Ministry of Food Processing Industries
Government of India

सत्यमेव जयते

NIFTEM
Knowledge. Innovation. Outreach

PM Formalization of

Micro Food Processing Enterprises (PMFME) Scheme

HAND BOOK OF CHIRONJI PROCESSING

National Institute of Food Technology and 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.	AGMARK	Agricultural Marketing
2.	BIS	Bureau of Indian Standards
3.	CFB	Corrugated Fiber Board
4.	CFTRI	Central Food Technological Research Institute
5.	FSS	Food Safety and Standards
6.	FSSAI	Food Safety and Standards Authority of India
7.	FoScoS	Food Safety Compliance System
8.	GST	Goods and Services Tax
9.	HACCP	Hazard Analysis Critical Control Point
10.	HDPE	High Density Poly- ethylene
11.	IMS	Indigenous Medicine System
12.	Kcal	Kilocalorie
13.	MAP	Modified Atmosphere Packaging
14.	MoFPI	Ministry of Food Processing Industries
15.	PP	Polypropylene
16.	SCC	Side Chain Crystallizable
17.	SHGs	Self Help Groups
18.	WVTR	Water Vapor Transmission Rate

CHAPTER - 1

INTRODUCTION

Minor forest products have been a source of livelihood for millions of forest dwellers in India and other developing and third world countries. The seeds of *Buchanania lanzan* (chironji) - a tree species belonging to the family *Anacardiacae* are commercially very useful for rural tribal people in various parts of India. The seeds/kernels of the plant yield fatty oil which is a substitute for olive and almond oils and widely used in confectionery as well as in Indigenous Medicine System (IMS). Due to unsustainable extraction of the seeds natural regeneration of chironji has become a major issue among environmentalists and field biologists during the last few decades

Buhanania lanzan was first reported by FrancisHamilton in 1798 belongs to the family Anacardiacae. It has diverse common names depending upon the region, Charoli (Gujarat), Chawar, Achar, Cuddapahalmond (Bengali), Piyal (Assam) Charu (Oriya), and Char (Telugu). The species is a native of the Indian sub-continent and is found in the tropical deciduous forests of the north, west, and central India. Chironji is a hardy plant and thrives well on rocky, gravelly red soils and also on saline and sodic soils but does not survive under waterlogged conditions. It grows in pockets of soil between crevices of barren rock and degraded rocky areas including salt-affected soils. For better growth and productivity, well-drained deep loam soil is ideal and it prefers tropical and subtropical climate and withstands drought admirably. It is found growing naturally in the forests of north, western and central India mostly in the states of Madhya Pradesh, Bihar, Orissa, Andhra Pradesh, Chhattisgarh, Jharkhand, Gujarat, Rajasthan, and Maharashtra·

1.1 Description

The tree is having 13-18 meters in height with a straight trunk, young branches clothed with silky hairs. Leaves thickly coriaceous, broadly oblong, obtuse, sometimes emarginate, glabrescent above, more or less villous beneath, reticulated veined, the nerves and veins impressed on the upper surface, base rounded, main nerves 10-20 pairs, petioles long (about 1.2cm). Flowers small, sessile, greenish-white, in the terminal and axillary pyramidal ferruginous-pilose panicles which are shorter than the leaves, bract small, caducous. Calyx lobes short, broadly ovate, ciliate. Petals long, ovate-oblong, subacute, disk fleshy. Stamens

10, a little shorter than the petals, filaments flattened, anthers about as long as the filaments. Ovaries 1 perfect, conical, villous, the other 4 reduced to cylindrical filaments.

Fruits of Thar Priya chironji

1.2 Area and production

Information regarding the area and production of this fruit in India is not available because it is not grown on a plantation scale. They can be seen growing in forest areas. The production in India is mainly concentrated in the drier states and the produce is collected by the villagers and sold in the local market. Its cultivation may spread to arid and semi-arid areas, resource-poor areas, and wastelands where other crops cannot be grown.

Flowering and fruit set

In chironji, flowers appear in January- February in different agro-climatic zones of the country. The time taken for the complete development of the flower varies from 16·20 days. New plantation of grafted plants starts flowering after 4th year. The cause of poor fruit set may be due to pollination problem or self-incompatibility. Seedling trees of higher age have better fruit sets than the tree of lower age group.

Fruit growth, maturity, harvesting, and yield

Singh et *al*.. 2006 studied developmental patterns in chironji genotypes and it was observed that the fruit growth was faster initially and slowed down while reaching towards maturity and followed sigmoid growth curve. The deep purple color appeared on the fruit surface of different genotypes during the peak period of ripening. The

specific gravity showed an increasing trend (more than one) in all the total soluble solids. total sugar, reducing sugar, and kernel protein increased as the fruits reached maturity. Titratable acidity showed a declining trend during development. Vitamin Cincreased during development and remained constant till the harvest period

