



PM Formalisation of Micro Food Processing Enterprises Scheme

Processing of Dates



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CHAPTER 1

INTRODUCTION

1.1 History of Dates

The date fruit ((Phoenix dactylifera L.) is not only a nourishing fruit that can easily be preserved as a product and it can be stored, and transported over long distances, especially in dry climates. Date palm also provides a suitable place for nomadic people to settle by making shade and protecting them from desert winds. The date



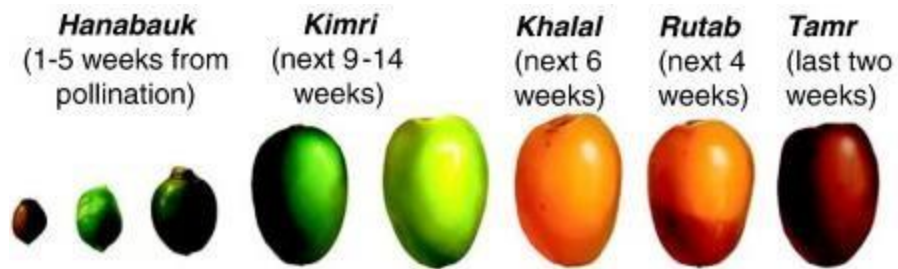
palm has been used as food for 6000 years and is one of the oldest plants cultivated by human beings. In arid and semi-arid regions of the world, it is an especially valuable commodity and plays an important role in the economic and political life of the population of these regions.

1.2. Stage of fruit development and ripening

Date ripening is a complicated process including chlorophyll degradation, carotenoid synthesis, cell wall degradation, and conversion of starch to sugars. During formation and ripening, date goes through the stages of hababauk, kimri, khalal, rutab and tamer.

- Hababauk: This stage appears after pollination; the fruit has a round shape, whitish cream color with green stripes. This stage is relatively slow and continues for 1–5 weeks after pollination.
- Kimri stage (green stage): At this stage, the fruit is apple green in color and quite hard. It is the longest stage of growth and development of dates and lasts a total of 9 -14 week.
- Doka or Khalal or bisr: In the next 6 weeks, the fruit is mature, hard and the color changes completely from green to greenish-yellow, yellow, pink, red, or scarlet depending on the variety. At this stage, sugar increases slowly and becomes mainly sucrose. This is the stage where date fruit reaches its maximum weight and size, sugar is rapidly increasing associated with a decrease in the moisture content of fruit (50-85 %).

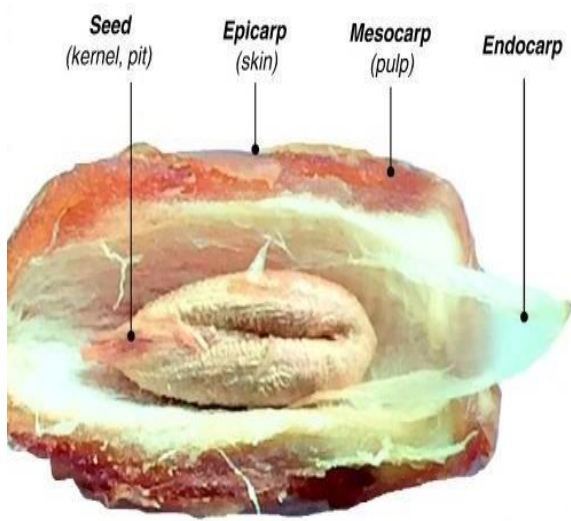
- Dang or Rutab: This stage is the start of ripening. The duration of this stage is around 4 weeks during this stage the fruit loses its water contents and becomes soft sweeter and start developing dark in color. Protein, fat, and ash percentages decrease at this stage.
- Pind or Tamer: This is the final stage of ripening. The duration of this stage is 2 weeks. During these stages fruit gains maximum total solids, highest sweetness, lowest astringency, dark brown color, soft texture, and a wrinkled appearance.



1.3. Major component of date fruit

S. No.	Constituents	Quantity (%)
	Water	5–20
	Sugar	44–88
	Protein	1–7
	Fat	0.1–0.5
	Pectin	1–4
	Ash	1–2.5
	Crude fiber	3–18
	Polyphenol	3

1.4. Importance



The fruit of the date palm (*Phoenix dactylifera* L.) is one of the most abundant fruits in the world. Hundreds of varieties having different textures, colors and flavors are available for valorization and adoption in food processing operations. The date fruit is composed of a pericarp, mesocarp, endocarp, and one seed (seed is also called the kernel, pit, or pyrene). The mesocarp, representing the most part of the fruit pulp, consists of enlarged parenchymatous

cells and is divided into outer-mesocarp and inner-mesocarp intermediated by 3–10 layers of stanniferous cells.

1.5. Statistics

1.5.1 Global scenario

Most of the world's date production is concentrated in the subtropical climate of North Africa and the Middle East. The harvesting season extends from July to late November, depending on the variety. However, the main harvest starts in September. The world date production is increasing at a steady rate, and it reached more than 1.1 million tonnes in 2019. Saudi Arabia is the leading producer of dates, with a 20% share of the world's production. It is followed by Iran (15%), the United Arab Emirates (12%), Tunisia (11%), Egypt (11%) and Algeria (9%). Depending on the season of ripening, the cultivars are classified as early, mid and late cultivars. Though there are nearly 40 cultivars imported from Middle East and North Africa, few only were found to be promising, under Indian conditions.

