & bird faeces in the stores/stairs & floors
- Presence of grains germs in the flour.

In order to improve the shelf life of the grains Products, the following additional precautions should be taken by millers -:

- ✓ Use clean & fumigated grains for grinding.
- ✓ Use scouring machines in the cleaning line.

- ✓ Set cleaning machines with optimum efficiency to separate out all the impurities from the Wheat grains
- ✓ Clean the dead pockets of the cleaning line frequently, to get rid of non-moving grains at the elevator bottom & outlets, grains conveyor troughs, and tempered grain conveyors.
- ✓ Fumigate empty Grains bag.
- ✓ Before grinding, use scourers to remove dirt in tempered grains
- ✓ Regularly clean the Grinding equipment etc.
- ✓ Fumigate packing materials before every use.
- ✓ Frequently fumigate bins & conveyors.
- ✓ Always keep the parking area & the Dalia storage area clean.
- ✓ Type of packaging materials used.

3.2. Oats Packaging:

Packaging refers to the act of designing and producing the container or wrapper of a product. It is one of the most important parts of marketing.

There are many factors that need to consider while selecting a suitable type of pack for the product:

- ➢ The product contents.
- ➢ The application of the product.
- ➢ Content stability.
- ➢ Protection from any environmental factors
- ➢ Acceptability of the pack to the customer.
- ➢ Regulatory, legal, and quality issues.

Characteristics of packaging material:

The material selected must have the following characteristics:

- ✓ Must meet tamper-resistance requirements
- ✓ Must not reactive with the product
- ✓ They must protect the preparation from environmental conditions
- ✓ Must be non-toxic
- ✓ Must not impart odour/taste to the product
- ✓ Must be FDA approved.

Oats is packed directly in gunny bags, gunny poly-line bags for bulk sale, and for retail sale in laminated pouches or poly-bags.

- **Hanging Bags-** Hanging bags in grocery stores and other shopping outlets are commonly used. They are a type of plastic bag that is also sealed with a back-middle seam on both ends as well. Hanging bags have a pre-cut hole that makes it easier for them to hang from hooks so that they can be seen in an attractive way.
- **Pillow bags -** A pillow bag is another typical type of package. The bags are named for their shape, which is like a cushion. They are found lying flat on grocery store shelves in the grocery store and were known to carry the items.
- **Gusseted Poly Bags-** Gusseted bags are often called flat-bottom bags because they feature a tucked in pleat that's been pressed flat. It allows the bag to expand for greater carrying capacity and to keep the shape of a box if necessary. These types of poly bags can be heat sealed, tied, stapled, or taped shut. They're the perfect poly bag for anyone looking to get more flour in a single bag.
- **Flexible Pouches-** Flexible pouches are a perfect way to carry most packaged items. They can be made with zipper-seal closures, which tend to keep the inside contents fresh for use. Flexible pouches offer amazing printing capabilities, so you can add your attractive product branding to the pouch itself. Many pouches stand up on their own, which helps you improve your shelf appearance.

3.3. Type of oats Packaging:

- **Primary packaging:** Primary packaging is packaging which is in close association with the product itself and is often referred to as a consumer unit. The main purpose of the primary packaging is to contain, protect and/or conserve the final product, in particular against contamination.
- **Secondary packaging:** Secondary packaging is the outer packaging of the main packaging, which connects packages and further covers or marks the prescription component.
- **Tertiary packaging:** Tertiary packaging is used for the handling, transportation, and delivery of bulk products.

3.4. Material of Packaging:

In addition to cellulose and Aluminium foil, a very large amount of polymeric materials is used for packaging products. Paper boards and metal containers are also used for such purposes. While a range of packaging materials are available, the ultimate option of the packaging depends on the appropriate shelf life, the efficiency of the packaging machine, and the cost that is purely based on the market segment targeted by the manufacturer. The most common choice of packaging medium is plastic (usually flexible) as it offers the requisite safety and preservation, resistance to grease, physical strength, machinability, and printability.

Plastics that are lighter in weight are also the most preferred material for the packaging of flour. Plastic films and their laminates are increasingly used due to better properties and aluminium laminates due to price and better flex crack properties. Plastic packaging products that can be used are described below.