1.3 Use of this vegan product

- **Food:** Charoli seeds are a popular ingredient in Indian sweets (Chironji ka Barfi, Piyush, shrikhand, kheer, and halwa), meaty kormas, lamb pepper with Chironji, Gajar ka Meetha, Hyderabadi Haleem, Charoli mutton, Malai kofta, and as a flavoring for batters and sauces.
- **Medicine:** Medicine: Ayurvedic medicine uses all the parts of this tree including its bark, fruits, roots, leaves, nuts, and kernels for its varied medicinal properties in treating cold, bowel disorders, premature ejaculation, fever, and rheumatism. The gum extracted from the bark of this tree and powder of the roots and dried leaves mixed with buttermilk is a traditional remedy for treating diarrhea. In the folklore medicine of Andhra Pradesh, Chironji gum was mixed with cow's milk for relieving rheumatic pain and they also used the leaves as a tonic for supporting cardiac functions. The leaf powder was also used in encouraging quick healing of wounds. The juice or the decoction of the Chironji leaves is being used in Unani medicine for purifying the blood, treating loss of libido, impotency, and also as a tonic for the digestive system.
- **Cosmetic:** Powdered seeds blended with milk and turmeric powder are used in India as a natural face pack for augmenting the glow, complexion, and suppleness of the skin.

1.4 Nutritive Value of chironji

Buchanania lanzan is nutritional, palatable, and used as a substitute for almonds in confectionery. The edible seed kernels of chironji contain a pleasant, slightly acidic flavor, and are eaten raw

or roasted. It yields fatty oil known as Chironji oil which is the best substitute of olive and almond oils in both confectionery and indigenous medicine used for glandular swellings of the neck. Fruits are laxative and are also used as an alternative medicine to relieve fever. Kernels of fruits are also used as an ointment in skin diseases[4]. It has a great potential in employment generation, particularly for forest dwellers. An estimate tells that the total potential of Chironji in undivided Madhya Pradesh yields about 5000 tonnes per annum that can generate 8 Lakh man-days of employment. (http://jhamfcofed.com/ resources/chironji.htm). Based on the economic potential of the species, Planning Commission adopted the species for enterprise development for central India under the 12th five years plan. The nutritional assessment of Chironji is presented in table 1.

Table 1: Nutritional content in Chironji (per single unit of Kernel)

	Constituents	**Fresh Flowers**
1	Starch	12.1
2	Proteins (%)	63-72
3	Fats (%)	59g
4	Niacin	1.5
5	Vitamin like Thiamene	0.69mg
6	Oil	34-47%
7	Phosphorus (mg/100 g)	528mg
8	Riboflavin	0.53 g

Harvesting of *chironji* nuts. The plant has great medicinal value and the kernels are used as expectorant and tonic. The fruit of *Chironji* mature in4 to 5 months and is harvested manually (Fig. 3) in April and May.

1.5 The traditional method of processing

De-skinning of chironji nuts: The skin of the harvested green nuts turns black (Fig. 4) on storage which has to be removed before shelling. The nuts are usually soaked overnight in water and rubbed with palms for small- scale processing and with the jute sack for large-scale processing. The water containing fine skin is decanted. The nuts are washed with freshwater to obtain clean nuts. The cleaned nuts are dried in sun for 2 to 3 days and stored for further processing i.e., shelling.

Shelling: Shelling is the process of separating the kernel from the hull. For small- scale (home level) the dried nuts are shelled by the prevailing method, i.e. by rubbing with a stone-slab on a rough stone surface followed by manual separation of kernels and for large scale shelling horizontal stone under runner or burr mill is used. Separated kernels are as shown in Fig. 6. The Sheller is made of two stone discs of75 - 80 mm thickness and 450 - 500 mm, the upper disc is stationary and about 2 mm deep lines are engraved starting from the center towards the periphery of the lower disc, and the two discs are connected through a shaft of 30 - 40 mm diameter (Fig.7). The impact and abrasive forces, which separates the coat from the kernel and split the kernel. The unit is connected to the grader through a power-driven shaft such a way that splitted or shelled kernels are fall on the grader. Power is transmitted to the under runner through a shaft from a grader which is connected to a 5 HP diesel engine (Fig. 8). The efficiency of the under the runner is low and it causes more

broken and powder. So there is a need for a chironji decorticator for shelling efficiently.

Grader: The main purpose of the grader is to separate the kernels from the hulls and to separate the kernels of different sizes. The shelled or splitted kernels will pass through the grader as shown in Fig. 9. The grader is having 3 screens of various sizes and the screens are moving by oscillating motion driven by shaft. Here grader separates the shelled produce as per its opening size, but due to poor performance of the under runner, again need to separate kernels from the hull and broken manually as shown in Fig. 10.

Although, chironji nuts and kernels have been used extensively the printed literature on their physical and engineering properties is scarce. There is a need for a study to generate primary data on physical and engineering properties which could be used for developing processing machinery(s) and the need to develop the machinery for chironji shelling.

CHAPTER- 2

PROCESS AND MACHINERY REQUIREMENT

2.1 Machines for chironji processing

Raw Material (Collection): Chironji Tree is a medium-sized deciduous tree, growing to about 50ft. tall. It bears fruits each containing a single seed, which is popular as an edible nut, known as chironji. It can be identified by the dark grey crocodile bark with the red blaze. The fruits of chironji mature in 4 to 5 months and need to be harvested manually (Figure 2) in April and May. The green-colored skins of harvested chironji fruits turn black on storage which needs to be removed before shelling. The chironji leaves and immature nut is illustrated in Figure2. Matured fruits need to be collected by using a long stick fitted with a hook without cutting the tree. Some ripe fruits should be left in the tree to facilitate regeneration.

