# OPERATING THE EXPELLER

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# PREFACE

In India thousands of expellers are working in the oil mills for extraction of oils. These expellers are spread in cities, towns and villages. The expellers are run by operators who have practical experiencewith no scientific background. The oil mill managers have to depend only on the knowledge of the operators available with them. It becomes some times a difficult situation when machine gives problem due to knowledge of the operator. At that time some guidance is necessary. It has been felt throughout the country that if any guidance of practical importance is available to the managers of oil mills, it shall be quite useful.

Presently, technical books available on the subject are mainly of theoritical nature, which can be understood by the scientists and technologists. Therefore a book is necessary giving the practical aspects in a simple way, so that it can be understood by the oil mill managers, businessman and operators. In the present book an attempt has been made to give oil mill operations in a simple language and the work is confined to the expellers only.

We hope that it will give all primary necessary information to the oil millers and operators and shall be useful to them. Suggestions from the readers for further improvement of the book would be greatly accepted.

We acknowledge the use of information found in various books, journals and other publications dealing with the subject, in preparation of this book.

**H. C. Gupta**

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CHAPTER I

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Some of the oil seeds are crushed in oil expellers directly and some are not crushed. This decision is taken based on the oil percentage in the oil seed. In general if the oil percentage is more than 20% the seed is treated in expellers, otherwise, it is not economical to expell the seed.

## 1. Raw Material Procurement :

At the time of purchase the purchaser should consider moisture content, percentage of damaged seeds,maturity of the seeds, oil percentage and other foreign matter. The rates are decided based on market price considering the above factors. There are guidelines available in different markets and specifications are followed accordingly. Raw material procurement is a very critical factor affecting productivity and profitability.

## 2. Storage of Oil Seeds :

Normally the oil seeds are stored in godowns packed in gunney bags. Care should be taken of proper moisture content in seed and proper aeration. Sometimes the seeds get damaged due to self combustion, if they are not dry. The most modern method of storing of oil seeds is to stock them in long vertical well ventilated bins or "silos" ,which may be consrtucted either with concrete, steel or wood .

## 3. Processing :

Before actual crushing of the seed for obtaining oil, following important steps should be observed.

## A. Pre-Cleaning of the seed :

Seeds usually contain impurities like sand, stone, stems of plant, earth, sutli, leaf, grass etc. Some times they contain iron and metallic pieces also. These impurities should be removed in order to obtain high quality of the oil. These impurities inspite of injuring the quality of the cake, lower the oil yield by absorpbtion of certain amount oil and tends to wear out of the machinery.

Pre-cleaning of the seed increases the life of expellers and minimises unwarranted breakdowns and keeps the better quality of finished products.

Different types of seed cleansing machines are used in the oil mill industry :

1. Hand cleaning machines.
2. Stationary seed cleaning machines.
3. Vibrating seed cleaning machines.
4. Rotary seed cleaning machines.
5. Brushing machines.

## B. Decortication :

Before passing the seeds to decortication machines, it should pass through the de-stoner machines, which will remove the stones of the seed size,which might have passed through pre-cleaning machines

Certain seeds like groundnut, castor and cotton seeds have outer covering known as shell or husk. This husk contains practically no oil and represents approximately 30% of the total weight of the seed. Its removal before crushing is important due to the following reasons :

1. It increases the pressing capacity of the mill.

2. If husk is allowed to be pressed, it forms the part of the cake and absorbs oil to an extent as would be lost in the cake. This, therefore results in the low yield of the oil.

3. The presence of husk in the seeds also impart colour to the oil.

4. The husk being of siliceous nature, have a detrimental effect on the expellers .

The decorticator machine setting needs checking very often to ensure that husk do not carry small kernal particles, which otherwise is a direct loss.

In these machines the seeds are passed through special rollers set up with cutting edges and ridges which cause break in their shells , while the seed remains untouched. Various types of machines are used to decorticate depending on the size and nature of the seed. Various makes of groundnut decorticators, castor seed shellers and cotton seed hullers are available in the market. After breaking the husk, the seeds are cleaned by blowing the husk carefully.

## C. Seed Conditioning :

In order to extract better quality of oil most efficiently, using minimum pressure and electricity, proper conditioning of the seeds is very essential. The following two factors ensures mainly most effective conditioning.