Polypropylene- Polypropylene films have better clarity than polyethylene and enjoy superior machinability due to stiffness. Lack of good salability has been a problem; however, PVDC and vinyl coating have been used to overcome this problem. Some varieties of PP have been specially developed for twist-wrap applications as they have the ability to lock in position after twisting.

Poly Vinyl Chloride (PVC)- PVC is a stiff and clear film having a low gas transmission rate. PVC can be used as small wraps, bags, and pouches. PVC when co-polymerized with polyvinylidene chloride is known as Saran. Since it is a costly material, it is only used as a coating to obtain barrier properties and heat salability. PVC film is also used for twist wraps, as it has twist retention properties and is excellent on high-speed machines.

Polyesters (PET) and Polyamide (PA) - Polyethylene terephthalate film has high tensile strength, gloss, and stiffness as well as puncture resistance. It has moderate WVTR but is a good barrier to volatiles and gases. To provide heat seal property, PET is normally laminated to other substrates. Nylons or polyamides are similar to PET but have high WVTR.

CHAPTER 4
FOOD SAFETY & FSSAI STANDARDS

4.1. Introduction to FSSAI:

The Food Safety and Standards Authority of India (FSSAI) has been established under Food Safety and Standards, 2006 which consolidates various acts & orders that have hitherto handled food-related issues in various Departments. The FSSAI is responsible for setting standards for food so that there is one body to deal with and no confusion in the minds of consumers, traders, manufacturers, and investors. The Act aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi-level, multi-departmental control to a single line of command.

Highlights of the Food Safety and Standard Act, 2006-

Various central Acts like Prevention of Food Adulteration Act, 1954 , Fruit Products Order , 1955, Meat Food Products Order , 1973, Vegetable Oil Products (Control) Order, 1947,Edible Oils Packaging (Regulation)Order 1988, Solvent Extracted Oil, De- Oiled Meal and Edible Flour (Control) Order, 1967, Milk and Milk Products Order, 1992 etc will be repealed after commencement of FSS Act, 2006.

The Act also aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi- level, multi- departmental control to a single line of command. To this effect, the Act establishes an independent statutory Authority – the Food Safety and Standards Authority of India with head office at Delhi. Food Safety and Standards Authority of India (FSSAI) and the State Food Safety Authorities shall enforce various provisions of the Act.

Establishment of the Authority-

Ministry of Health & Family Welfare, Government of India is the Administrative Ministry for the implementation of FSSAI. The Chairperson and Chief Executive Officer of Food Safety and Standards Authority of India (FSSAI) have already been appointed by Government of India. The Chairperson is in the rank of Secretary to Government of India.

4.2. FSSAI Registration & Licensing Process:

According to Section 31(1) of Food Safety and Standards (FSS) Act, 2006,Every Food Business Operator (FBO) in the country is required to be licensed under the Food Safety & Standards Authority of India (FSSAI).

As per FSS (Licensing & Registration) Regulations, 2011, Licenses and Registrations are granted to FBOs in a 3 tier system

- Registration - for petty FBOs with annual turnover less than Rs 12 lakhs
- State license - for medium-scale food manufacturers, processor and transporters
- Central License - for large-scale food manufacturers, processor and transporters

FSSAI registration is done online on the FSSAI website through Food Safety Compliance System (FoSCoS)

- FoSCoS has replaced the Food Licensing and Registration System (FLRS).
- Petty food business operators are required to obtain FSSAI Registration Certificate
- "Petty Food Manufacturer" means any food manufacturer, whomanufactures or sells any article of food himself or a petty retailer, hawker, itinerant vendor or temporary stall holder (or) distributes foods including in any religious or social gathering except a caterer;

or

- Other food businesses including small scale or cottage or such other industries relating to food business or tiny food businesses with an annual turnover not exceeding Rs. 12lakhs and/or whose production capacity of food (other than milk and milk products and meat and meat products) does not exceed 100 kg/ltr per day

Any person or entity that does not classify as a petty food business operator is required to obtain an FSSAI license for operating a food business in India.

FSSAI License - two types - State FSSAI License and central FSSAI License

Based on the size and nature of the business, the licensing authority would change.

