



# Unit 4 Topic 4,5&6

# CASHEWNUT PROCESSING

Cashew processing methods have improved considerably over the years. Traditionally the various processing operations were performed manually by experienced semi-skilled workers. This is still the case in India, which is the world's largest producer of cashew kernels. Since the 1960s, various mechanized pieces of equipment have been developed and are available in several countries. The processes that have been mechanized are roasting, cashew nut shell liquid extraction and shelling. For the most part, the cleaning of raw materials and sizing and kernel grading have remained labour intensive manual operations. The main objective of processing is to remove the valuable cashew kernel from the shell with as little damage as possible. Whole kernels command a higher price than do broken pieces. Pale, ivory coloured or white kernels are preferable to coloured or burnt ones. The processor must therefore, finely tune the process in order to achieve the best quality kernels. There are significant differences in investment requirements, labour skills, health requirements and levels of efficiency between the Indian manual technology and the medium to large-scale mechanical and semi-mechanical operations. In general the Indian processing system involves lower investment and variable costs and achieves far greater efficiency in terms of kernel material yield and the proportion of whole kernels extracted. However this system requires large numbers of experienced workers who work at unhealthy levels of exposure to CNSL. The mechanized systems are more vulnerable to breakdown due to shortage of spare parts, require large volumes of nuts for efficient operation and operate well below manufacture specifications when strict grading and sizing activities are not in place prior to shelling .

There are two types in cashew processing,

- 1. Wet process,
- 2. Dry process,





# **Process Flow Chart – Wet Process**







# 2. Process Flow Chart – Dry Process







Proper Harvesting techniques - Only matured nuts from fully grown apple must be harvested..

**Proper storing methods** – Dried nuts should be stored in jute / sisal bags [80kg nut per bag] and not heaped or stored in silos to avoid warm humid Condition in storage room. Storing in woven HDPE bags are not recommended for storage of raw nuts. While storing it is necessary to provide proper wooden dunnage to prevent damage to the cashew nut in bags by avoiding direct contact of bags to the Warehouse floor. This can be economically achieved by keeping bamboos, criss-crossed and tied and placed on the warehouse floor. Dried nuts should be stored in well-ventilated, fly-proof place with low humidity, free of stored product pests and well insulated to prevent water Seepage during rains



# **Cleaning and conditioning**

The first processing operation is the removal of foreign matter and dirt from the nuts. The nuts are collected from the ground after falling from the trees. Apples are removed along with other foreign matter. At the simplest level, the nuts can be sieved by hand using a three-quarter inch (20 mm) mesh sieve to remove dust and dirt (**ITDG**, 2000).

The cleaned nuts are then conditioned in preparation for removal of the shell. Conditioning increases the brittleness of the shell and thereby facilitates its removal. The nuts are soaked in water in order to avoid scorching during the roasting operation. Conditioning is carried out in order to prepare for removal of the CSNL.

In small-scale operations, after cleaning, the nuts are placed in a large open drum (180-220 liters / 40-45 gallons). Water is poured into the drum and the nuts are allowed to stand for ten minutes prior to draining off the water through a hole in the base of the drum. The dampened nuts are then allowed to stand in order to absorb the adhering water. This soaking and conditioning operation is repeated up to three or four times until moisture content of nine percent is attained.

# GRADING

The grading operation is important since it is the last opportunity for quality control of the kernels. After the kernels are extracted from the shells, dried and peeled, they are graded for export according to size and condition. The grading system is known as the American Standard, which is also incorporated in the Indian Government export criteria. Kernels are categorized on the basis of colour and condition. Peeled cashew nuts can be classified into between 11 and 24 grades .These are roughly divided into three groups: white whole, white pieces and scorched grades. The three groups are further broken down as follows:





### Steam cooking:

The raw cashew nuts suns dried and stored in the warehouse are steamed in boiler [without steam pressurizing the cooker vessel] for about 30 minutes. The cooking time is varied depending upon the conditions of cashew nut and atmospheric conditions. The steaming expands the shell, softens the nuts due to penetration of steam into the shell. After steaming, the nuts are air-cured by spreading out on the floor in the shade. These ultimately harden the shell and make it fit enough for de-shelling in the manually operated cutting machine. The steam processing preserves the original color of the cashew kernel inside the Nut. The cut shells of steam roasting process yield quality Cashew Nut Shell Liquid [C.N.S.L.].