- Halawy: An early variety with small fruits. At full maturity before ripening (doka stage) the fruits are yellow in color and free from astringency.
- Khadrawy: Small to medium sized fruits; light yellow at doka stage.

- Barhee: Mid –season to slightly late cultivar with small to medium sized fruits, yellow color and low astringency at doka stage.
- Medjool: A late cultivar; fruits are large, broad, oblong-ovate, orange yellow with reddish brown stippling at doka stage.
- Zahid: Mid – season cultivation with small to medium sized fruits ; it is tolerant to rain and humidity.

1.5.2 National scenario

Today, we are the world's largest Date importers, due to its unbeatable taste, versatility, and various health benefits, most Indians have been attracted by dates. Nutritionists and dieticians are also prescribing dates to their patients, as they help strengthen the bones, keep the nervous system energized, boost digestion, and maintain control of cholesterol. Dates are also helpful for managing medical problems, such as night blindness, hyperacidity, obesity, dehydration, anxiety in pediatrics, skin allergies, and tumors.



In view of this consideration, the global date market is therefore expected to see substantial growth over the projected period; Global data for date consumption is projected to rise at a CAGR of 4.5 percent over the 2020-2025 forecast periods.

1.6 Value Added Products from Dates

Many products can be processed from date, including date syrup, beer, animal feed, date powder, different types of bread, marmalade, sweet candy, chocolate, date paste, and others. The date palm not only has an important role in the desert ecosystem, but it has many applications for farming and animal husbandry. It is also important in the agricultural economy. The stem of the date plant can be used as making boats, covering the roof of rural houses, used for making paper and fiber.

Date fruit is an important product in the world and plays a significant role in the economic and political life in date growing regions. Date palm (*Phoenix dactylifera* L.) is a monocotyledon plant that goes through the stages of hababauk, kimri, khalal, rutab, and tamer during ripening. The main constituents of date include water, sugar, protein, fat, pectin, ash, crude fiber, and polyphenols. Processing of date includes cleaning, grading, heat treatment, drying, fumigation, irradiation, moistening, pitting, pasteurization, coating, and packaging. Date palm products include semi-finished and ready-to-use date products, derived products from date such as date juice, date syrup, date spread, liquid date sugar, “Tarooneh” arrack, and sago. Fermented products from date include alcohol, wine, organic acids, and single cell protein. Date by-products containing date pit and press cake can be used in producing alcohol and animal feed. As date pit contains dietary fiber and phenolic compounds, it can be used in functional foods. The aim of the present study is to collect comprehensive information about date fruit and dates processing.



1.6.1 Pretreatments prevent fruits from darkening during long-term storage

- **Sulfuring:**

In this method, sublimed sulfur is ignited and burned in an enclosed box with the fruit. The sulfur fumes penetrate the fruit and act as a pretreatment by retarding spoilage and darkening of the fruit. The sulfur fumes also reduce the loss of vitamins A and C.

- **Sulfite dip:**

Sulfite dips can achieve the same long-term anti-darkening effect as sulfuring, but more quickly and easily. Either sodium bisulfite or sodium meta-bisulfite that are USP (food grade) or Reagent grade (pure) can be used.

Directions: Dissolve $\frac{3}{4}$ to $1\frac{1}{2}$ teaspoons sodium bisulfite per quart of water. (If using sodium sulfite, use $1\frac{1}{2}$ to 3 teaspoons. If using sodium meta-bisulfite, use 1 to 2 tablespoons.) Place the prepared fruit in the mixture and soak 5 minutes for slices, 15 minutes for halves. Remove fruits, rinse lightly under cold water and place on drying trays for drying.

- **Ascorbic Acid**

Ascorbic acid (vitamin C) mixed with water is a safe way to prevent fruit browning. However, its protection does not last as sulfuring or sulfiting.

Directions: Mix 3000 mg ascorbic acid tablets, crushed in 2 cups of water. Place the fruit in the solution for 3 to 5 minutes. Remove fruit, drain well and place on dryer trays. After this solution is used twice, add more ascorbic acid.

- **Fruit juice dip**

A fruit juice that is high in vitamin C can also be used as a pretreatment, though it is not as effective as pure ascorbic acid. Juices high in vitamin C include orange, lemon, pineapple, and grape. Each juice adds its own color and flavor to the fruit.

Directions: Place enough juice to cover the fruit in a bowl. Add sliced fruit. Soak 3 to 5 minutes, remove fruit, drain well and place on dryer trays. This solution may be used twice, before being replaced.

- **Honey dip**

Honey dipped fruit is much higher in calories.

Directions: Mix ½ cup sugar with 1 ½ cups boiling water. Cool to lukewarm and add ½ cup honey. Place fruit in dip and soak 3 to 5 minutes. Remove fruit, drain well and place on dryer trays.

1.7 Scope of Dates Industry

Date is one of the best fruits, which contains fructose as sugar ingredients, which is totally fermentable sugar and can be completely converted to ethyl alcohol by fermentation process. There are few expensive fabricating companies who can design the distillery plants and fabricate the plants. There is very good demand of medical alcohol. There is much more demand of it in India also. It is required about 30000000 litres alcohol needed for Homoeopathic medicine only and again it is required for Allopathic medicine. Few new entrepreneurs can venture into this project.