- Large food manufacturer/processors/transporters and importers of food products require central FSSAI license
- Medium-sized food manufacturers, processor and transporters requires state FSSAI license.
- License period: 1 to 5 years as requested by the FBO.
- A higher fee for obtaining FSSAI license for more years.

- If a FBO has obtained the license for one or two years, renewal may be done, no later than 30 days prior to the expiry date of the license.

4.3. Food Safety & FSSAI Standards & Regulations:

"2.4 Cereals and Cereal Products; 2.4.12 Rolled Oats": ROLLED OATS (quick cooking oats) means the product made from sound hulled oats (*Avena sativa*). It shall be free from added colours, rancidity and flavouring agents. It shall be in the form of flakes of uniform size having a light cream colour. It shall be free from dirt, insects and insect fragments. It shall conform to the following standards:—

Moisture	**Not more than 10.0 %**
Total ash	Not more than 2.0 per cent on dry basis
Ash insoluble in dilute HCl (on dry basis).	Not more than 0.1 percent
Nitrogen-	Not less than 1.8 per cent on dry basis.
Crude Fibre	Not more than 2.0 percent on dry Basis
Alcohol acidity (with 90 per cent alcohol)	Shall be equivalent to not more than 8.0 ml. N. NaOH Per 100 gm. of dried substance.

Food Safety

Part I - General Hygienic and Sanitary practices to be followed by Petty Food Business Operators applying for Registration

Sanitary and hygienic requirements for food manufacturer/ processor/handler

The place where food is manufactured, processed or handled shall comply with the following requirements:

1. The premises shall be located in a sanitary place and free from filthy surroundings and shall maintain overall hygienic environment. All new units shall set up away from environmentally polluted areas.

2. The premises to conduct food business for manufacturing should have adequate space for manufacturing and storage to maintain overall hygienic environment.

3. The premises shall be clean, adequately lighted and ventilated and sufficient free space for movement.

4. Floors, Ceilings and walls must be maintained in a sound condition. They should be smooth and easy to clean with no flaking paint or plaster.

5. The floor and skirted walls shall be washed as per requirement with an effective disinfectant the premises shall be kept free from all insects. No spraying shall be done during the conduct of business, but instead fly swats/ flaps should be used to kill spray flies getting into the premises. Windows, doors and other openings shall be fitted with net or screen, as appropriate to make the premise insect free The water used in the manufacturing shall be potable and if required chemical and bacteriological examination of the water shall be done at regular intervals at any recognized laboratory.

6. Continuous supply of potable water shall be ensured in the premises. In case of intermittent water supply, adequate storage arrangement for water used in food or washing shall be made.

7. Equipment and machinery when employed shall be of such design which will permit easy cleaning. Arrangements for cleaning of containers, tables, working parts of machinery, etc. shall be provided.

8. No vessel, container or other equipment, the use of which is likely to cause metallic contamination injurious to health shall be employed in the preparation, packing or storage of food. (Copper or brass vessels shall have proper lining).

9. All equipments shall be kept clean, washed, dried and stacked at the close of business to ensure freedom from growth of mould/ fungi and infestation.

10. All equipments shall be placed well away from the walls to allow proper inspection.

11. There should be efficient drainage system and there shall be adequate provisions for disposal of refuse.

12. The workers working in processing and preparation shall use clean aprons, hand gloves, and head wears.

13. Persons suffering from infectious diseases shall not be permitted to work. Any cuts or wounds shall remain covered at all time and the person should not be allowed to come in direct contact with food.

14. All food handlers shall keep their finger nails trimmed, clean and wash their hands with soap, or detergent and water before commencing work and every time after using toilet. Scratching of body parts, hair shall be avoided during food handling processes.

15. All food handlers should avoid wearing, false nails or other items or loose jewellery that might fall into food and also avoid touching their face or hair.

16. Eating, chewing, smoking, spitting and nose blowing shall be prohibited within the premises especially while handling food.

17. All articles that are stored or are intended for sale shall be fit for consumption and have proper cover to avoid contamination.

18. The vehicles used to transport foods must be maintained in good repair and kept clean.

19. Foods while in transport in packaged form or in containers shall maintain the required temperature.

20. Insecticides / disinfectants shall be kept and stored separately and `away from food manufacturing / storing/ handling areas.