S.NO	GROUPS	SPECIFICATION
1.	White wholes	
	W180 (super large)	Between 120 and 180 kernels per lb (266-395 per kg)
	W210 (large)	200 and 210 kernels per lb (395-465 per kg)
	W240	230 and 240 kernels per lb (485-530 per kg)
	W280	270 and 280 kernels per lb (575-620 per kg)
	W320	300 and 320 kernels per lb (660-706 per kg)
	W450	400 and 450 kernels per lb (880-990 per kg)
2.	White pieces	
	Butts	A kernel broken cleanly across the section of the nut.
	Splits	Kernel which has broken down the natural line of
	Pieces	cleavage to form a cotyledon.
	Small pieces	A kernel which has broken across the section but does
	Baby bits	not qualify for a butt and is above a specific size.
		As above but smaller.
		Very small pieces of kernel which are white in colour.
	Scorched grades	Whole kernels that have been slightly scorched during
3.	Wholes	the process but are otherwise sound. These are not
	Butts	graded according to size.
		Butts that have been scorched.

### Drying

The shelled kernel is covered with the testa, the removal of which is facilitated by drying the shelled kernel, to produce the blanched kernel. Drying causes shrinkage of the kernel, thereby allowing the testa to be easily removed either







mechanically, or by hand with a knife. Drying also protects the kernel from pest and fungal attack at this vulnerable stage. All processors dry the shelled kernels prior to peeling.

Artificial drying is more reliable and is required in medium or large-scale operations. Drying usually takes six hours, at a temperature of around 70°C. A uniform temperature throughout the drier is essential to avoid under-drying or scorching. Various drier designs are available. Figure shows a tray dryer, designed by ITDG, for drying cashew kernels.

The dryer contains a series of mesh-bottom trays that are slotted into the drying cabinet. The trays should be of a size that can be lifted when full. A lever mechanism automatically moves the trays down when dried trays are removed and when new ones are entered into the cabinet.



# Shelling

The Steam cooked and air-cured Cashew nuts are de-shelled by hand and leg operated cutters. Two workers work on one cutter, one de-shells the nut and the other worker retrieves the kernels from the cut opened shell. The nuts are fed one by one manually between the two sets of blade to fit the Contour of the fixed blade. The pressing of the pedal pierces the Cashew nut on the convex side by means of two blades. The two blades are used to split the nut by operating the handle of the cutter. After de-shelling the nut falls freely due to gravity and is collected beneath the cutter. The operator's assistant works upon each de-shelled nut and takes out the cashew kernel embedded inside the shell.

### Peeling of conditioned cashew kernels

The Cashew kernels conditioned as above is now ready for peeling. Peeling of the Testa is done manually; usage of sharp edges of knife is discouraged as it causes scraping of kernels. Scrapping mars [spoils] the look of the Cashew kernel and is more pronounced after oil roasting. However knives are very selectively used on a very small quantity of Cashew kernel, whose skin does not peel off easily in manual peeling. Major classification / grading of kernels into wholes, brokens and rejections are done at this stage. A skilled laborer can peel approximately 6 to 8 kg.

### Filling and packing

The grated and moisture conditioned cashewkernal are filled in 18Lt/ square tins, 25Ibs (11.34kg) to a tin. The Cashewkernal are fed into the vibratory filling machine through a pneumatic Foreign Matter Segregator (PFMS). 8





Tins (Leak tested and Tar weighed) are filled at a time; Filled tins are then weighed for a net weighed of 11.34 kg plus or minus 10gm using electronic weighing scale. The weighed tins are "Vita Packed". Vita packing is the process of vacuumising and injecting inert gas viz. Carbon-di-oxide or Nitrogen into the cashewkernal filled tins. The gas infused tins is hand-soldered hermetically using lead free solder.

# Modern Packaging system

Cashew Kernels can be also being packed in multilayer flexible pouches; gas flushed and sealed 25 pounds net per pouch. All importers in USA and Europe prefer this system of packing.

# CASHEW NUT PROCESSING – DRY PROCESS

### **Pre-heating and peeling**

After extracting the kernel from the shell, the testa, which is a thin reddish coloured skin covering the kernel, must be removed. Removal of the testa is facilitated by drying through slight heating. Care must be taken not to overheat the cashew kernels as they become scorched and discoloured. Traditionally the kernels are heated on either a metal plate or open pan over an open fire. The kernels are tossed over the heat to avoid roasting and burning. An alternative and preferable method is to use a mechanical drier maintained at 55 to 60°C. The kernels are loaded into the drier and dried for three to four hours until the nuts give the appropriate sound when rattled together.

# Grading

The peeled kernels are divided into wholes, splits and broken pieces. They are stored in bulk in cardboard cartons or polythene bags. The dried kernels are further graded into sizes 180W, 240W and 320W according to the size of the nut. This process is carried out by experienced graders.