There is large use of animal feed in India, Middle East and also in the European Countries. It will help to increase the animal health. Most of the raw ingredients available in our country, most of the European Countries, and also in the Middle East. It is used as feed for the animal growth and nutrition. Due to globally increase of population there is sharp decrease of green fields used for animals. According to observation there is globally increase of population about 0.5% per annum. There is demand of animal feed increase 1.5-2% per annum. It can be concluded that there is very big demand created globally in every year. So there is very good scope for new entrepreneur who can manufacture well balanced animal feed.

The global production of date's fruit is about 5.4 mn metric tonnes per year. The five largest producers are Egypt, Iran, Saudi Arabia, Pakistan, & Iraq. Approximately, 93% of dates harvested in the country are consumed within.

Global "Date Fruit Market" size is projected to reach USD 16370 million by 2026, from USD 12150 million in 2020, at a CAGR of 5.1% During 2020-2026. 360 Research Reports provides

key analysis on the global market in a report, titled "Date Fruit Market by Types (Conventional Date Fruit, Organic Date Fruit), Applications (Whole Date product, Date Syrup, Date Paste, Deep Processing, Cakes and Pastries) and Region - Global Forecast to 2026"

CHAPTER 2

PROCESSING OF DATES

2.1 Dates Processing

Postharvest management of Date

Dates are sorted after harvesting. Sorting is performed manually by workers who, remove other material as well as, extract degraded and infested dates from the dates. Date processing involved the removal of the caps and pits to reduced transportation costs. It is achieved by



crushing and sieving the fruits, or more sophisticatedly, by piercing the seed out of the fruit, scraping date pits. The next stage includes fumigation and sterilizing the fruit to avoid pest damage. Fumigation, heat treatment, cold storage, and irradiation, of which fumigation is the most common technology, but prevent from fumigated contamination irradiation by gamma rays are the main latest and safe technology for avoiding insect infestation.

2.1.1 Proper processing technologies are given below:

Good harvesting and handling practices during and post-harvesting can reduce the mechanical damage and wastage of fruit due to microbial attacks.

- Transportation after harvesting.

The harvested fruit is packed into large plastic or wooden bins for transportation to the packing station. To prevent the fruit damage and losses due to heat the fruits of date are transported carefully in the morning hours. The insect-pest is attacked in fruit after harvesting so quick transportation is recommended.



- Quick initial Sorting

The first post-harvest handling operation involves the separation of ripe dates from immature ones or from those affected by insects, birds, rats, transport, etc. during processing.

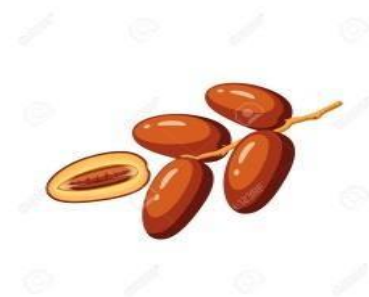


- Cleaning

Dates coming from the farm may be contaminated with sand particles, dust, dirt, or other chemical products all these foreign particles should be removed by washing in running water. Fruit cleaning may be done by gently brushing the dates and blowing air on the fruits to prevent damage to the skin. The washer can also be used to clean dates.

- Removing of seed

The pit is removed (if required) manually, Pull open the date with the help of a small serrated or paring knife and remove the pit from the Date.



- Drying

After washing it is necessary to remove the moisture from the fruit to prevent the growth of molds and yeasts. The moisture of fruit should not be more than 20 %. Air-drying at the 55–650 c for drying of soft dates is generally used.

- Sorting

Dates are sorted to remove culls and to divide them into standard sizes. Sorting can be carried out manually or mechanically in crates or on moving conveyor belts. Fruits are sorted according to maturity, color, flesh consistency, shape, and size. The fruit damaged, undeveloped, and overripe, distorted fruits are discarded.



- Sizing/grading

Sizing and grading are done manually or mechanically to separate fruit based on size and weight. Uniformity of size in a package is one of the quality criteria for dates. Date size varies depending on the varieties.

- Detection of Metal

This process is also carried out with the grading or sorting simultaneously. It is necessary to identify any other particles of metal or items that may have been collected during harvesting or processing. Fruit of dates are passed through a metal detector, it is highly recommended as metals could be highly injurious during date chewing.

- Surface coating

This process is carried out to minimize stickiness and/or enhance the appearance of the dates. Several ingredients, including a 5 or 6 % solution of soluble starch as a dip, or 3% methylcellulose, or a mixture of 2 % butylated hydroxyanisole, 6 % vegetable oil, of 2 % butylated hydroxytoluene, 90 % water, and a wetting agent, have been recommended for this reason. Glucose syrup, corn syrup, sorbitol, or glycerols are also commonly used.

- Packaging

The packaging is the most essential operations to prevent the dates from moisture absorption and loss, physical damage, insect pest infection, and increase shelf life of the products. The fruits of dates are packed in several types and sizes of packaging on the basis of the nature of the market. 0.25 -1 kg or 2 kg volume packaging are commonly used for the local market, small consumer packages are also used such as bags containing about 50–100 g dates. On the packaging labels, data such as weight, country of origin, cost, and date of expiry should be mention properly. Thermoforming Packaging machines are commonly used for various sizes of the packaging of date.

- Cooling and storage

Cooling of dates to below 100C (preferably to 0 0C) before transportation or storage under the same temperatures (0–100C) and 65–75% relative humidity is recommended to maintain quality.

Hydro cooling of khalal dates (0-100c for 20 minutes) can be used but its required disinfection of water and removal of excess surface moisture before transportation.



