

# OILSEED PROCESSING

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# OILSEED PROCESSING

## ➤ Seed cleaning

- It is essential to winnow and sieve oilseeds, prior to expelling, to remove as much dirt, dust, sand and small stones as possible.
- The presence of sand results in high wear on critical components of expellers.

## ➤ Decortication

- Some oilseeds have a hard outer shell which must be removed before processing because they lack in oil content.
- This process is called decortication.
- It is done by a impact huller.
- Complete removal is not preferred as about 8-10% hull facilitate efficient oil expelling.

## ➤ **Breaking/Size reduction**

- Generally, small oilseeds (such as **sesame** or **rapeseed**) can be processed directly,
- Larger seeds (such as **copra**) need to be ground before processing.
- It is done by hammer mill.
- This also reduces power consumption.

## ➤ **Rolling(crushing/grinding/flaking)**

- Rolling a seed generally results in an improvement in oil extraction by increasing the surface area of the seed while at the same time retaining channels for the flow of oil.
- 0.3mm thick flakes require more extraction as compared to 0.15mm thick flakes.
- The flakes should be very fine and preferably **thinner than 0.1 mm**.
- Rolling before processing increases oil yields by **10%**.

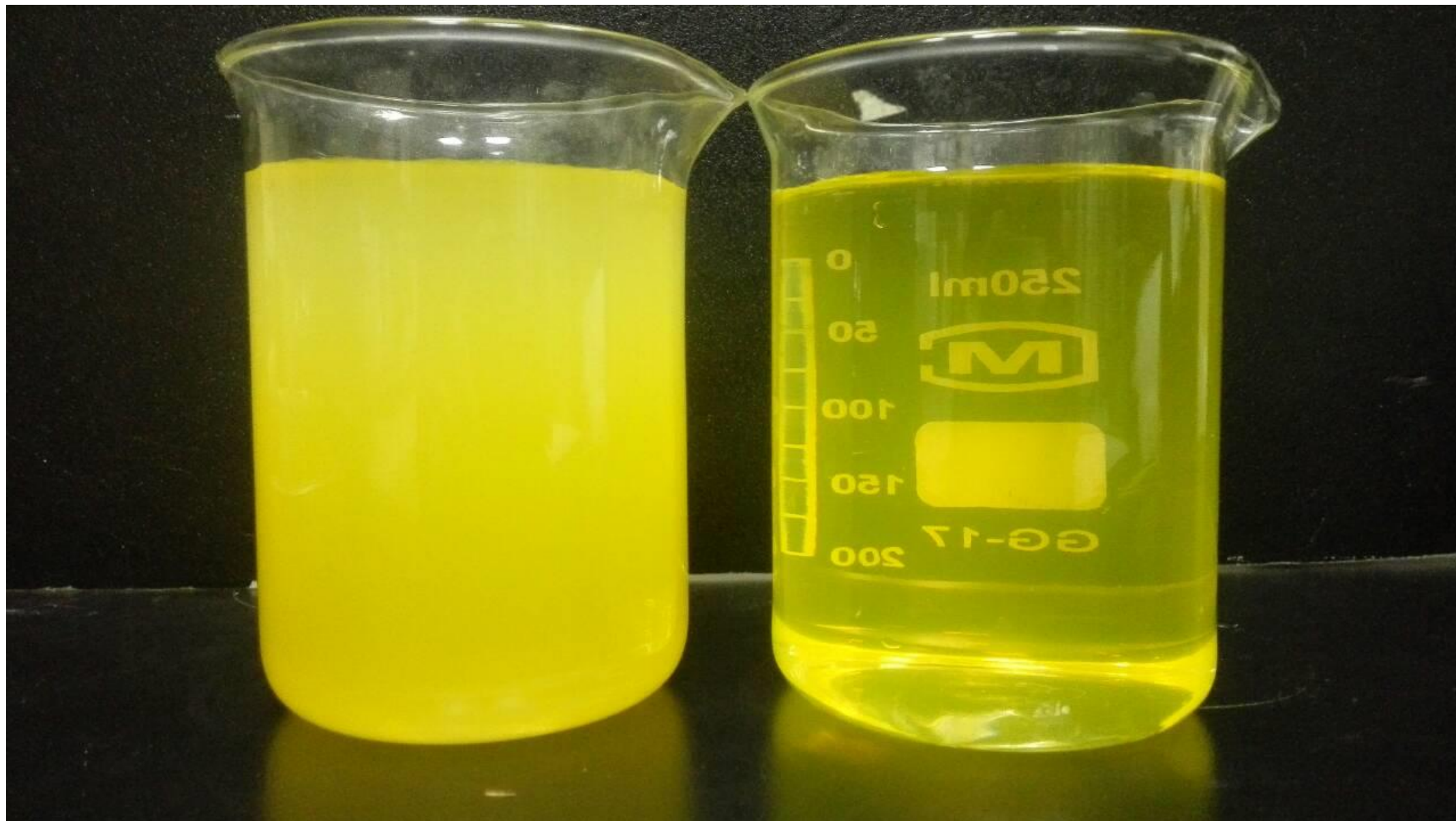
- **Conditioning/Heat treatment**
- Conditioning or 'cooking' oilseeds involves heating the oilseed in the presence of water.
- Heating breaks oil-protein emulsion making it easier for oil to extract.
- The water may be that which is naturally present in the seed, or it may be added.
- The changes brought about by conditioning are complex but include the **coalescence of the small droplets of oil**, present in the seed, into drops large enough to flow easily from the seed.
- In addition, higher processing temperatures improve oil flow by **reducing the viscosity** of the oil.

