DRY PROCESS OF COCONUT OIL EXPELLING TECHNIQUES – SOME OBSERVATIONS

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Coconut oil expelling techniques are classified into dry and wet process. The oil expelling techniques, which starts with copra as the raw material is termed as the dry process, while the method that uses fresh coconuts as starting material is generally called as wet process.

Copra is crushed into small pieces and then it is further dried in the dryers before sending it into the expellers, then copra pieces are compressed in between the press plates. The oil expelling out from the copra is collected and then dried and filtered for further purification. But in the traditional coconut oil expelling, the copra is not being crushed into small pieces, the larger pieces of copra is crushed in the *Chekkus* or Rotaries and then manual pressing is done to squeeze out the oil. The purification process is commonly not carried out in the traditional oil expelling.

Copra has been crushed and expelled in different techniques, however the techniques differ from region to region and country to country. Adopting an efficient and most appropriate technique is an important factor. Therefore, this observation is highlighting some ideas to coconut growers to adopt the most appropriate technique to expel good quality oil based on their status.

The Primitive method.

The ancient people used heavy stones, wedges, levers and twisted ropes like coconut since there were no any other devices or technologies developed for this purpose. These are used to apply pressure on the dried coconut to squeeze out oil.

They are inefficient, of low capacity and labour intensive.

The Ghanis *(Chekkus).*

It is one of the traditional methods used to expel oil from copra. As a cottage industry oil extraction is still done in the *chekku* in the rural areas of India and Sri Lanka. The *chekku* is a fixed wooden or stone mortar inside which revolves a wooden pestle, leaning against the sides of the mortar. The pestle is attached to a long pole which is moved round by a bullock or a pair of bullocks or motors (Power-ghani) or even by human labour. The copra is crushed within the mortar as a result of the friction caused by the revolving pestle. The oil is released by friction and pressure and runs out of a small aperture at the base of the mortar.

Fig1: Traditional Animal powered Ghani.

The pressure on the pestle is regulated by levers and weights. Only a small quantity of copra can be crushed in the *chekku*, usually 100 kg of copra in eight hours. While a typical one-bullock ghani can process 40 kg of copra/day (Thanpan, 1981).

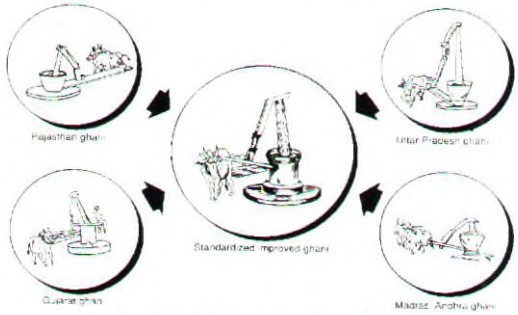

Fig2: Traditional Indian Ghanis.

The power-driven *chekkus* or rotaries are used in slightly larger establishments. In principle, they are similar to *chekkus* but here the mortar itself revolves against the pestle. Both the pestle and mortar are made of cast iron. The rotaries are worked in pairs and are driven either by steam or oil engine or electric motor. The crushing capacity of a rotary mill varies from 200 to 300 kg of copra per day shift (8 hours).

Fig 3: Powered Ghani

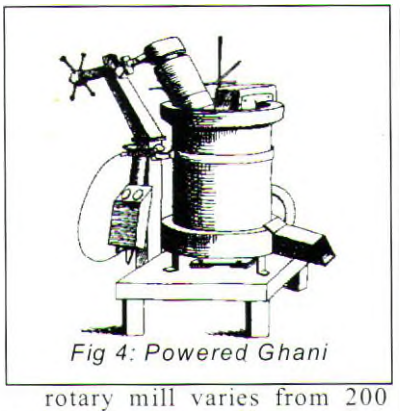

Fig 4: Powered Ghani

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The efficiency of these are very near to that of expellers but the operational cost and maintenance expenses are slightly more in relation to the output. But small-scale industrial establishments still prefer these because of its low block capital requirement.

The Expellers.

Expellers are used in large scale milling establishments and diverse types with varying capacities are available in the market. The number of expellers in individual establishments varies from 1 to 24, but two expellers usually constitute a unit because double crushing gives the maximum extraction. The extraction of oil in the expeller takes place within a steel cage or barrel by means of a harden steel worm or screw, so arranged on a revolving shaft, as to produce increasing pressure as the copra is pushed from one end of the cage to the other. The oil escapes through the openings build on the barrel and the cake through an adjustable pressure orifice at the end of the barrel.

While passing through the first expeller, the pulped copra yields about 50 % of its oil. The resulting cake is again ground, heated and passed in a second expeller to extract the remaining oil. Generally, expellers can squeeze out 90% or more of the oil present in copra.

The smaller expeller mills have the crushing capacity of 2 to 3 tonnes of copra per shift of 8 hours. A few bigger units are also available in the country with expellers of 20 to 40 tonnes capacity for pre-pressing and 7 to 20 tonnes capacity for finishing pressing per shift. The expeller which operate continuously and automatically are, on the other hand considered as the most ideal equipment for extraction of oil from copra.

The small scale coconut oil expelling plants are often located in rural areas, and employ either locally manufactured expellers, local Comet, Hander or Mini 40 (from Germany, Japan and Britain respectively) or Rotaries (Powered *"Chekkus"*).