2.2 Current trends in Dates processing

A major trend that is in line with increased consumption of dried fruit, including dates, is healthy snacking. Consumers are searching for healthier alternatives to snack between meals, or for snacks that can replace meals. Younger consumers who are taking more care of their health and wellness no longer favour sweets such as candies or chocolate snacks but switch to protein bars and other low-sugar alternatives. As a result, dried fruit (together with nuts) is becoming increasingly popular as snack.

However, dates are not considered light snacks, because they are rich in carbohydrates. Depending on the variety, they contain between 45% and 80% sugar. Sugar from dates has a low glycaemic index, which means it will be digested slowly, keeping energy levels even throughout the day. Slow release of energy ensures athletes have enough strength to perform well during their activity.

2.2.1 Fruit Processing

Fruits are highly perishable items which needs processing to make it durable. Fruit processing is any deliberate change in a fruit that occurs before it's available for us to eat. Processing methods extend the shelf life of fruits.

Fruit processing has three major aims:

1. To make fruit safe (microbiologically & chemically).
2. To provide good quality products with good flavor, color, texture and taste.
3. To make convenient fruits products

As time passes spoilage increases rapidly. Fruit processing involves many steps.

- **Cleaning and washing**

First, the fruits should be cleaned thoroughly to remove any adhering dirt or pesticide residues. This cleaning process usually involves washing the product with running water.

- **Sorting**

To achieve a uniformly sized product, fruits and vegetables are sorted immediately after cleaning according to their size, shape, weight or colour. Sorting by size is especially important if the products are to be dried or heated, because their size will determine how much time will be needed for these processes.

- **Peeling**

Many types of fruits have to be peeled in order to be preserved. This can easily be done with a stainless steel knife. It is extremely important that the knife be made of stainless steel because this will prevent the discoloration of the plant tissues.

- **Cutting**

Cutting is important in order to get uniform pieces for heating, drying and packing. Fruits are usually cut into cubes, thin slices, rings or shreds. The cutting utensils have to be sharp and clean to prevent micro-organisms from entering the food.

- **Blanching**

Blanching is a slight heat treatment, using hot water or steam that is applied mostly to fruits before canning or freezing. It is done by immersing fruits in water at a temperature of 90-95°C.

The result is that fruits become soft and the enzymes are inactivated. Blanching is done before a product is dried in order to prevent unwanted colour and odour changes and an excessive loss of vitamins.

2.3 Fruit Preservation

Fruit preservation is the process of treating and handling food to stop or slow down fruit spoilage, loss of quality, edibility or nutritional value and thus allow for longer fruit storage. Preservation usually involves preventing the growth of bacteria, fungi (such as yeasts), and other micro-organisms as well as retarding the oxidation of fats which causes rancidity. Fruit preservation can also include processes which inhibit visual deterioration, such as the enzymatic browning reaction in apples after they are cut, which can occur after fruit cutting.

Many processes designed to preserve food will involve a number of fruit preservation methods. Preserving fruit by turning it into jam, for example, involves boiling (to reduce the fruit's moisture content and to kill bacteria, yeasts, etc.), sugaring (to prevent their re-growth) and sealing within an airtight jar (to prevent recontamination). Maintaining or creating nutritional value, texture and flavor is an important aspect of fruit preservation.

2.3.1. Preservation methods

- **Drying**

Drying is one of the most ancient fruit preservation techniques, which reduces water activity sufficiently low to prevent bacterial growth. Drying is the partial removal of water from solid foods. It is one of the oldest methods of food preservation. It was traditionally carried out in the presence of sun.

- **Refrigeration**

Refrigeration preserves fruit by slowing down the growth and reproduction of micro-organisms and the action of enzymes. Refrigerators should be set to below 4°C to control the growth of micro-organisms. This lowered temperature also reduces the respiration rate of fruits and retard the spoilage. Commercial and domestic refrigerators improved the shelf life of foods such as fresh fruits and salads to be stored safely for longer periods, particularly during warm weather.

- **Vacuum packing**

Vacuum-packing stores food in a vacuum environment, usually in an air-tight bag or bottle. The vacuum environment strips bacteria of oxygen needed for survival, slowing spoiling. Vacuum-packing is commonly used for storing dried fruits to reduce loss of flavor during oxidation.

- **Freezing**

Freezing is also one of the most commonly used processes commercially and domestically for preserving fruit including prepared fruit stuffs which would not have required freezing in their unprepared state. Lowering the temperature below the freezing point of the product stops microorganisms from growing and reduces the activity of enzymes. Fruits are heat treated (blanched) before freezing to eliminate enzymes. Home freezers are held at -10°C , commercial freezers are under -18°C . At this temperature, the growth of micro-organisms is almost stopped.

- **Pasteurization**

Pasteurization is a process of heating a product at a specific temperature for a controlled period of time to destroy the most heat resistant vegetative pathogenic organism. The process is also applied for fruit juices and juice products.

- **Canning**

Canning involves cooking food, sealing it in sterile cans or jars and boiling the containers to kill bacteria.

2.3.2. Importance of Sugar & Preservatives in Fruit Preservation

Sugar is used to preserve fruits, either in syrup with fruit such as apples, pears, peaches, apricots, plums or in crystallized form where the preserved material is cooked in sugar to the point of crystallization and the resultant product is then stored dry. This method is used for the skins of citrus fruit (candied peel) and ginger.