2.2 Value Addition/ Processing: De-skinning of chironji nuts

The skin of the harvested green nuts turns black (Fig. 4 shown below) on storage which has to be removed before shelling. The nuts should be usually soaked overnight in water and rubbed with palms for small-scale processing and with the jute sack for large-scale processing. The water containing fine skin should then be decanted. The nuts need to be washed with freshwater to obtain clean nuts (Fig. 5). The cleaned nuts than dried in sun for 2 to 3 days and stored for further processing i.e., shelling. Shelling – Shelling is the process of separating the kernel from the hull. For small scale (home level), the dried nuts need to be shelled by the prevailing method, i.e. by rubbing with a stone-slab on a rough stone surface followed by manual separation of kernels and for large scale shelling horizontal stone under runner or burr mill needs to be used. Separated kernels are as shown in Fig. 6. The sheller should be made of two stone discs of 75 - 80 mm thickness and 450 - 500 mm, the upper disc being stationary and about 2 mm deep lines be engraved starting from center towards the periphery of the lower disc and the two discs connected through a shaft of 30 - 40 mm diameter (Fig. 7). The impact and abrasive forces, which separates the coat from the kernel and split the kernel. The unit to be connected to the grader through a power-driven shaft in such a way that split or shelled kernels fall on the grader. Power to be transmitted to under runner through a shaft from grader which is connected to 5 HP diesel engine (Fig. 8). The efficiency of the under the runner is low and it will cause more broken and powder. So, there is a need for a chironji decorticator for shelling efficiently. Grader – The main purpose of the

grader is to separate the kernels from the hulls and to separate the kernels of different sizes. The shelled or splitted kernels will need to pass through the grader. The grader should have 3 screens of various sizes and screens moving by oscillating motion driven by shaft. Here, the grader will separate the shelled produce as per its opening size, but due to poor performance of under runner, again needs to separate kernels from the hull and broken manually.

2.3 Automatic Packing Machine Tarpaulin Sheets Weighing Scale

Cylinder Seed Grader Seed Dryer Machine Value Added Product:

•Chironji Nut

•Chironji kernel (can be used for the preparation of different kinds of sweets)

•Chironji pulp (products like squash, RTS, and nectar may be prepared from the pulp of the fruit)Quality Specification (physical parameters analyzed in field level):

•Chironji seeds shall be wholesome, mature, clean & dried

•It shall have characteristic size, shape and color (Gray to Black)

•Foreign matter (Organic and Inorganic) – Max 5% Broken and damaged seeds – Max 4% Percentage of seed floating on water – Max 10%Storage of Value Added Product: Broken chironji as well as chironji exposed to high levels of moisture easily damaged by pests, thus lime coating and usage of polyethylene bags is suggested to preserve overall characteristics.

CHAPTER- 3

PACKAGING OF CHIRONJI PRODUCE

3.1 Introduction

Indian Food Industry is on the thrones of a major revolution, thanks to economic liberalization. Demand for fresh produce is increasing in the internal market as well as other countries due to globalization. India is one of the largest producers of horticulture produces both in terms of the number of varieties and quantities. Nearly 20-25% of total production is lost every year due to poor handling, storage, and transportation methods. The main purpose of packaging is to provide products with the attributes necessary to survive several different hazards which can be expected during storage, transportation, and distribution. In recent days, entrepreneurs in India are showing greater interest in internal marketing as well as the export of fresh produce. The trade is attractive but is not an easy enterprise; a high degree of organization and professionalism is necessary to export fresh produce successfully, especially to the sophisticated markets of Europe. It can make good use of indigenous horticultural skills. The combined requirements of fresh produce and its transport environment often impose unusually severe conditions on the packaging employed. As a result, a higher package quantity is usually needed for fresh fruits and vegetables for manufactured goods of the same weight. For designing a package for a specific product and particular target market, a clear picture of the distribution system should be drawn up, as hazards involved in transportation are different for different modes (i.e. packaging requirements for ship transportation are different than that by air transportation). The models may be used depending upon the characteristics of the produce and the market. Fresh produces are lining tissue, high in 'water content, and diverse in terms of morphology, composition, and physiology. So package design should be based on the requirement of the product in terms of mechanical fragility, susceptibility to or benefits at high or low relative humidity, limitations or benefits at high or low temperatures, and optimum atmospheric composition.

Some of the commodities with high sensitivity to ethylene gas, hence the need to avoid gas build-up in transit, which allows for effective external air ventilation (e.g. avocados and package may protect from moisture loss). Certain commodities have

special treatments

e.g. sulfur dioxide treatment of grapes. The package assists in the protection of commodity against damage, the appropriate design of package and fittings should reduce the chance ofbruising.

3.2 Systems approach

A systems approach to modern fresh produce processing and distribution organizations includes all the information required for packaging it reproduces, whereby the produce and the package become together the produce sold in the market. This may be grouped into the following :

I. Protection requirement and constraints of the product:

1. Mechanical fragility of the product; ability to sustain prolonged compression shocksand vibration in transit.
2. Susceptibility to or benefits at high or low relative humidity.
3. Tolerance or benefits at high and low temperatures; contaminant hazards.
4. Atmospheric composition is conducive to better preserve the quality or its damagepotential.