### *1. Seed Cracking :*

Before crushing of seed it is desirable to pass the seed in a seed cracker machine, wherein seed is allowed to pass through two rotating chilled rollers of steel. In some cases the rolling operation is performed by passing seed through a set of five heavy rolls, staged vertically above each other. Several types of machines like disintegrater, edge-runners, reduction rolls high etc. are employed for the preliminary reduction of a variety of seeds like Mahua, Copra, Rape, Sesame, groundnuts etc. For Copra special cutters and breaking machines are used. The cracked seed facilitates efficient cooking and drying of seed later on in expeller kettles.

### *2. Cooking and drying :*

This is the most important step in the extaction of oil by expeller method. The cracked seeds are properly cooked with open steam. Following are the main objects of cooking :-

1. To regulate the moisture content of the seed meal.

2. To coagulate the proteins in the walls of the fat containing cells.

3. To make the cell walls permeable to the flow of oil

The oil droplets are almost ultramicroscopic in size and are distributed throughout the seed. One effect of coooking is to cause these very small droplets to unite into drops large enough to flow from the seed. Second effect of cooking is drying of the seed to give the seed mass the proper plasticity for efficient pressing. Third effect of cooking is to decrease the affinity of the oil for the solid surface of the seed, so that the best possible yield of oil may be obtained when the seeds are subsequently pressed. Other important effects of cooking are insolubilization of phosphatides and other undesirable impurities, destruction of molds and bacteria, increase of fluidity of the oil through increase in temperature and in case of cotton seed, detoxification of gossypol or related substances. Very dry seeds cannot be expressed efficiently. Cooking operation regulates the moisture. The optimum moisture of cooked seeds varies widely accordingly to the variety of the seed and the method to be used for expression.

During the process, the cracked seed is cooked in steam kettles made right over the expeller machine. The temperature of the seed is raised and the moisture of the seed is raised from 3-5% to 14-15%. Thereafter the moisture is again be brought down to about 5%by drying the cooked seed in a steam jacketed type kettle. Normally the real retention time in expeller kettle for cooking/drying operations is considered 40-45 minutes for groundnut. However, this may vary little from seed to seed.

There are, however no hard and fast rules for the treatment of these seeds, and the operation is purely a matter of experience.

The theory involved in the process of cooking is that the combined heat and moisture break up the oil cells, soften their gelatinous coatings, increase the clarity of the oil

and coagulate the albuminous sediment forming particles in the seed, thus making it readily, possible for the oil to flow out easily when subjected to pressure.

## D. Expelling The Seed :

The expeller consists of a pressing box or cage surrounding a horizontal shaft mounted with a series of worms. At the feeding end of the cage there is an opening through which the meal is fed into the expeller. At the discharge end of the cage there is a cone which practically retricts the passage. The rotation of the horizontal shaft causes the meal to push forward by its screw action, thereby increasing the internal pressure and thus squeezing the oil. The internal pressure of the expeller is regulated by the adjustment of the cone. The extracted oil flows through the perforated box, while the cake passes out through the opening around the cone.

The expeller is a self contained unit which has its own heating kettle and an arrangement for automatic feeding. The expeller requires no attention after setting so long as proper temperature and moisture content of the seed meal is regulated. The meal as it passes through the expeller becomes hotter by liberation of frictional heat.

For the satisfactory extraction of different oil seeds the design of the worms plays a very important role. High grade steel worms possess great resisting power for pressure and abrasion, thus resulting in their long life.

Oil expellers are designed to operate at two pressures LOW and HIGH. Low pressure expellers remove only

a portion of oil in the seed meal and generally have very high capacities ranging from 30-80 M.T. of seed per day of 24 hours . They are used in combination with their high pressure expellers or with solvent extraction plants or to extract the maximum oil from high oil containing seeds from which complete extraction at a stretch is not generally possible. High pressure expellers produce at one stretch all the possible extractable oil from the seed meal. High pressure expellers operate at a pressure of 2.5-3.0 ton per square inch and have low capacities.

## E. Filteration of Oil :

The oil which comes out of the expeller contains lot of foots, suspended particles of seed and cake. This oil requires filteration before it is stored in storage tanks. This filteration takes place by pumping the oil to the filter press, where it passes through a layer of the filter cloth. The liquid oil passes through the filter cloth and solid matter deposits on the filter cloth.

There are two important types of filter presses, generally used in oil mill industry.