Preservative / food additives can be antimicrobial; which inhibit the growth of bacteria or fungi, including mold or antioxidant; such as oxygen absorbers, which inhibit the oxidation of fruit

constituents. Common antimicrobial preservatives include calcium propionate, sodium nitrate, sodium nitrite; sulfites (sulfur dioxide, sodium bisulfate, potassium metabisulfite, etc) and antioxidants which include BHA (Butylated Hydroxy Anisole) and BHT (Butylated Hydroxy Toluene).

➤ Storage

Always store the preserved food in a cool place, at a temperature below 20°C. Keep glass bottles and jars out of light. The storage area has to be dry and with a consistent temperature. Moisture will make tins rust.

2.4 Formulation of Date Processing

Raw Materials Required	Weight
Starch	5 or 6 %
Methylcellulose	3 %
Vegetable Oil	2 %
Water	90 %

2.4.1 Flow chart for Date Processing



2.4.2 FPO Specification:

Fruit Products Order -1955, promulgated under Section 3 of the Essential Commodities Act - 1955, aims at regulating sanitary and hygienic conditions in manufacture of fruit, vegetable products. It is mandatory for all manufacturers of fruit, vegetable products to obtain a license

under this Order. To ensure good quality products, manufactured under hygienic conditions, the Fruit Product Order lays down the minimum requirements for:

1. Sanitary and hygienic conditions of premises, surrounding and personnel.
2. Water to be used for processing.
3. Machinery and equipment.
4. Product standards.

Besides this, maximum limits of preservatives, additives and contaminants have also been specified for various products. This order is implemented by Ministry of Food Processing Industries through the Directorate of Fruit & Vegetable Preservation at New Delhi. The Directorate has four regional offices located at Delhi. The Directorate has four regional offices located at Delhi, Mumbai, Calcutta and Chennai, as well as sub-offices at Lucknow and Guwahati. The officials of the Directorate undertake frequent inspections of the manufacturing units and draw random samples of products from the manufactures and markets which are analyzed in the laboratories to test their conformity with the specifications laid under FPO.

The Central Fruit Advisory Committee comprising of the officials of concerned Government Departments, Technical experts, representatives of Central food Technology Research Institute, Bureau of Indian standards, Fruits and Vegetable Products and processing Industry, is responsible for recommending amendments in the Fruit Product Order, In view of the demands of the industry, and the liberalized economic scenario, major amendments were made in FPO during 1997.

- **FOOD LAWS:**

- **Prevention of Food Adulteration Act (Ministry of Health)**
The Act lays down specifications for various food products and is mandatory. The Ministry of Health in 1995 had constituted a Task Force under the chairmanship of Shri E.S. Venkataramaiah, Chief Justice of India (retired). The Task Force recommended that there should be emphasis on good manufacturing practices instead of detection of adulteration and prosecution. It also expresses concern about lack of laboratory

equipments and quantified persons. In addition it also suggested that the name of PFA Act be changed to Food Safety Act.

- Agriculture Produce (Grading & Marking) Act (Ministry of Rural Development)
This Act is commonly known as AGMARK and is voluntary. The Act lays down the specifications for various agricultural commodities including some processed foods.
- Laws being operated by Bureau of Indian Standards (BIS)
BIS is the largest body for formulating standards for various food items. These standards are also voluntary.
- Essential Commodities Act- A number of quality control orders has been issued under Essential Commodities Act such as FPO, MMPO, Meat Product Order and Vegetable Oils Control Order. These orders are mandatory and primarily meant for regulating the hygienic conditions. They need to be clubbed under one order which may call Food Products Order.
- Harmonization of Food Laws- The review of multiple laws is necessary to have a uniform and logical approach for regulating the quality of food. The following action is being taken by various Ministries:-
 - The Ministry of Civil Supplies & Consumer Affairs has brought out a paper for consideration of Committee of Secretaries (COS). The paper recommends that BIS should formulate standards for all food items in the country. This will be a major step towards harmonization of food laws and is still under consideration of COS for finalization.
 - The Task Force constituted by the Prime Minister under the chairmanship of Shri Nulsi Wadia has submitted its report which is under the consideration of the Government. The Task Force had advocated promotion of food safety and quality. The Task Force has further made following suggestions:-
 - Food Regulation Authority (FRA) is set up to formulate and update food standards for domestic and export market.
 - FRA should replace the PFA to conform to international standards. The Task Force has given ten specific recommendations such as provision of storage simplicitor, simplification of sampling procedure, simplification of procedure for nominee, time limit for prosecution, standard methods of analysis to be prescribed, penalty should

graded according to the gravity of offences and provision of adequate/infrastructure and laboratories.

- Harmonization of Indian standard with quality norms of Codex and WTO.

2.4.3 Equipments involved

- Weighing machine- weighing scales are used to measure weight of product and raw materials.



- Thermoforming Packaging- These machines are a vacuum packaging machine and it is commonly used for packaging of dates in various sizes of sealed disposable packages.



➤ Printing and packaging machine



CHAPTER 3

PACKAGING OF PROCESSED DATES

3.1 Characteristics of Dates

Dates are the fruit product of the date palm, a tree native to the Middle East and Africa. Date palms grow thick clusters of date fruits below their fronds. Unripe date fruits are green in color, and but they slowly turn yellow-orange as they mature. Fully ripe dates are a rich brown color with thick, glossy, sticky skin. The center of the sweet date flesh contains a small pit.