II. Marketing requirements of the product:

1. Several products and a number of the product (types/grades) in the same container.
2. Weight of the container (gross and net).
3. Means of handling, storage, and transportation environment (chain from productionto consumption).
4. Modes and types of wholesale and retail outlets.
5. Modes of quantizing (by weight, by count, by volume, etc.).
6. Modes of coding and labeling (prices, dates, health hazard warnings, utilizationinstructions, etc.).

III. Requirements and constraints of the package:

1. Types of packaging materials, types, and construction of containers, standardization requirements, and types of closures. Modes of package manufacturing (in-plant versus contacting suppliers).

2. Modes of empty container storage (in knocked down form?)
3. Feeding containers into the packaging line.

IV. The processing and packaging line in the packaging house:

1. Type and sequence of processing and packaging stages (mechanized, semi-mechanized, manual), number of workers and their skills at each station, etc.
2. Unitizing methods, master containers, bundling, strapping, palletizing, shrink wrapping or stretch wrapping of pallets, airline or maritime containerization, etc.

V. Quality criteria of alternative packaging systems available:

1. Total packaging cost per unit product.
2. Containment and protective qualities, marketability, and salability.
3. Disposal or recycling possibilities of the package.

3.3 Packaging house operation

The packaging line begins with unloading harvested produce. Bulk bins of 200-500 kg capacity are used for big packaging houses but in India reusable plastic crates are used. Freshly harvested produce stacked up for interim storage. Interim storage may serve several purposes, depending on the type of produce. The latest damage, sustained during harvesting, will appear as visual defects several hours later and can be detected. Storing field-warm produce for few hours in a cool place, such as cold storage corridors, whereby produce temperature is reduced by several degrees before processing will help to reduce subsequent spoilage and damage in the packaging line.

The most important process in fresh produce is respiration, the biochemical oxidation of all living cells. Respiration rate is proportional to temperature, approximately doubling for every 10°C. Due to high respiration, the heat build-up will be more, which in turn increases the temperature and respiration of produce. This reduces the shelf-life of the produce. The heat produced may be calculated by

1 mg CC>2/kg hr. = 61.2 k.cal/metric ton. day = 220 BTU/ton.day.

The term precooling refers to several practices whereby the temperature of the freshly harvested produce is quickly lowered to shorten the period of initial high respiration rates as well as to reduce the loads on the long-term cold storage facilities. The success of efficient precooling depends upon the fast removal of field heat from all fruits, preferably within 2 to 3 hours. Regular cold storage room with about 150 air

changes per hour gives the best result, but with the danger of excess moisture loss.

Hydro cooling consists of drenching field-warm produce with a stream of cold water taking care of chilling injury suitable for leafy vegetables. There are three types of hydro coolers. Immersion, flooding, and spraying. Another precooling method suitable for lettuce is vacuum cooling. This system uses hermetically sealed vacuum chambers whereby the pressure is reduced until the vaporizing temperature of the water is near O°C (4.6 mm Hg), removes moisture uniformly from all tissues, not just from the surfaces. The products are subjected to a cleaning process, which begins with a soaking tank, where dirt clods and pesticide residues are softened and diluted by the warm or cold solution of water detergents and disinfectants. The fruit is thoroughly washed by a piece of cloth or soft brushes with water spray. The product is then treated with fungicide treatment if any. Before processing further, produce is dried by air steams from overhead fans. In the next stage, the undersized produce called culls is eliminated can be sent for converting, called a precise stage.

The grading process next follows to segregate the produce into quality groups, such as ripe fruits which must be marketed immediately, grade A, B, C, export-grade, or culls. Before or after grading, high-quality fresh produce processing may be included a waxing, operation, especially when a long shelf-life is desired. Most produce has a natural wax layer on its rind or skin which protects it from excessive moisture loss while allowing free metabolic gas exchange. This wax is largely removed by the cleaning operation. By applying an artificial wax, the keeping quality of produce is reinstalled or even bettered, which includes chemical additives to inhibit spoilage or to add gloss to color for sales appeal. Sizing is an additional sorting operation whereby the sorting attribute is size. Now uniformly sized and graded produce is ready to be packaged. Depending upon product type and grade, distance to markets, cost, and availability of packaging materials, the product may be packed in a large variety of shipping containers.

The packaging operation usually includes the set up of containers, before quantizing of produce, filling, and container closure. Quantitizing may be by count or by weight or by a combination of the two. Accurate sizing provides a proportional link between count and weight whereby only 'check weighing is required after filling by count. Container fill may be random or pattern-packed. Pattern packed increases protection of produce, by minimizing contact pressure by increasing the number of

contact points until its maximum of 12, is emphasized and maximizing volume utilization. Sometimes the produce is pre-packed in packaging house in consumers pack, mostly different types of plastic bags or overwrapped trays. The final packaging operation is container closures which may be performed by gluing, stapling, strapping. Unitization and palletization may be done according to the container requirement and market need.