1. Recessed plate or chamber type filter press.
2. Plate and frame type filter press

*Recessed Plate types Filter Press :*

This consists primarily of a series of cast iron plates. These plates are recessed and have a raised rim round the perifery of each face, so that when two plates are brought

together the dished centres from a chamber in between them. While the press is open a filter cloth is laid over each plate, hanging down on both sides and extending beyond the edges. Through the centre of each plate there is a circular feed hole and there are corresponding holes in the filter cloth. The filter clothes are secured round the central feed hole by special tightening nuts.

When all the plates and clothes are assembled together and tightened, the cloth forms a tight joint between the machined edges of the plate. The tightening of these plates is effected by means of rack and pinion arrangement. The pinion is rotated by means of a tommy bar, inserted in the holes round its flange.

The crude oil to be filtered is pumped into the press and while passing through the central feed holes, fills in all the chambers between the plates. The only outlet for the liquid are the pores of the clothes . The faces of the plates are cast with certain types of grooves so that while the cloth is supported, a series of intersecting chambers are formed over the whole surface, allowing the flow of oil without any hinderance. The oil trickles down into a gutter formed along the plates, just above the lower raised edge. Each plate then discharges through a plane spout or bib cock into a collecting tray.

*Plate and frame type filter press :*

In this type of filter press the edge of the plates are all finely machined and are almost in level with the filtering surface . An independent frame is used between these

plates to form a chamber. The plate and the frames are arranged alternatively and the filter cloth is simply hung over. The clothes are nipped between the edges of the plates and the frames when they are closed together. The plates have special recess to form the fitting surface and for drainage. The filter oil is discharged by means of bib spout or cocks.

This type of filter press has an advantage over recessed plate type filter press in capacity. These can hold more quantity of sediments, so more oil can be filtered at a time without opening the filter press.

The foots separated by the filter press are generally mixed with the oil seed fed to the expeller.

## 4. Storage of Oil and Cake :

*Storage of Oils :*

The filtered oil from the filter press is usually pumped on to the storage tanks. The capacity of oil storage necessary for a mill, generally depends on its capacity and commercial considerations. Greater storage capacity is always considered better since it enables the crusher to continue its operations even when the oil market is unfavourable.

*Storage of Cake :*

The storage of oil cake is also as important as the storage of oil seeds. The fresh cake is hot and contains superficial moisture. This cake is cooled by spreading it in well ventilated floors for a period of

24-36 hours. Thus the moisture and temperature are generally adjusted according to the atmospheric conditions. The cake now can be filled in gunney bags and stacked properly. Particular attention should be given to cake godowns for proper ventilation.

## 5. Quality Control :

The oil mill managers should be quality conscious. They should purchase the raw material of good quality for getting best yields and good profits. This rule applies to oil seeds as well as other inputs like gunney bags, fuel, spare parts etc. They should always have an eye of the oil content of the oil seeds purchased. Similarly they should check regularly the quality of the oil and cake produced in their mills.

They should always use best make, standard and repudated spare parts in their machines to reduce the breakdowns and to increase the efficiency of the machine.

CHAPTER II

# Role of moisture, temperature and fibrous material in cooking and expelling the oil seeds.

## Role of moisture :

One of the frequent causes of difficulty in extracting oil is the excess of moisture in the seed. It should always be borne in mind that moisture and heat are both necessary in the cooking kettle. The damping of the material is best effected by adding hot moisture or open steam by means of damping sprays fitted in the heating kettle with suitable regulating devices, so that the same could be controlled according to the needs.

If the seeds initially contain high percentage of moisture, the process of cooking will not be good. Therefore care should be taken to see that the seeds pressed do not contain moisture above a certain limit, if best resutls are to be obtained. With seeds having high moisture contents it will not be possible to add the necessary cooking and tempering moisture, in this case the cooking suffers and all oil can not be extracted. Excess of moisture in the cooked meal reacts very unfavourably in case of expellers, so even if the meal is dry when fed into the kettle, too great a quantity of moisture should not be added.

Moisture in oil seed is not pressed with the oil in the expelling and contrary to expectations it is the moisture and not the oil which forms the lubricant for the material sliding through the expeller pressing cage. It is the ability of the material to resist being pushed through the expeller pressing cage. It is the ability of the material to resist being pushed through the expeller pressing cage on account of friction with the lining, which to a large extent determines the amount of pressure which can be applied to it and it will be seen that an excess of moisture will so reduce the resistance that the material will slide too freely through the pressing cage and thus reduce the pressure which can be applied, resulting too much oil being left in the cake.