3.1.1. The factors that lead to spoilage/defects in dates are highlighted as below:

- (a) Blemishes - Scars, discoloration, sunburn, dark spots, black nose or similar abnormalities in surface appearance affecting an aggregate area greater than that of a circle 7 mm in diameter.
- (b) Damaged- (Un-pitted dates only) - dates affected by mashing and/or tearing of the flesh exposing the pit or to such an extent that it significantly detracts from the visual appearance of the date.
- (c) Unripe Dates- Dates which may be light in weight, light in colour, have shriveled or little flesh or a decidedly rubbery texture.
- (d) Un-pollinated Dates- Dates not pollinated as evidenced by thin flesh, immature characteristics and no pit in un-pitted dates.
- (e) Dirt - Dates having embedded organic or inorganic material similar to dirt or sand in character and affecting an aggregate area greater than that of a circle 3 mm in diameter.
- (f) Insects and mites- Dates damaged by insects or mites or contaminated by damage and contamination the presence of dead insects or mites, fragments of insects or mites or their excreta.
- (g) Scouring- Breakdown of the sugars into alcohol and acetic acid by yeasts and bacteria.

(h) Mould- Presence of mould filaments visible to the naked eye.

3.1.2. Selection of Packaging Material

Factors to consider include product damage, fines, stickiness, bag opening size, re-closure among other things. In selection of packaging materials for Dates the following need to be considered:

3.1.3. Water Vapour Transmission Rate (WVTR)

Knowledge of WVTR of packaging materials and the effect of folding, creasing, crumpling of materials on papers and aluminum foil show considerable effect. However, thermoplastic materials are not much affected.

Effect of Folding and Crumpling on the WVTR of Dates

	WVTR, g/m ² , 24 hr. 38°C & 90% RH.			
	Flat	Folded	Crumpled	Gelboflex
Met PET (12μ)	0.9	1.7	3.4	18
Met PET / LDPE (50μ)	0.5	0.6	0.7	0.6
2-sides PVDC coated PET	4.2	3.7	5.9	4.8
2-sides PVDC coated PET/LDPE	2.9	3.6	3.3	3.1

3.1.4. Gas Transmission Rate

Permeability to gases like oxygen decides the shelf-life of oxygen sensitive fruit items. The oxygen transmission rates (OTR) of some plastic materials and the effect of folding and crumpling.

Effect of Folding and Crumpling on the OTR

	Oxygen transmission rate, ml /m ² , 24 hr. Atm. at 25°C.			
	Flat	Folded	Crumpled	Gelboflex
Met PET (12μ)	< 1	5.5	16	59
Met PET / LDPE (50μ)	< 1	< 1	2	3.5
2-sides PVDC coated PET	6	6	8	7
2-sides PVDC coated PET/LDPE	7	7	9	11

Besides OTR, permeability to volatiles and flavours is important in candies packaging. Polyolefins have high values, whereas plastics such as polyester, nylons, ethylene vinyl alcohol (EVOH) have good barrier properties for transmission of volatiles. The odour permeability's (for volatiles used in candies) of some materials.

Odour Transmission of Packaging Materials

Packaging Material	Thickness (μ)	Days to Aroma Leakage			
		Vanillin	Menthol	Piperonal	Camphor
BOPP / PE	17/50	6	2	1	13
PET / PE	12/50	2	16	5	< 30
PET / EVOH	12/15	< 30	< 30	30	< 30
OPP / EVOH / PE	18/15/50	30	< 30	27	< 30
PET / EVOH / PE	12/15/50	15	25	27	< 30

3.1.5. Tensile Strength & Elongation

Tensile Strength and Elongation properties of materials need to be studied as their running on high-speed machines should be suitable.

3.1.6. Tear Strength

For a fruit processed product, tear strength is of importance as low tear values are necessary and useful for opening packages by hands.

3.1.7. Heat Seal Strength

The performance of a finished package is determined by the effectiveness of the package seal i.e. the permeability to water vapor, gases and volatiles increase if the seal is not perfect. Thermoplastic films such as polyethylene give excellent heat seals.

3.1.8. Performance Properties

Apart from the above mentioned important properties, a material has to perform well on machines, therefore knowledge of physical properties like slip, stiffness, blocking resistance is also necessary.

Twist retention for twist wrap is also of importance. The initial function of packaging is to protect. However, the emotional role played by packaging is also of importance, especially when

the confection is a gift. A sophisticated packaging using deluxe materials is often used as a way of expressing feelings.

Packaging must also be specialized for specific target groups. A different pack size is required for quick impulse buys at petrol stations and roadside shops than for the super markets selling predominantly family sized packs.

3.2 Packaging Materials used for Dates

A very high quantum of polymeric materials, besides cellulose and aluminium foil are used for packaging items. Paper board and metal containers are also used for certain applications. Although a variety of packaging materials are available, the ultimate choice of the wrapper depends upon the required shelf-life, performance on the wrapping machine and the cost which is purely based on the segment of the market targeted by the manufacturer. The most common choice of packaging medium is plastic (generally flexible) as it provides the required protection and preservation, grease resistance, physical strength, machinability and printability. Plastics being lighter in weight are, therefore, the most preferred material for packaging of candies.

There are many changing trends in the packaging of candies. Plastic films and their laminates are increasingly replacing waxed papers due to better properties and aluminium foil laminates due to price and better flex crack property. Depending on the type of package i.e. twist wrap, pillow pack and vertical flow pack or roll pack, the plastic based packaging films used for candies are listed below.