3.4 Specific Applications

The particular type of package used depends upon the shape and perishability of the product. There are five main classifications soft, fruit, hard fruit; stem products; root vegetables; and green vegetables. Soft fruits are highly perishable and easily subject to anaerobic spoilage. They bruise and squash easily which leads to rotting. They are packaged in semi-rigid containers with a cover of cellophane, cellulose acetate, polystyrene, or another suitable film cover. Adequate ventilation is a must to avoid fogging. Handling must be careful and avoided as much as possible. Shelf-life is limited due to individual damage and decay. Some berries under ideal conditions only remain top quality for 2 or 3 days. Typical soft fruits are cherries, grapes, blueberries, strawberries, raspberries, plum,etc.

3.5 Types of packaging: Packaging can be classified in several ways; the most importantone is by stages of the distribution system for which it is primarily intended.

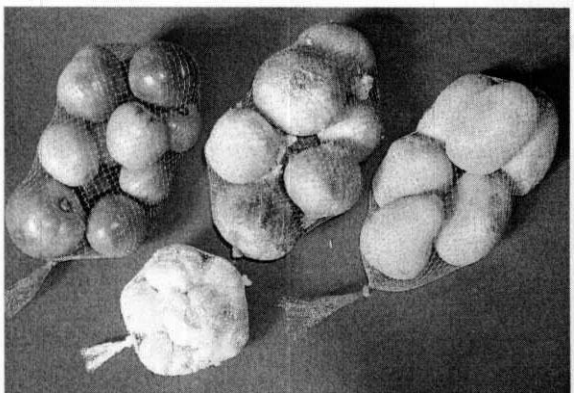
- Consumer or unit packaging,
- Transport packaging;
- Unit load packaging.

Consumer packaging

The package in which the consumer receives the product is called consumer packaging. The term prepackaging of produce in consumer units before its presentation to the final consumer. Prepackaging may be undertaken at any stage throughout the distribution chain from the field to the retailer's premises, depending upon, the need of produce for protection, expected transport and storage time, required shelf-life, packaging material costs, and costs of packaging and sorting at different points, transport and storage cost and latest knowledge of the market requirements. Types of consumer package:

Bags

Bags are the most common and favored retail packs because of their low material and packaging cost. In terms of cost to strength ratio, 25 - 40 micron low-density polyethylene or 12.5-micron high-density polyethylene bags are most suited. Net bags are used to provide desired ventilation and allow free air moment for the products such as citrus fruits, onions potatoes, etc. The bags can be made of paper, perforated polyethylene or polypropylene film, plastic,or cotton nets.



Net bags

PM FI

Tray

Tray packs made of foamed polystyrene or PVC or PP are overwrapped with heat shrinkable or stretch films. A tight wrap immobilizes the fruits and keeps them apart. Trays of molded pulp, cardboard, thermoformed plastic, or expanded polystyrene are used.

Sleeve packs

Combine the low cost of bags and protective qualities and sales appeal of tray packs. Wraps of plastic film such as polyethylene or PVC, in the form of shrink-wrap, stretch film, or cling film. Regular net stocking or expanded plastic netting can also be used. The traditional fruits and vegetable retail trade packs the produce in the presence of consumers and the qualities and quantities required by them. The package normally used is a simple wrap of paper or a paper or polyethylene bag. Sleeve packs can be fabricated to contain from one to as many as ten fruits. The main advantage of sleeve packs is that they immobilize the produce at a fraction of the cost of tray packs and produce can be observed from all sides without damage to the fruit.

Transport packaging

The transport packaging for fresh produce may be divided into two size groups:

i) The predominant size group, suitable for carrying by man, is in the range of 15 to 25 kg.

ii) The other group, recently becoming increasingly popular is in the 200-500 kg range suitablefor forklift handling refers to as pallet container.

Wooden boxes

Includes natural wood and industrially manufactured wood-based sheet materials. The timber used must be inexpensive and easily worked. All wood that is used for the production of the packaging should be well dried to prevent cracks and mold growth

later. Manufactured wood-based sheet materials include plywood, hardboard, and particleboard. Plywood is usually made from birch. It is rigid and strong, though perhaps somewhat less resistant to splintering than poplar, but is smoother and flatten so suitable for direct printing. Hardboard is dark in color but its appearance can be improved with decorative printing but deforms after long storage in high relative humidity. The particleboard is thicker and rigid but relatively brittle.

Corrugated fibre board boxes

Corrugated fibre board boxes are the most commonly used shipping containers where cartons, glass, cans, and pouches are the unit containers. The popularity of CFB as a container in the food industry as well as in other industrial packaging is for the followingreasons:

1. Low cost to strength and weight ratio.
2. Smooth, no abrasive surface.
3. Good cushioning characteristics.
4. Excellent printability.
5. Easy to set up and collapsible for storage, and
6. Reusable and recyclable market.

Corrugated fibre board boxes

The most commonly used material for the plastic corrugated box is polypropylene and HOPE. Its advantage over CFB is its low weight to strength ratio and its reusability. The printability is also excellent when compared to CFB boxes. But CFB has an edge over plastic fibre board boxes when cushioning properties are taken into consideration. The disadvantages are ultraviolet degradation and temperature resistance.