On the other hand if the cooked material is too dry when fed to the pressing cage, the friction with the lining maybe so great that the material may even refuse to slide along the cage, in this case the cage and pressing worms will choke up with hard pressed meal, causing machine to stop. Breaking of the pushing portions of the knife bars may result from running the expeller on cooked meal which is too dry.

The moisture in the cooked material must be closely regulated and the material should contain just sufficient moisture for lubrication purposes, which will allow it to be pressed through the cage and at the same time maintain friction with the lining of the cage.

Cooked meal which is too dry will not form a proper cake but break into small pieces on leaving the discharge end of the expeller. Excessive moisture on the other hand produces a soft cake, even though the cake is thin, and if the cake leaves the discharge cone in a stringy torn condition, or shows a tendency to twist with the cone, it indicates that the cooked meal is too high in moisture. When the meal, however,

is in correct condition for pressing as far as moisture is concerned, the cake should emerge all round the cone in large pieces and should be tough enough, when first made to resist being pulled apart very easily.

Sometimes due to not proper cooking the oil is in emulsion form or hazy in nature due to presence of some phosphatides, fine foots and some surface active agents. It has also been found by experience that damaged seeds give lower yield of oil than undamaged seeds of equivalent oil content.

**Role of Temperature :**

Excessive heat sometimes has the effect of causing oil and cake to become dark in colour. There are many other factors which affects the above change and cooking temperature alone may not be taken as the sole cause for it. Until the behaviour of the different oil seeds have been noted, it is till then, not advisable to reduce the cooking temperatures at the expense of proper and sufficient cooking of the material. Since different oil seeds behave differently towards heating conditions, it is not advisable to find out by experience the most suitable temperature at which to press the meal to produce oil and cake with suitable colour.

As a general rule it may be taken that proper yields cannot be in any case expected with cooked meal temperature below 75°C, whereas for most of the oil seeds the temperature of the meal should be between 90°C- 95°C.

The thoroughness of the heating can be quite closely estimated by taking a sample of the seed meal from the cooking kettle in the bare hand. The temperature should be as high as to prohibit more than a momentary handling. When firmly compressed in the hand, the meal should form a compact ball like mass not crumbling and oil should ooze out freely between the fingers.

**Heating Kettles :**

The cooking of oil seeds is generally done in heating kettles or tempering trough. The heating kettles are normally round shaped cylindrical vessels, steam jacketed both at its base and sides or at its base only. Various types of kettles are available in the market.These kettles are equipped with agitators and open steam admission arrangements. The kettles may be from one high to five high depending on the seed and design. Another device employed for cooking the meal is called ' Tempering Trough ' and cosists of a steam jacketed conveyor fitted with a small feed container tank. The conveyor may be either single staged or double staged, in the latter case two conveyors are placed one above the other, with suitable discharge ends, and driving arrangements. In this the meal takes longer time to travel and is thus cooked better than in a single staged kettle.

Open steam is supplied to the meal at the entrance by means of a steam nozzle. Thus automised steam get well mixed up with the meal to be heated for giving the requisite moisture content. The slow forward movement of the meal effect a thorough cooking.

If the seed is cooked carefully at critical temperature and critical moisture required for the seed, the efficiency of the expeller can increase by 50% or so.

## Importance of Fibrous Materials :

Apart from heat and moisture, there is yet another very important factor, which contributes towards a high percentage of oil being left in the cake and that is fibrous material.

Seeds or meals, deficient in fibre, prove very soft and smooth for pressing cage. They offer very little resistance and readily slip through the cage. Thus it may not be possible to exert sufficient pressure up on them as to secure the best yield of oil. Such meals have a tendency to readily escape through the drainage spaces between the lining bars of the cage and the pressure as soon as it is exerted, is lost. On account of the meal being soft and smooth, the pressing worms are unable to get a proper grip upon such materials, and the meal is often worked up to a paste which will not move along the cage and no oil can be obtained from them.

It is necessary that the materials which are to be pressed in the expeller should contain a proportion of fibrous matter or ' binder ' which will get up resistance to pressing and which will bind the material together to enable it to be pressed.

The skin of such seed as linseed, rape sesame, undecorticated cotton seed etc. from a good binder. But when such seeds like cotton seeds are decorticated and the meats are very cleanly separated from the husk, those meals become too soft to set up any resistance in the expeller and the best yield of oil are difficult to be secured. When processing of such decorticated cotton seeds it is deidedly advantageous to allow a portion of the husk to go with the meals to the expeller. From 5-8% of husk with meats will have negligible effects on the quality of the oil or cake, but the expression of the oil will greatly improve, since the presence of the husk impart to the meal good binding properties.