➤ Polyethylene (PE)

It is considered to be the backbone of packaging films. Since one of the greatest threats to the integrity of candies products comes from moisture, polyethylene with its low water vapour transmission is of definite interest. Polyethylene films are fairly free of plasticizers and other additives and are quite extensively used as a part of lamination. Its ability to heat seal increases its value.

Low Density Polyethylene (LDPE) is an economical material with low WVTR, however, it has high permeabilities to flavours/volatiles, poor grease resistance and are limp. High-density polyethylene (HDPE) is stiffer, more translucent and has better barrier properties but needs higher temperature for sealing.

Later additions include high molecular weight high-density polyethylene (HM HDPE) and linear low-density polyethylene (LLDPE). HM HDPE is a paper like film with high physical strength and barrier properties, but is less transparent than ordinary polyethylene. HM HDPE is available in twist-wrap grades. Polyethylene films are also suitable for making bags and pouches. A copolymer of polyethylene and poly vinyl alcohol, and EVOH has outstanding gas barrier properties especially when dry.

➤ **Polypropylene**

Polypropylene films are undergoing a growth trend in the candies industry. They have better clarity than polyethylene and enjoy superior machine ability due to stiffness. Lack of good seal ability 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. Pearlsed polypropylene with an opal finish and attractive gloss is also used. Both as laminates and overwraps, PP film is now widely used for all types of candies packaging applications.

➤ **Poly Vinyl Chloride (PVC)**

PVC is a stiff and clear film having low gas transmission rate. PVC can be used as small wraps, bags and pouches. PVC when co-polymerised 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 sealability. 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.

➤ **Metallised Films**

When polymeric films are metallised there is an improvement in their barrier properties. Metallisation is also used for decorative purposes and aesthetics. The films, which are used for

metallisation are PVC, PET, PP and polyamides. To safeguard the interest of the consumer the Standards of Weights & Measures (Packaged Commodities) Rules, have imposed a limit on the weight of the wrapper. Under this, it is essential that in the case of twist wrap and pillow wrap candies, where the weight of the individual pieces is less than 10 grams, the size of the wrapper and the type of wrapping material selected is such that it meets the limit on weight of wrapper, under the above rules.

3.2.1 Types of Packages

- **Hanging Bags-** Hanging bags are frequently seen in grocery stores and other retail locations. They are a type of plastic bag that is sealed on both ends and sometimes with a back-middle seam as well. Hanging bags have a pre-cut hole that allows them to hang easily from hooks, so they can be displayed in an attractive way.
- **Pillow Bags and Pouches-** Another common type of packaging is a pillow pouch or bag. The bags get their name from their shape, which resembles a pillow. They are found lying flat on grocery store shelves and have been known to hold mini chocolate bars and individually wrapped dates.
- **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 dates in a single bag. You will often see gusseted poly bags next to a pick-n-mix station where you fill up a bag full of different candies to take home.
- **Reclosable Zipper Bags and Pouches-** Reclosable bags and pouches are essential for Date products because they give customer convenient access to their goodies while preserving freshness. Zipper closures let customers use portion control or take their dates on the go.

- **Flexible Pouches-** Flexible pouches are a great option for holding processed Dates and other Fruits. They can be manufactured with zipper-seal closures, which help keep the interior 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 Methods for packaging of Dates and packing equipment

Fresh dates are perishable and are highly susceptible to losses from damage and deterioration between harvest and the final consumer. Within the range of measures which can be applied to prevent such mechanical and/or biologically induced losses, appropriate packaging plays a vital role in protecting produce from avoidable deterioration.

Packing the fruit in various ways is the last stage of its preparation for the consumer. Therefore, there is no contact with the fruit itself, and we depend on packaging to protect, contain and market the product. Various methods of packing, including the traditional ways, are already described in detail by Dowson (1962). In this section we shall only relate to modern methods used for fruit intended mainly for export. The methods of packing are of two kinds: in bulk and for retail sales.

- **Bulk Pack-** The dates are usually packed in cardboard boxes (sometimes in plastic bags for additional protection and preservation of moisture, before being placed in boxes). The usual weight is 5 kg or 15 lbs. (depending on the country where the fruit was produced or where it is to be marketed). The quality of the fruit may differ according to customer requirements. The fruit is sold on the open market and intended for customers wanting to buy fruit in large quantities. The fruit may be handed over to be repacked in the countries where it is to be marketed and where retail packing will be carried out according to the customer requirements.

The fruit may also be used for products in which dates are the main or secondary component, such as sauces, syrups, spreads and products used in baking.

- Retail pack- Retail packing has been greatly developed in recent years, especially since the large networks have increased their share of the food market throughout the world. These packages have to be adapted to consumer demands at all levels, starting with the codes used by a certain network, to repackaging and to the surface on which they are to be placed, ending with the writing on the packages such as the nutritional composition, and the last date for sale or for use.

Retail packages can be divided into two categories:

a) Packing according to some arrangement, usually 'fish bone', the traditional way, which was developed in Marseilles in France and is called 'glove box' or 'boite à gants' in French. There are usually 26 - 30 dates in this box, placed in two layers, separated by cellophane, weighing 220 g - 250 g. A natural or plastic spikelet is placed in the top layer. Most of the dates in such boxes are sold at Christmas time under various names. The variety most commonly used is Deglet Nour, but other varieties can also be found. Packing is done manually and much time is invested in arranging the dates in the boxes. The fruit is usually covered with glucose (natural) to give it a shine appearance.

b) Packing by automatic weighing (without any inner arrangement): Much packing is done in this way, starting with the 'window' type, where a cellophane window showing the fruit is part of the package design, which is usually made of cardboard.