# Drying

Kernels are dried to a final moisture content of five per cent, using either a mechanical drier or oven. It is important to ensure that the drying temperature is not too high as this would cause roasting and discoloration rather than just drying of the kernels. Trained processors examine the kernels for the correct level of dryness by observing the colour and texture and shaking a few nuts together to hear the correct sound.

# **Roasting and centrifuging**

Following conditioning, the nuts must be prepared for the removal of shells. The application of heat to the nut releases the CNSL and makes the shell brittle, thus facilitating extraction of the kernel when breaking the shell open. Three methods of roasting are used: open pan roasting (as described in Chapter 5), drum roasting and roasting via the hot oil method. The latter is best suited to medium-scale operations because of the associated higher equipment costs and viability of CNSL collection. The roasted cashew nuts may be centrifuged to remove any adhering surface liquid from the nut.

### **Drum roasting**

An improvement on the open pan roaster was the development of a drum roaster, within which the cashew nuts are roasted. The drum is tilted at an angle over the fire and rotated during heating to prevent the nuts from burning





(Figure). During rotation, nuts pass through the cylinder and out of the opposite end of the drum. The duration of the roasting process can be regulated by changing the speed of rotation of the drum. The cylinder is covered in a hood connected to a chimney which draws the black smoke upward into the atmosphere and makes it less unpleasant for the operator (FAO,1969).



Figure : Diagram of a drum roaster fired from a furnace below

# The hot oil method

An increased demand for CNSL in the mid 1930s, led to a major change in cashew nut processing by hot oil' method and was widely adopted. The principle of this method is that oil bearing substances, when treated in the same or similar oil at a high temperature, give up their oil constituents to the bulk, thereby increasing the volume of the bulk. When cashew nuts are submerged in a bath of hot CNSL, the CNSL within the shell is therefore extracted, resulting in an increase in the volume of the bath liquid.

# Simple hot oil process

The simplest hot oil process is one that consists of a tank in which CNSL is heated and a wire basket that contains the nuts to be roasted. The nuts are placed in the basket and weighted down with a piece of mild steel plate (1 mm thick). A thermometer is inserted in the side well below the liquid level. Trays on either side of the tank act as draining areas, allowing excess oil to run back into the tank. The tank is heated from below by a built-in furnace. The nuts are held in the hot oil for 1.5 minutes at a temperature of 185°C. The entire process is manually operated. After roasting, the nuts are placed on a wire mesh screen over a tank for further draining and cooling prior to shelling.

# Shelling

The objective of shelling is to produce clean, whole kernels, which are cracks. Shelling has always been manually performed in India. Other have difficulty in competing with the great skill and the low wages of workers. India has therefore enjoyed a virtual monopoly of cashew for a long time. Manual shelling is still relevant to the small-scale

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although a close look at mechanical options is recommended in all cases.

### Development of a cashew nut sheller in India

A mechanical Sheller was designed in India by researchers at the Post Harvest Technology Centre, Indian Institute of Technology in Kharagpur. The Sheller uses principles of compression and shear, taking into account the physical and mechanical properties of cashew nuts. The machine consists of four compartments power supply, transmission, feeding, shelling and discharging .Shelling of roasted nuts takes place between two wooden discs, one of which is stationary (fixed to the machine casing) while the other is mounted on to a shaft. The rotating disc is spring loaded in order to compress and shear the roasted cashew nut against the stationary disc. Sufficient pressure is exerted by the spring in order to compress the nuts between the two discs.

### Packaging

The type of packaging used is largely dependent on the target market. For the local market, kernels are packed in bulk and sealed in polythene bags. For the export market they are packed and flushed with nitrogen. Regardless of the target market, cashews must be packed in airtight containers so as to avoid the absorption of moisture from the air. They must be stored away from sunlight in order to prevent oxidative rancidity.

#### S.NO **EQUIPMENTS** TYPES SIB Boiler 1. Cashew Cooking System Baby Boiler HMT Boiler 2. Cashew Nut Shelling System Hand Operated Leg Operated Automatic Cashew Shelling Machine Cashew Drier 3. Cashew Drying System Cashew Humidifiers 4. Humidifiers Kernel Sizing System Sizing system 5. Cashew Kernels Dust Cleaner Cashew Kernels Tin Filling Machine 6. **Tin Packing Systems** Cashew Kernels Vacuum & Gas Filling Machine Cashew Kernel Bulk Packing System

### LIST OF EQUIPMENTS USED IN CASHEW NUT PROCESSING





7.	Pouch Packing Systems	Bulk Packing Roller Conveyer Vibrating Filler Cashew Packing Mould, Closed Single Chamber Vacuum Drier Trolly Cashew Peeling Table
8.	Other Machines	Cashew Kernel Salt coating Pan Heat Exchang Continous Oil Fryer Cashew inspection Conveyar