CHAPTER III

# Practical Operational Guidelines for Expellers :

For successful operation of the expellers few hints are given here. They will serve as general guides for the operators and will assist in removing most of the difficulties generally faced by them.

Before starting any expeller the following points should be carefully ascertained.

1. That the pressure worm shaft will revolve in the correct direction i.e. in an anti-clockwise direction when looking from the driving end of the expeller. However this should be ascertained from the instructions available from the makers.

2. That the pressure cone is withdrawn right out of the barrel.

3. That there is no foreign matter in the expeller or kettle. The driving pulleys should be pulled round by hand for a few revolutions to check this and to ensure that the machines run freely.

4. That all parts of the machine are well lubricated , all grease cups and oil baths should be filled with necessary lubricants. Grease should also be liberally applied to all gears and pinions.

5. That the cage of the expeller is properly cleaned and the interspaces are perfectly clear. If the interspaces are blocked it will prevent the oil from flowing out and the cake will not be properly formed.

## Starting up :

A few minutes before starting the expeller, steam of about 15-25 lbs. per sq. inch pressure should be admitted to the jacket of the tempering trough or the heating kettles, as thecase may be, and the first meal entering the heating devices should be well cooked before pressing is commenced. However, if pressing is immediately commenced, the meal may not be properly cooked, and as the expeller is continuously drawing its feed from the cooker. It will be difficult to catch up with the demands of the expeller of providing a properly cooked meal. When pressing is started after the first charge to the cooker is properly treated, the supply of fresh meal should be continued to the cooker and the machine will continue to draw the proper meal throughout.

## Advancing the Cone :

When the meal starts to come out of the discharge and, it is advisable to advance the pressure cone into the pressure cage, a little at a time, so as to gradually build up the pressure in the cage for the formation of the cake. Attempts to suddenly push the cone right in at once, may result in the blockade of the cage, and will create difficulties in the right formation of the cake. When the expeller has worked in this way for sometime, the cone is then so adjusted as to get the best yield of oil, the thickness of the cake varying according to the nature of seed, between 1/8" - 3/8". When

the expeller is working continuously it is always advisable to run the pressure cone back at least once in 24 hours to ensure that it does not get fixed in one position.

If at any time, the expeller shows a tendency to choke, the cone is withdrawn a little away, until the discharge of the cake starts freely, then the cone can be again turned to the original position.

## Thickness of the Cake :

The position of the cone governs the thickness of the cake, that will be produced. But different manufacturers may have their own requirements regarding thickness and oil contents of the cake, it is not possible to define a standard thickness of the cake for all materials.

It may be taken as a rule that the cake from more fibrous material, cannot be made as thin as that from the less fibrous materials. For example, decorticated cotton seed can be compressed to a much thinner cake than undecorticated cotton seed, yet the oil contents of the two cakes may remain the same.

The first pressed cake of those oily materials which are usually pressed twice such as groundnuts, castorseed, sesame, copra, etc. must be much thicker than the cakes of second or single pressing of seeds. First pressed cakes are generally 3/8"- 5/8 " thick whilst final cakes are 1/8" - 3/16" thick. First pressed cakes are general found to fall into pieces readily on leaving the discharge, but this is quite in order as the low pressure necessary to reduce the oil content to about 20-25% is not sufficient to make hard cake.

If the material is once pressed such as decorticated cotton seed, well rolled linseed, or rape, the cake is about 1/8" thick. Soya, undecorticated cotton seed, dry maize greem meal etc. will make a cake about 3/16" thick. Second pressed groundnut, copra or castor cake should be about 1/8"-5/16" thick. These thicknesses are only as guide but the cake is all right, when the cake is tough and the cone side of the cake is brightly polished, without being burnt, and the outside is slightly polished.

## Stopping the Machine :

When the machine is intended to be stopped, first the feed should be stopped and then the cone should run out to its extreme position in order to pass out any meal left in the cage. A handful of dry whole seeds are then run from the feed chute and the machine should be stopped when this is seen emerging out from the cake end. This will ensure the readiness for starting the machine again without any difficulty.