## ➤ REFINING

- Cold press oil can be of such high quality as to need no refining if it comes from seeds that are fresh and of good quality.
- All other oil, especially that which has been pressed from lower quality feedstock, is likely to have some undesirable **cloudiness, color,** or **flavor** that needs to be removed.

## Removal of Cloudiness

- Pressed oils need to be filtered to remove particles from the pressing operation, if the oil is to be clear and clean.
- If the cloudiness is caused by **gums** precipitating, the gums can be removed by **washing the oil with about 2 percent water**.
- For this process to be effective, the oil should be **heated**, and the **hot oil mixed with water**, with active stirring.
- Next the water and oil must be separated. For this, a **centrifuge** is most effective.
- The degummed oil should be **dried by heating** to drive off all moisture, for the reasons cited previously.
- Degumming can also be done by using **acid** and **enzymes**.



## ➤ Removal of Excess Color

For the removal of excess color, **bleaching earths** are effective.

- The oil is heated and mixed with **1-2 percent** of its weight of an effective **bleaching earth**.
- After a contact time of approximately **one hour**, the bleaching earth is **separated by filtration**.
- **Activated carbon** can also be used.





## ➤ Removal of Unwanted Flavors

- Unwanted flavors are more difficult to remove.
- They may be due to excessive free fatty acids. (Acidity of over 10 percent is common; if over 20 percent acid, the oil is good only for making soap.)
- Free fatty acids can be removed from the oil by washing the oil with alkali.
- The fatty acid will react with the soda to form soap, which stays in the water phase.
- It is let to stay for several hours and siphon off the oil layer.
- If the oil still contains fatty acids, you should repeat the operation.

- Other types of flavors than those of fatty acids can be removed from oil, but an expensive and difficult process known as **deodorization** is used.
- It involves **distilling off the unwanted flavors under high heat and high vacuum**.
- Normally the oils being processed by small-scale pressing would have the flavors of the raw material from which they came, and there would be no need for deodorization

# OBJECTIVE OF OIL EXTRACTION:

- To obtain higher yield of oil.
- To minimize damage to quality of oil
- To obtain purer components, namely oil and oil cake.
- To produce oil cake with better utility.

## ➤ METHODS OF EXTRACTING OIL FROM NUTS AND SEEDS

- Oil can be extracted from nuts and seeds by
  - a. Heat,
  - b. Solvents, or
  - c. Pressure.
- Extraction by **heat is not used** commercially for vegetable oils.
- Extraction by solvents and pressure is generally used.