Dates are also packed into tubs made of transparent plastic, showing the fruit as part of the package design. The information for the client is usually on the lid. This type of packing can be of varying sizes, according to the client demands. Bags, usually made of PET polyethylene, are the cheapest and most economical way of packing.

Many attempts are being made to introduce mechanization and automation in order to save on packing and weighing. In recent years computerized combinatorial scales have been developed, making it possible to pack exact quantities, combined with automatic packing machines for many types of packages.

3.3.1 Quality considerations during packing

Quality control of packed products is the last time the fruit is checked before reaching the customer. Documented checking of the packages entails:

- Weight of the package;
- Weight of the fruit;
- Arrangement of the fruit (in glove boxes);
- Uniformity of the fruit;
- Damage to the fruit;
- Defects; and
- Moisture content.

The surrounding area is also checked:

- Cleanliness of the conveyer belts;
- Calibration of the scales (automatic or manual);
- Writing on the packages;
- Satisfactory working of the metal detector (installed on every retail packing line);
- Repackaging installations and marking; and
- Qualification for international standards such as ISO and HACCP

3.4 Future Trends

During the last 30 years or so several changes in date harvesting, packing, processing and marketing have taken place. Perhaps one of the most striking trends in a number of date producing countries of the Old World has been that, under the influence of newly acquired oil wealth, date cultivation, packing and processing could be modernized, in spite of a tendency of decreasing importance of the date as a staple food resulting from the same welfare increase. The highly traditional nature and close relationship of the date grower and his crop has undoubtedly also played a role in preventing a decline in date production. New outlets for at least part of the crop were found through better handling and processing methods to cater for more sophisticated emerging markets. Modern technologies, mostly imported, sometimes adapted, made it possible to achieve more uniformity and higher quality standards.

Considering the fact that the first step in industrialization is the most difficult, when all the problems have to be faced together and simultaneously, it can be concluded that progress has been made and will continue to be made. Some of the salient technical aspects of this progress are the following:

- Increased use of plastic boxes and crates for improved field handling and storage of dates.
- Use of vibrating tables and conveyors during grading for better inspection and bulk packing of dates by vibration instead of pressing.
- Increased use of vacuum fumigation and the use of phosphine, the latter also during transit.
- Continued consideration for the introduction of insect control by irradiation.
- Regulation of moisture content (hydration, dehydration) in the packing plants for better control on product quality and uniformity.
- An emerging trend of marketing khalaal and rutab under refrigerated conditions.
- Increased automation in date packing plant operations.
- Introduction of automatic filling of bags and thermo-form packs and packing under vacuum and nitrogen gas.
- Increased use of mechanized pitting and stuffing of dates.
- Improved bulk date shipments, facilitated by worldwide spread of containerization.
- Intensified production of date products and industrial use of dates.

CHAPTER 4

FOOD SAFETY REGULATIONS AND STANDARDS OF PROCESSED DATES

4.1 Standards

Dates mean the product obtained by drying sound, clean fruits of proper maturity belonging to *Phoenix dactylifera*. The product may be washed, pitted or unpitted, with or without cap, pressed or loose. The product may be treated with sugar, glucose syrup, flour and vegetable oil. The product shall be free from foreign matter, living insects, mould, dead insects, insect fragments and rodent contamination. The product shall have pleasant taste and smell, free from odour and evidence of fermentation. The product shall be free from any added colouring matter. The product may contain food additives permitted in these regulations including Appendix A. The product shall conform to the microbiological requirements given in Appendix B. The product shall conform to the following requirements:—

- (i) Moisture (m/m)- Not more than 30.0 percent
- (ii) Ash insoluble in dil Hcl- Not more than 0.1 percent
- (iii) Blemished / Damaged Units- Not more than 5.0 percent
- (iv) Extraneous matter- Not more than 1.0 percent

Explanation—

- (i) 'Blemished' means units showing scars, discoloration, sun burn, dark spots on the surface;
- (ii) 'Damaged' means dates affected by mashing and/ or tearing of the flesh exposing the pit or significantly changing the appearance.
- (iii) 'Extraneous vegetable matter' means stalks, pieces of shells, pits, fibre, peel, etc. 5. Dry Fruits and Nuts means the products obtained by drying sound, clean fruits and nuts of proper

4.1.2 Processed fruits

Includes all forms of processing other than peeling, cutting and surface treating fresh fruits.

- Dates used for making date Products shall be free from diseases and contain no parthenocarpic or unripe fruits.

- They shall be free from fermentation and mold, insects or insect fragments, eggs, larvae, dirt, and foreign matter.
- Date Paste shall be soft and have no alteration in smell and flavor.
- It shall not contain whole or broken pits, stalks or extraneous fragments.
- The product shall be made from a single variety of dates or a blend of several varieties of dates.
- It shall also conform to the following standards.

4.2 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.

4.3 Labelling Standards

Labeling requirements for packaged food products as laid down in the Part VII 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

4.3.1 Wherever applicable, the product label also must contain 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 Labeling) Regulation 2011” and the Compendium of Food Safety and Standards (Packaging and Labeling) Regulation before designing labels for products to be exported to India. FSSAI revised the labeling 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 Labeling Regulation 2011, “prepackaged” or “pre packed food” including multi-piece packages, should carry mandatory information on the label.



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