In case of starchy meal, instead of dry whole seeds, a small quantity of oily foots should be fed to the expeller through the feed hooper, when the soft oily material is seen to be emerging from the cake discharge end, the expeller may be stopped. The soft foots will not bake in the heat of the press cage and expeller will be ensured in ready condition for starting up again.

## General :

Care should always be taken to see that the feeding is uniform and sufficient and the meal is properly cooked.

From time to time the expeller box should be opened to see that the worms etc. are in good condition. All bolts, nuts, should also be properly checked.

All these guidelines will ensure efficient and economic working of the expellers.

CHAPTER IV

# General Problems, Their Causes and solutions :

1. **Problem** : *Heavy oil flow along the cage centre and discharge end, instead of feed section.*

   *Cause* : Expeller is not getting sufficient feed.

2. **Problem :** *Cake contains more oil contents.*

   *Causes :*
   1. Expeller is not getting sufficient feed.
   2. Improper cooking.
   3. Increased inter spaces between the bars.
   4. Insufficient fibrous matter or binder in the meal.
   5. Very dry seed.
   6. Excess moisture in the seed.
   7. Discharge of heavy foots.
   8. Design of the expeller.
   9. Wrong setting of worms.
   10. Immature seed.
   11. Worms are worn out.

3. **Problem :** *Heavy wear and tear of the worms, knife bars and machine.*

*Causes :*
1. Presence of sand, mud, stones in the feed material.
2. Presence of iron or metallic pieces.
3. Too dry seed is fed.
4. Running the machine in choked condition.

4. **Problem :** *Low yield of oil :*

*Causes :*
1. Present of impurities in the feed material.
2. Improper cooking.
3. Excess of moisture in the seed.
4. Heavy discharge of foots through cage.
5. Presence of damaged seed in the feed material.
6. Design of the expeller.
7. Wrong setting of worms.
8. Immature seed.
9. Worms are worn out.

5. **Problem :** *Heavy discharge of foots :*

*Causes :*
1. Excess moisture in the cooked meal.
2. More inter spaces in cage bars.

3. Breakage of cage bars.

4. Low fibrous material.

6. **Problem :** *Improper cake.*

*Causes* : 1. Improper cooking.

2. Cooked material contains excess moisture.

3. Blockage of inter spaces in cage bars.

4. Too dry feed material.

7. **Problem :** *Material refuses to slide.*

*Causes* : 1. Cooked material is too dry.

2. Choking of cage.

3. Improper spacers used in the cage.

8. **Problem :** *Oil is not clear.*

*Causes* : 1. Improper cooking.

2. Excess moisture in cooked meal.

3. Low cooking temperature.

4. Immature seed.

9. **Problem :** *No oil coming out of the expeller.*

*Causes* : 1. Feed material is very soft and smooth.

2. Feed material is deficient in fibrous material.

3. Material is over cooked.

**10. Problems** :*1. Expeller giving groaning sound.*

2. Violent vibrations in the machine.

3. Machine throwing the belts off.

4. Blowing the fuses of driving motor.

*Causes* : 1. Feed material is too dry.

2. Presence of metallic piece in the cage.

3. Choking of cage and pressing worms.

**11. Problem :** *Oil drips from discharge end.*

*Causes* : 1. Improper fitting of worms and collars.

**Position of oil flow :**

The heaviest flow of oil from the cage is normally at the feed section. If this does not happens and the oil flows from further along the cage at the centre or discharge end, it is an indication that the expeller is not getting sufficient feed. In an expeller, the pressure is generated according to the volume of material fed to it. When the cage is not running full of meal, much pressure is lost, and when the pressure is lost, good extraction will not take place and cake will contain more percentage of

oil. The feed from the cooker should be regulated, so that the feed hooper is always full.

When the expeller is properly working, good amount of oil also flows through the intermediate chamber, but very little oil trickles out from the last chamber.

**Abnormal discharge of Foots :**

In expellers when properly prepared and cooked meal is pressed a small percentage of oily meal known as ' foots ' is discharged along the cage. These foots are normally mixed with the meal in the kettle and thus disposed off in the process. If it is allowed to accumulate, they result in the development of acidity.

Some times there is an abnormal discharge of foots from the cage. It means that the pressure on the meal is being lost and the discharged cake will be containing more oil content. This may be due to improper cooking of the meal, or increased interspaces between the cage bars. Low fibrous material in the meal is also a frequent cause of an abnormal discharge of ' foots '.

The cause of such abnormal discharge of foots, should be immediately removed, otherwise it will give heavy losses to the efficient working of the mill.