# OIL EXTRACTION BY PRESSING

- It require **pretreatment**.
- Pretreatment is done to reduce proportion of non-oil bearing husk and break the cellular structure by mechanical action and cooking.
- Cooking also control moisture content of feed.
- It is of **two** types
  1. SMALL BATCH PRESSES
  2. COMMERCIAL BATCH PRESS
  3. EXPELLERS OR CONTINUOUS SCREW PRESSES

# ➤ Small Batch Presses

- Small batch presses are simple, but inefficient.
- It is done by using **screw press** known as **expeller**.
- Few resources are needed for an operation on this scale: **wood** fires for **heating**, and **hand labor** for **pressing**.
- Much hand labor is required to produce a small amount of oil this way.
- Oilseed is pressed to cake of moderate oil content which is further processed on solvent extraction plant to recover remaining oil.
- This process is widely used.

- The press is fed using a variable speed conveyor within the feeder unit.
- Oil releases along the length of the cage is allowed to drain into the base, where it is collected.
- The solid material within press is discharged into conveyors is removed in subsequent processing.

## **Advantages of small batch presses:**

- They can be made of locally available materials.
- They can produce a good quality product.
- They are easy to repair.
- Their cost is low.
- They do not require trained operators.

## **Disadvantages of small batch presses:**

- They are labor intensive.
- Complete recovery of the oil from the seeds is difficult.
- If seeds are plentiful, this is a serious problem.



## • Commercial Batch Presses

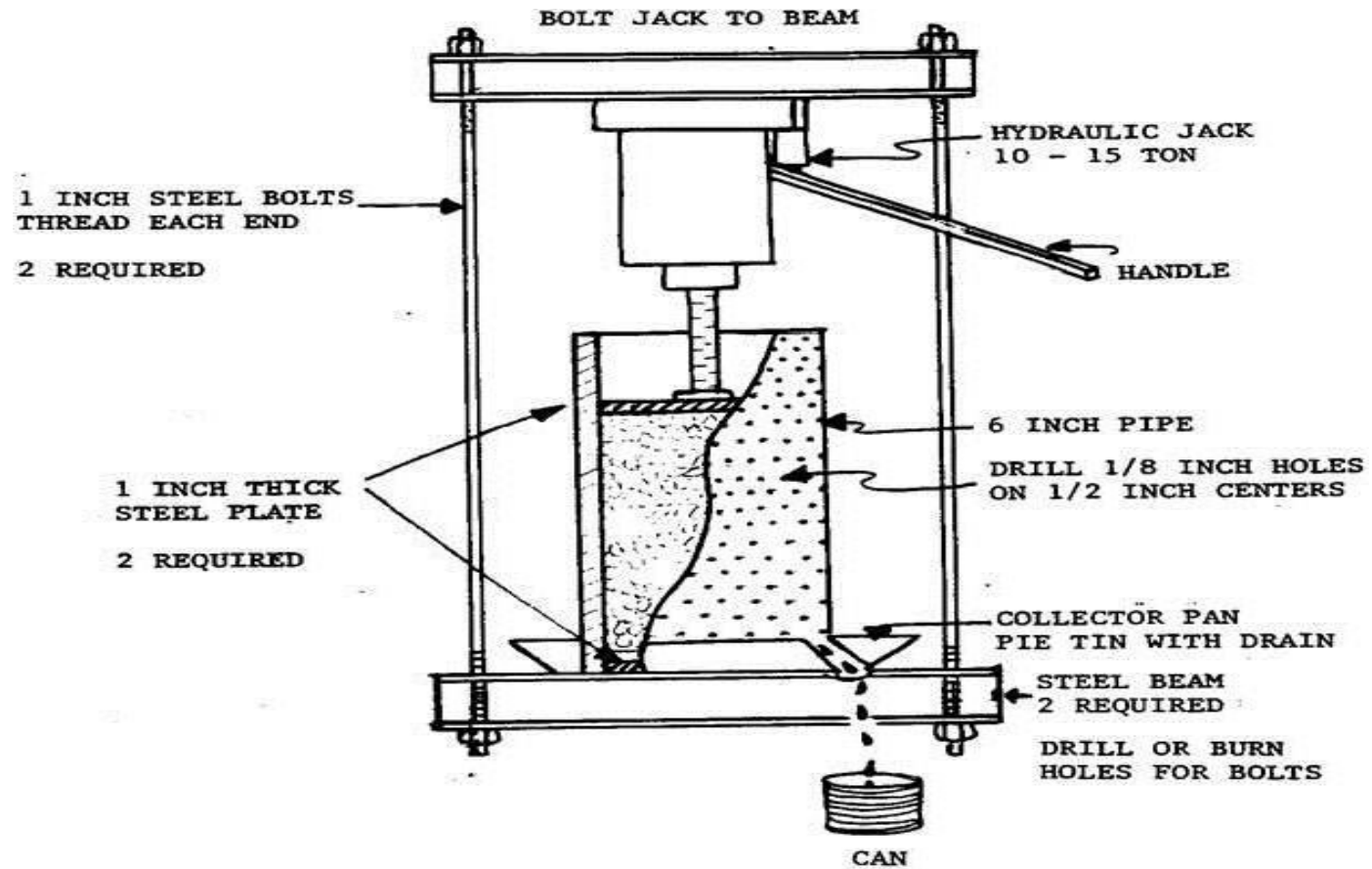
- ❖ Hydraulic presses, which are suitable only for batch processing, may be powered either by hand or by electricity.
- ❖ In many parts of the world, they are the most practical and economical way to extract oil from seeds