Plastic crates

Plastic crates are usually made up of HOPE or Polypropylene by injection molding has been replacing wooden and wire crates. These crates must have good resistant properties to ultraviolet degradation and shock damages.

Sacks

These are flexible shipping containers that are generally used in food industries to bring raw materials viz. fruits and vegetables from the field. If the weight of content is more than 10 kg then it is called sack otherwise bags. The commonly used materials for sacks

are cotton, jute, flan, plastics (HOPE, Polypropylene). These sacks are advantageous to use as it cost less, high strength, reusability and requires small space for the empties. The disadvantage of the plastic woven sack is poor stackability due to the low coefficient of friction.

Palletization

Pallets have been standardized keeping because of the standard package sizes and sea containers. The size of the pallet takes on strategic importance since they correspond directly to the sizes of the various types of containers, ship cargo compartments, trucks, fork trucks, etc. The most commonly used pallet sizes are 120x80 cm (Euro pallet) and 120x100 cm (Sea pallet). Sea pallets are most commonly used outside Europe.

Palletized loads are used to reduce handling costs by allowing the substitution of mechanical handling for manual methods.

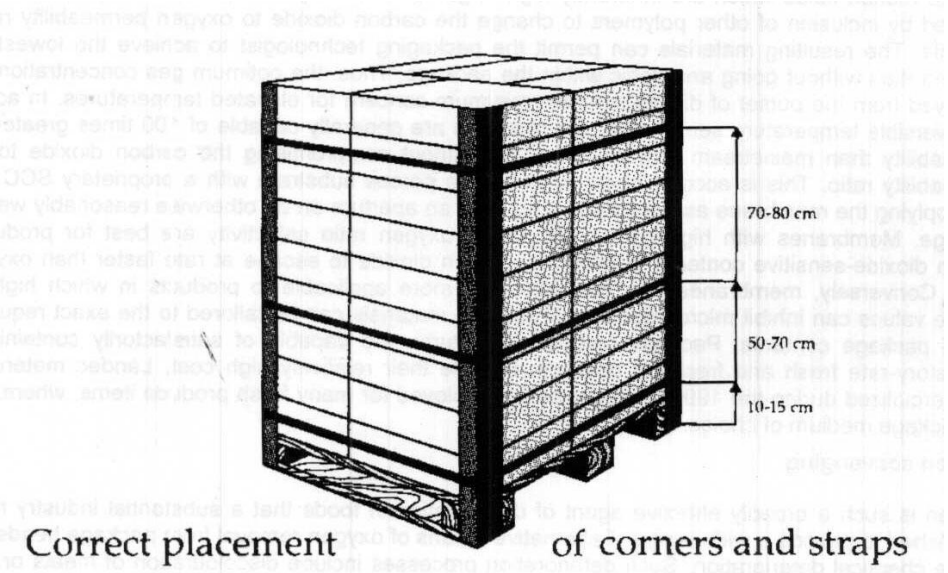
- A decrease in sorting.
- Redraw labeling requirement.
- Better utilization of storage space.
- A reduction in mechanical strains and damages.
- A reduction of the total distribution time.
- Better maintenance of product quality.

Two principles are used in the assembly of pallet loads.

1. The modular principle, in which all packages are oriented in the same direction.
2. The two-way principle, in which the packages in each tier form a pattern such thatsome packages are oriented lengthwise and others crosswise on the pallet.

Unitization

Corner posts made with plastic or wood or Molded paper boards are generally used as columns for unitization. The boxes are held together utilizing strapping around the boxes as shown below.



3.7 Modified Atmosphere Packaging (MAP)

A modified atmosphere is the initial alteration of the gaseous environment near the product, permitting the packaged product interactions to naturally vary their immediate gaseous environment.

A controlled atmosphere is a process by which the gaseous environment is modified to the desired level and controlled at this level, with strict limits, throughout storage and is usually applied to bulk storage.Normal composition of air 20% O2, 79% N2, 0.03% CO2.

Smart packaging

To be able to control the package structure to deliver a controlled atmosphere within packages is a major accomplishment that truly deserves the name "smart packaging." The term "smart" packaging was coined about fifteen years ago to describe package structures that allegedly sensed changes in the internal or surrounding environment and altered some of their relevant properties in response. Simultaneously, academics and true researchers, concerned that the term was too juvenile, invented the term "interactive" packaging to describe the same entities and later shortened it to "active" packaging, the nomenclature employed today. The problem with too much active packaging today is that it is not very intelligent, i.e., it does not really change with the environment but rather functions less passively than "ordinary" "barrier" packaging.