**Expeller Refuses to Feed :**

*Position No. 1 :*

If after running the expeller for sometime in good

order, and a good cake has been made, the expeller then refuses to take sufficient feed to give desire pressure and a good tough cake, the indication is that the oil is collecting in the press cage instead of quickly flowing out through the bars.

This generally occurs with more oily seeds and irregular feeding, when sudden rush of oil content cannot escape quickly. This oil mixes with the incoming meal, forms a spongy mass, which the worms cannot grip and is, therefore, allowed to churn in the cage as an oily paste. If this happens the door of the feed chamber should be opened and oily mass is allowed to run out. The feed should be stopped and a few pieces of dry broken cake should be run, which will clear the whole cage. The feed from the cooker should then be opened and working resumed. If this defect becomes persistent, the chamber should be opened and the spaces between the cage bars of the feed section should be slightly enlarged by inserting suitable spacers between them.

*Position No. 2 :*

The expeller refuses to take meal, after it has been stopped for sometime. This indicates that a block of hardened meal hasbeen formed and is adhering to the worms and the cage lining. This generally happens when the meal is left in the cage before closing, which bakes hard in the heat of the press cage. When such an obstruction occurs, it is, advisable not to attempt to force the meal, as it may result in damages. In such case, the chamber should be opened and the hard meal removed. Such position should be avoided as far as possible by stopping the machine in a proper way as described in chapter-IV

## Material Entering pressure Cone :

Some times oil creeps in between the cone bore and the sleeves and retards the ready movement of the cone in or out. This oil becomes hard in between the cone and sleeve, due to presence of uncoagulated albuminoids in the oil which is released by improperly cooked meal. This happens because the cone remains hot due to friction and the albumen gets baked into an extremely hard thin cake, resembling a thin strip of 'Bakelite'. It is this deposit which retards the free movements of the cone in or out.

To avoid such problems, the meal is properly cooked so that all albuminoids are coagulated and left in the cake. The cone should also be taken out at least once in 24 hours. When this is done, the sleeve on which it slides should be thickly greased, which will prevent albumen penetration too far.

## Effect on Worms :

The pressing worms of an expeller usually get the heaviest wear & tear, which generally starts from the last worm i.e. worm which is nearer to the cone. If this worm is changed from time to time, the wear and tear on other worms is generally minimised. If worn out worms are allowed to continue, they create space between the bars and top rim of the worm, this prevents the material being forced forward and therefore keep churning in the feed section. This results low capacity and yield of the machine

Some times oil drips continously from the discharge end along the cake. This indicates that worms and collars are not properly fitted in the shaft and oil finds passage in between them and flows to the entire length of the shaft. This difficulty can be removed by putting thick brown paper rings in between the.worms and collars etc.

CHAPTER V

# Some Important Oil Seeds and Their Oils

In India various oil seeds are produced. These oil seeds have considerable variations in their composition and oil quantities available depending on the climate, soil, variety of seeds, region etc. Following chart gives an indication of the range of total oil available in various seeds.

| S.No. | Name of oil seeds | Oil percentage |
|---|---|---|
| 1. | Coconut | 50-60 |
| 2. | Cotton seed | 20-25 |
| 3. | Castor seed | 30-35 |
| 4. | Groundnut Kernal | 40-45 |
| 5. | Gokhru | 30-33 |
| 6. | Karanj | 27-39 |
| 7. | Linseed | 32-43 |
| 8. | Maize Germ | 17-20 |
| 9. | Mahua | 50-55 |
| 10. | Niger | 38-50 |
| 11. | Neem | 42-45 |
| 12. | Okraseed | 15-20 |
| 13. | Palm Kernal | 50-55 |
| 14. | Poppyseed | 40-50 |
| 15. | Pilu/Khakan | 40-43 |
| 16. | Rai | 30-42 |
| 17. | Rape seed/Mustard | 40-45 |

| | | |
|---|---|---|
| 18. | Rubber seed | 42-50 |
| 19. | Sesame seed | 50-57 |
| 20. | Soyabean seed | 15-20 |
| 21. | Safflower | 28 |
| 22. | Sunflower | 35-40 |
| 23. | Sarson yellow | 35-48 |
| 24. | Sarson Brown | 35-48 |
| 25. | Toria | 40-45 |
| 26. | Taramira | 30-35 |
| 27. | Tobacco seed | 33-38 |
| 28. | Tea seed | 48 |