### Advantages

- 1.They can be driven by hand or by electricity.
- 2.They are economical to operate.
- 3.They are simple to operate and maintain.
- 4.Operators require only minimum training.
- 5.Recovery of oil from seeds is excellent.

### Disadvantages

- 1.The cost of the machinery is substantial, and delivery
- 2.Time may be long.
- 3.Spare parts are difficult to obtain in remote areas.
- 4.Electric power, or generators to produce it, may not be available to operate the larger models.

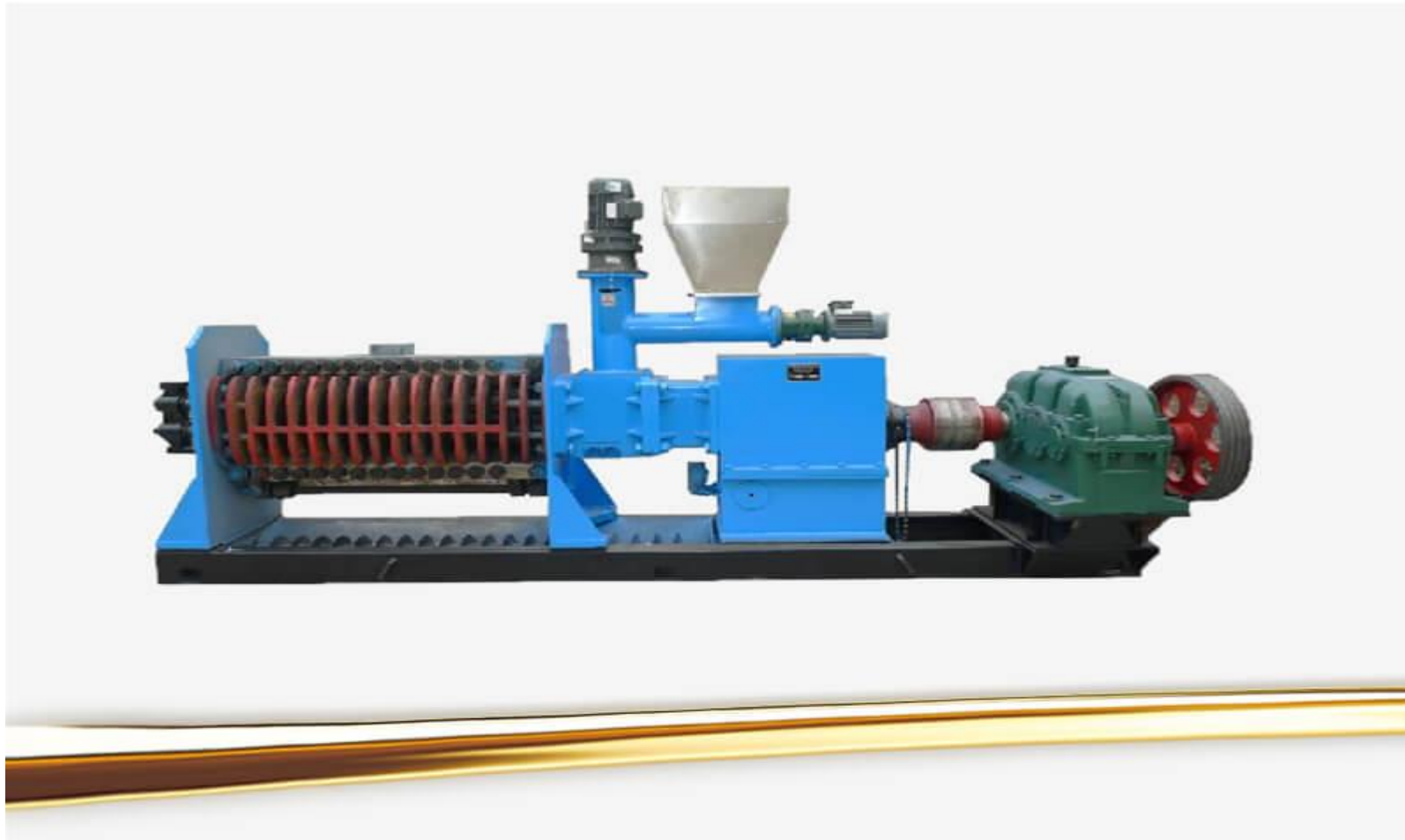




Hand operated palm oil  
extractor



Machine operated cold press



**MECHANICAL SCREW PRESS**

# FACTORS AFFECTING MECHANICAL SCREW PRESS

- Compression ratio: 10:1 or 5:1 or 15:1
- Feed moisture content: 5-11% wb
- Pressing temperature:  $<100^{\circ}\text{C}$
- Applied pressure: pressure is directly proportional to oil recovery.
- Pressing time: oil recovery increases with pressing time.
- Oil recovery: oil is reduced to 3%. If 450kg/tonne /day feed is handled then it reduces oil content to 10%

# EXPELLERS OR CONTINUOUS SCREW PRESSES

- Expellers, or continuous screw presses, are used throughout the world for the expression of oil from copra, palm kernels, peanuts, cottonseeds, flaxseed, and almost every other variety of seed.
- Expellers achieve the pressure needed to express the oil by means of an [auger that turns inside a barrel](#). The [barrel is closed, except for an opening through which the oil drains](#).
- An [expeller can exert much greater pressure on the seed cake than a hydraulic batch press can](#). This increased pressure permits the recovery of a larger proportion of the oil.
- Generally, about [3 to 4 percent of the oil is left](#) in the cake with an expeller, compared to [6 to 4 percent with a hydraulic press](#).
- It is used both by itself and as a pre-press before solvent extraction.

# EXPELLERS OR CONTINUOUS SCREW PRESSES

## ADVANTAGES

- They are the **most common type** of mechanical extraction equipment in use commercially today.
- They require **less labor** than any other method.
- Where **power is reasonable** in cost, and labor is expensive, continuous expellers are economical.
- Plant **capacity is higher** than with batch equipment.
- Expellers **extract a greater proportion of the oil** than do hydraulic batch presses.