Intellipac polymeric package materials, manufactured by Landec Corp., Menlo Park, Calif., are side-chain-Crystallizable (SCC) polymers with the ability to effectively and reversibly melt as the temperature increases and thus foster increased gas transmission through them. SCC polymers are acrylics with side chains independently of the main chain. By varying the side-chain length, the melting point can be altered. By making the appropriate copolymers, it is possible to produce any melting point from 0 to 68 0 C., well within the extreme distribution temperature range of minimally processed foods. SCC polymers are unique because of their sharp melting transition and the ease with which it is possible to produce melting points in a specific temperature range. When elevated to the switch temperature, SCC polymers become molten fluids that are inherently high in gas permeability. The permeation properties may be modified by the inclusion of other polymers to change the carbon dioxide to oxygen permeability ratios, for example. The resulting materials can permit the packaging technologist to achieve the lowest oxygen concentration without going anaerobic within the package. Thus, the optimum gas concentration may be employed from the outset of distribution with minimum concern for elevated temperatures. In addition to the reversible temperature sensitivities, the materials are generally capable of 100 times greater oxygen permeability than mainstream polyethylene films without compromising the carbon dioxide to oxygen permeability ratio. This is accomplished by coating a porous substrate with a proprietary SCC polymer and applying the membrane as a package label over an aperture on an otherwise reasonably well-sealed package. Membranes with high carbon dioxide to oxygen ratio selectivity are best for products with carbon dioxide-sensitive contents to allow the carbon dioxide to escape at a rate faster than oxygen can enter. Conversely, membranes with low ratios are more applicable to products in which high carbon dioxide values can inhibit microorganisms. Thus, the materials can be tailored to the exact requirements of the package contents. Package materials structures are capable of satisfactorily containing high- respiratory-rate fresh and fresh-cut produce. Despite their relatively high cost, Landec materials were commercialized during the 1990s and are being employed for many fresh produce items, where they are the package medium of choice.

3.9 Oxygen scavenging

Oxygen is such a broadly effective agent of deterioration in foods that a substantial industry has been established to provide a wide range of alternative means of oxygen removal from package headspaces to reduce chemical deterioration. Such deterioration processes include discoloration of meats or rancidity development due to lipid oxidation.

The choice of method of oxygen removal depends upon both economic factors and the properties of the particular food. In practice, the application of a short inert-gas flush coupled with the use of a scavenger is likely to be an attractive combination. The performance of oxygen scavenging sachets depends strongly on the equilibrium relative humidity of the food and the range of sachets available. The inclusion of iron-based scavenging compositions in sachets has been improved by the development of adhesive scavenging labels for the inner wall of packages.

Technologies for thin films typically used in MAP systems need an additional feature to prevent premature reaction if they are to provide maximum scavenging capacity. The transition-metal-catalyzed (optionally light-activated) process patented by W.R. Grace, Inc. approaches this by pre-planned activation involving the generation of full capacity by consumption of antioxidants. Amoco Chemicals have reported some performance data for their Amosorb®, water-activated, master batch for blending into a variety of plastics. No

compositional detail is yet provided but the master batch and plastics incorporating it is stable at relative humidities below 40%.

Co2-scavengers and emitters

Co2 is formed in some foods due to deterioration and respiration reactions. The produced Co2 has to be removed from the package to avoid food deterioration and/or package destruction. Co2-absorbers might therefore be useful. The 02 -and Co2 -scavenging sachet Fresh Lock® or Ageless® E is used in coffee to delay oxidative favor changes and absorb the occluded 602 which if not removed would cause the package to burst. The active compound Ca(OH)2 of Fresh Lock® reacts at sufficiently high humidity with the Co2 to produce CaCoa. Multiform Desiccants patented a Co2 -absorbent sachet including a porous envelope containing CaO and a hydrating agent such as silica gel on

which water is absorbed.

In some cases, however, high 602 -levels (10-80%) are desirable for foods such as meat and poultry because these high levels inhibit surface microbial growth and thereby extend shelf-life. Fresh meat, poultry, fish, and cheese can benefit from packaging in a high Co2 - atmosphere. Removal of 02 from a package by use of 02 -absorbers creates a partial vacuum which may result in a collapse of flexible packaging's. Also, when a package is flushed with a mixture of gases including €02, the Co2 dissolves partly in the product and creates a partial vacuum. In such cases, the simultaneous release of Co2from inserted sachets which consume 02 is desirable. Such systems are based on either ferrous carbonate or a mixture of ascorbic acid and sodium bicarbonate. The 02 -absorbers/Co2 -generators are mainly used in products where package volume and package appearance are critical.

Antimicrobial packaging

Substantial recent research has been directed at determining how the surfaces of plastics can be made not only sterile but also capable of having an antimicrobial effect on the packaged food or beverage. This type of effect has already been achieved in outer layers of laminates by the use of modified printing presses.

Horseradish extract on a cyclodextrin carrier has been used in a drip sheet for fish or in a film wrap for lunches in Japan.

Approaches to antimicrobial packaging can be classified as either of two types. The first consists of binding an agent to the surface of packages and this would require a molecular structure large enough to retain activity on the microbial cell wall even though bound to the plastic. Such agents are likely to be limited to enzymes or other antimicrobial proteins. The second approach involves the release of agents into the food or beverage or localized removal of a food ingredient essential for microbial growth.