4.4. Labelling Standards (Regulation 2.5 of FSS)

Labelling requirements for packaged food products as laid down in the Part 2.4 of the Prevention of Food Adulteration (PFA) Rules, 1955, and the Standards of Weights and Measures (Packaged Commodities) Rules of 1977, require that the labels contain the following information:

1. Name, trade name or description
2. Name of ingredients used in the product in descending order of their composition by weight or volume
3. Name and complete address of manufacturer/packer, importer, country of origin of the imported food (if the food article is manufactured outside India, but packed in India)
4. Nutritional Information
5. Information Relating to Food Additives, Colors and Flavors
6. Instructions for Use
7. Veg or Non-Veg Symbol
8. Net weight, number or volume of contents

9. Distinctive batch, lot or code number
10. Month and year of manufacture and packaging
11. Month and year by which the product is best consumed
12. Maximum retail price

Provided that — (i) the nutritional information may not be necessary, in case of foods such as raw agricultural commodities, like, wheat, rice, cereals, flour, spice mixes, herbs, condiments, table salt, sugar, jaggery, or non –nutritive products, like, soluble tea, coffee, soluble coffee, coffee-chicory mixture, packaged drinking water, packaged mineral water, alcoholic beverages or flour and vegetables, processed and pre-packaged assorted vegetables, flours, vegetables and products that comprise of single ingredient, pickles, papad, or foods served for immediate consumption such as served in hospitals, hotels or by food services vendors or halwais, or food shipped in bulk which is not for sale in that form to consumers.

Wherever applicable, the product label also must contains the following

The purpose of irradiation and license number in case of irradiated food. Extraneous addition of coloring material.

Non-vegetarian food – any food which contains whole or part of any animal including birds, fresh water or marine animals, eggs or product of any animal origin as an ingredient, not including milk or milk products – must have a symbol of a brown color-filled circle inside a brown square outline prominently displayed on the package, contrasting against the background on the display label in close proximity to the name or brand name of the food.

Vegetarian food must have a similar symbol of green color-filled circle inside a square with a green outline prominently displayed.

All declarations may be: Printed in English or Hindi on a label securely affixed to the package, or Made on an additional wrapper containing the imported package, or Printed on the package itself, or May be made on a card or tape affixed firmly to the package and bearing the required information prior to customs clearance.

Exporters should review the Chapter 2 of the “FSS (Packaging and Labelling) Regulation 2011” and the Compendium of Food Safety and Standards (Packaging and Labelling) Regulation before designing labels for products to be exported to India. FSSAI revised the labelling Regulation and a draft notification to that effect was published on April 11, 2018, inviting comments from WTO member countries and the comments received are under review and the publication date remains unknown.

According to the FSS Packaging and Labelling Regulation 2011, “pre-packaged” or “pre packed food” including multi-piece packages, should carry mandatory information on the label.

Chapter 5
Opportunities for Micro/Unorganized Enterprises

5.1. PM-FME Scheme:

Ministry of Food Processing Industries (MoFPI), in partnership with the States, has launched an all India centrally sponsored "PM Formalisation of Micro Food Processing Enterprises Scheme (PM FME Scheme)" for providing financial, technical and business support for up-gradation of existing micro food processing enterprises. The objectives of the scheme are:

I. Support for capital investment for up-gradation and formalization with registration for GST, FSSAI hygiene standards and Udyog Aadhar;
II. Capacity building through skill training, imparting technical knowledge on food safety, standards & hygiene and quality improvement;
III. Hand holding support for preparation of DPR, availing bank loan and up-gradation;
IV. Support to Farmer Producer Organizations (FPOs), Self Help Groups (SHGs), producers cooperatives for capital investment, common infrastructure and support branding and marketing.[iv]

References

[i] https://www.marketdataforecast.com/market-reports/oats-market

[ii] https://www.apnikheti.com/en/pn/agriculture/crops/cereals/oats

[iii] https://fdc.nal.usda.gov/fdc-app.html#/food-details/173904/nutrients
[iv] https://mofpi.nic.in/pmfme/docs/SchemeBrochureI.pdf