## DISADVANTAGES

- **Maintenance costs** are high, and maintenance requires skilled mechanics.
- **More energy** is required than for batch processing.
- The press must **operate continuously** for at least eight hours; intermittent operation is unsatisfactory.
- Oil from an expeller has **more impurities** than oil from a batch press, and must be heated and filtered to obtain a clean oil.

# Equipment required

- **Pre-extraction equipment:** Dehullers, Seed/ kernel crackers, Roasters
- **Extraction equipment:** manual presses, ghanis, expellers
- **Equipment for basic refining** of the oil: Filters, Settling tanks.



# TINYTECH TINY OIL MILL

GROUND NUT  
100 KG.



THIS PLANT  
PRODUCE  
1000 LITER OIL  
IN 24 HOURS



WORKING  
IN 80  
COUNTRIES



GROUNDNUT  
DECORTICATOR

HUSK  
28 KG.

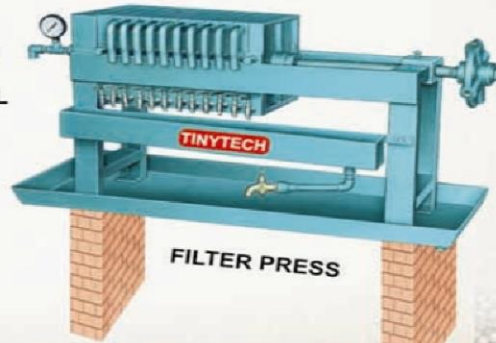
BOILER

KERNEL  
72 KG.



CAKE  
42 KG.

OIL



FILTER PRESS



PURE OIL 30 KG.

SESAME COTTONSEED GROUNDNUT SUNFLOWER CASTOR SEED COPRA RAPESEED



# OIL CLARIFICATION

- Certain amount of fine cake or meal come along with the expelled oil so, to improve the quality of oil, these materials need to be removed completely.
- Clarification is done in two stages:
  - a) **Screening**: It is done by using a static or vibratory screener.
  - b) **Filtration**: hermetically sealed filter with stainless steel leaves is used.

# GHANI

- Oil extraction is done by animal/power drawn ghanis which are predecessors of present day expellers.
- The application of pressure effects the oil expulsion from oilseeds in a ghani.
- Ghani consists of:
  - a. Wooden mortar and
  - b. Pestle
- The mortar is fixed while the pestle is attached to one or a pair of animals is rotated in the mortar.

- The seed get crushed by the generation of **friction** or **pressure**.
- The oil is collected from a opening at the bottom.
- The oil cake is scooped out from the top in the mortar.
- Ghanies are made up of **wood** with the exception of a small iron band fixed around the top edge of the mortar.
- It can be easily made using locally available material.
- The pressing method is different from place to place.
- The pestle is turned around at a **speed** of **5-7rpm**.

- While in operation ,it makes up and down movement ,crushing the material in the material.
- The traditional ghani, operated by bullocks has capacity of **6-10kg/charge**(daily crushing capacity 60-80kg) of **90 minutes** and require a floor space of **36m<sup>2</sup>**.
- It generally takes **3 h** to crush one charge of **16kg mustard** seed.

# POWER GHANI

- Ghani are driven by 2hp/3phase/1440rpm electric motor.
- It moves the pestle at a speed of 11rpm through **belt pulley arrangement**.
- Power increases oil yield by 1% and reduces time of crushing by 20%.
- The improved **overhead power ghani** can crush 12-15kg seed/charge of 60 min each.
- It is also made of wood or iron.
- The floor space required is 7.2m<sup>2</sup>.

# GHANI OPERATION

- Oilseeds in ghanies are neither reduced in size nor cooked prior to their crushing.
- Heat is developed during crushing (below 50°C).
- About 4% water is added for hydration of proteins which help in expulsion of oil.
- Oilseed cake obtained from ghani contains 12-14% of oil.
- Further in solvent extraction the left over oil is extracted.

- The oil obtained from is of **premier quality**.
- It has good flavor and contain useful constituents.
- This is possible due to low temperature during processing operation.



# GHANI