3.12 Prepackaging

The package in which the consumer receives the product is called consumer packaging. The term prepackaging of produce in consumer units before its presentation to the final consumer. Prepackaging may be undertaken at any stage throughout the distribution chain from the field to the retailer's premises, depending upon, the need of produce for protection, expected transport and storage time, required shelf-life, packaging material

costs, and costs of packaging and sorting at different points, transport and storage cost and latest knowledge of the market requirements. The experiments carried out at CFTRI showed the extended shelf-life of different fruits, vegetables, and cut flowers are shown in the table:

CHAPTER- 4

FOOD SAFETY AND FSSAI STANDARDS

4.1 Food Safety and Standards Authority of India (FSSAI)

- The Food Safety & Standards Authority of India is the principal Government Authority responsible for preparing specific regulations under the Act. FSSAI is an autonomous body established under the Ministry of Health & Family Welfare, Government of India
- FSSAI has been established under the Food Safety and Standards Act, 2006
- Came into action- August 2011
- FSSAI is responsible for protecting and promoting public health through the regulation and supervision of food safety.
- Businesses having an annual turnover above 20 crores can apply for FSSAI central license.
- 1. Rental Agreement of Business Premises.
- 2. ID Proof of the Concerned Person (Aadhar Card / Driving License / Passport / Voter ID)
- 3. If any Government Registration Certificates (Company Incorporation Certificate / Firm Registration / Partnership Deed / Pan card / GST / Shop & Establishment / Trade License)
- 4. If the applicant is a private limited company or partnership firm then they should provide MOA & AOA or Partnership deed copy.
- 5. IE Code (Import Export Code) Certificate (for the category of export and import IE code is compulsory)
- 6. Authority letter from the company letterhead to the concerned person stating that he is authorized to file an FSSAI application.

- 7. List of food categories desired to be manufactured (In the case of manufacturers).

4.2 Food Safety and Regulatory Requirements for Chironji Processing

- Any food business operation to function in India should adhere to certain product-specific standards, safety, and hygienic parameters.
- The food safety regulations are laid down by the Food Safety & Standards Authority of India, which came into existence in 2006.
- Other agencies involved in standardization and quality certification are the Bureau of Indian Standards (BIS), AGMARK, Codex.
- FSSAI replaces the then existed laws like the Prevention of Food Adulteration Act (1954), Fruit Products Order, Milk & Milk Products Order, Export (Quality Control & Inspection) Act, Meat Products order, Agricultural Produce (Grading & Marketing) Act
- Every food business operator involved in the manufacture, processing, storage and distribution, and sale of food products must compulsorily obtain FSSAI Registration or License.
- It is a 14-digit registration or a license number that is printed on all the food packages. The 14-digit registration number gives details about the assembling state, producer's permit.

4.3 HACCP Procedure

Appropriate to the nature and size of the operation and sufficient to assist the business to verify that the HACCP controls are in place and being maintained.

Documentation shall include (as a minimum) the following:

- HACCP team composition;
- Product description;
- Intended use;
- Flow chart;

- Hazard analysis;
- CCP determination;
- Critical limit determination;
- Validation process; and
- HACCP plan

The HACCP plan shall include the following information for each identified CCP:

- Food safety hazard(s) to be controlled at the CCP;
- Control measure(s);
- Critical limit(s);
- Monitoring procedure(s);
- Corrections and corrective action(s) to be taken if critical limits are exceeded;
- Responsibilities and authorities for monitoring, corrective action, and verification;

  Record(s) of monitoring

4.4 Labeling Standards

Labeling requirements for packaged food products as laid down in 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 should 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 Flavours.
6. Instructions for Use.
7. Vegetarian or Non-Vegetarian 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 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 food shipped in bulk which is not for sale in that form to consumers.

4.5 Marketing

- Chironji being essentially a forest crop, there is a lack of an organized marketing process. In forest areas, the proportion of flowers and seed collection is much less than in the areas around. villages. However local middlemen purchase the dehulled kernels of chironji from villagers and supply them to wholesale markets. It ultimately reached expellers from the wholesale market.
- About 75 % of farmers sell their produce at farm level to the village merchants, retailers, big producers, or pre-harvest contractors. They cannot afford to transport their produce to distant markets on account of the non-availability of transport facilities, expensive transport, and malpractices in the market. Information regarding demand, supply, price, market outlook, knowledge of consumer's preference, marketing channels are important for the marketing of produce.

4.6 Conclusion

- The research workers have to come along with the people of the tribal community, so they may have more and valuable knowledge. In the coming next generation, the importance of plant and chironji trees is going to increase because of their effectiveness, easy availability, low cost and comparatively being devoid of toxic.

- Plants are the important economical source of several well-established drugs looking upon wide prospects and potential of *Madhuca Indica* for various purposes; it is worthwhile to cultivate this plant on large scale especially on unproductive and wasteland. This will help in the financial full support of poor and landless families. Generally this plant *Madhuca Indica* is known only for its liquor making purpose, but one has to come forward to change the thinking of unaware people
- The research workers have to come along with the people of the tribal community, so they may have more and valuable knowledge. In the coming next generation, the importance of plant and chironji trees is going to increase because of their effectiveness, easy availability, low cost and comparatively being devoid of toxic.
- Plants are the important economical source of several well-established drugs looking upon wide prospects and potential of *Madhuca Indica* for various purposes; it is worthwhile to cultivate this plant on large scale especially on unproductive and wasteland. This will help in the financial full support of poor and landless families. Generally this plant *Madhuca Indica* is known only for its liquor making purpose, but one has to come forward to change the thinking of unaware people.

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. Handholding support for the preparation of DPR, availing bank loans, 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.