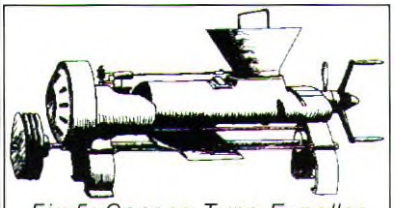

Fig 5: Cecoco Type Expeller

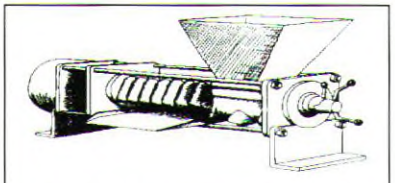

Fig 6: Mini 40 Type Expeller.

The Hydraulic Press.

Hydraulic presses are replacing the primitive native presses, which give a small yield of oil at comparatively high labour cost. Hydraulic installations are found in Europe, United States, Philippines, Jaya, India and Sri Lanka.

In the dry hydraulic press, oleaginous coconut meat is dried and the oil is pressed from the copra. The oil is expelled out by a series of steps. First the copra is reduced to small pieces or flakes by hammer mill. The material is then heated in order to coagulate the proteins, to make the mass more permeable to oil flow, to decrease the affinity of the oil for tissue solids, to cause coalescence of small oil droplets and to increase fluidity of the oil. Although this is relatively expensive and cumbersome to operate, there are advantages in that no press cloths or racks are needed. Since considerable heat is generated during pressing at 6000 psi there is no need to preheat the ground copra.

Oil may be removed from the heated ground copra by mechanical pressing or by the rarely used centrifugal procedure. Mechanical pressing by the open hydraulic pressing is universally used, and this may be continuous or by batches. By the batch method, the copra is spread on press cloths and metal tracks. These are stacked, with space between, and pressed with about 14000 psi applied by hydraulic lift, causing the oil to flow to the edge of tier and down the sides into a collecting trough. The crude oil is pumped into tanks holding 10000 gal. (38000 liters) or more and exported or refined.

Hydraulic presses are also used for direct crushing of copra and their capacity varies from 0.5 to 50 tonnes per hour. Because hydraulic presses work batch wise and are expensive and cumbersome, they are not in general use now.

The Solvent Extraction.

In the recovery of oil from coconuts, this method has not been used in areas where coconuts are grown and/or copra is made because of the lack of facilities and technical supervision. It is a high technology process and it has to be carried out at comparatively large scale because of its high capital cost. Essentially the process is one of continuos

countercurrent extraction with the raw material flowing in one direction against a solvent, usually the hexane is used as solvent. After oil extraction, the solvent passes to a recovery plant where the solvent is stripped off under vacuum. The crude oil then passes on for refining. Due to the large scale involved it would seem unlikely that solvent extraction would find much application in minor oil product processing.

It is reported that considerable coconut oil was recovered by this method from copra in Germany during Word War II. This method has been used very little in more industrialised countries because other methods are more economical. Solvent extraction of fat from oil-bearing seeds is growing in Europe. It has become increasingly more economical than mechanical expression of oil because automation replaces considerable labour.

Solvent extraction plants have been used to extract the residual oil present in the rotary and expeller crushed cake. In this process, the cake is broken into bits and fed to flaking rolls.

The Ram Press.

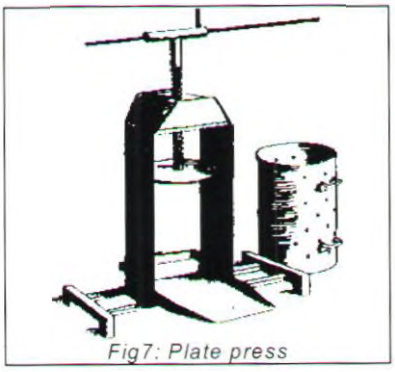

Fig7: Plate press

It is manually operated low-cost piece of equipment, which was originally designed to use by small holders to process soft-shelled sunflower seed to obtain scarce cooking oil.

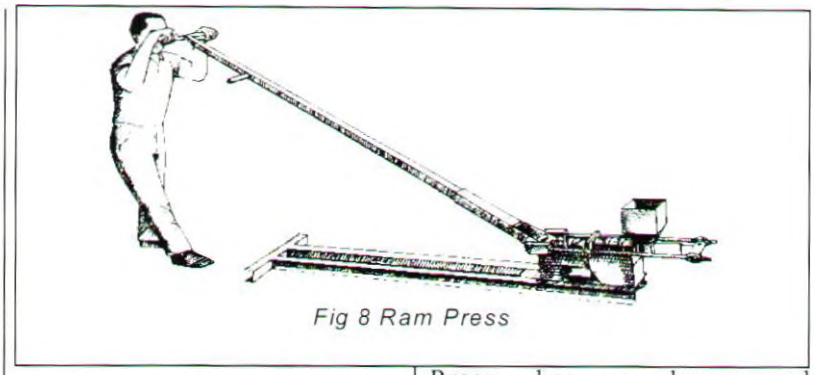

Fig 8 Ram Press

The original design of the Ram Press was arduous to use and took two men to operate. It is a method of expelling oil from dried coconut either in the form of dried fresh coconut gratings, copra or dried residue from aqueous coconut processes. But it is most commonly used for copra. The Ram Press also called the Bielenberg press was developed by the Appropriate Technology International, a Washington based NGO, in 1985 through its village oil press project in Tanzania.

But recently NRI has developed a new version of Ram Press can be operated by a woman as its prime advantage of this version. The oil extraction efficiency observed was 60-70%. It has a long, pivoted lever that moves a piston backwards and forwards inside a cylindrical cage constructed from metal bars spaced to allow the passage of oil. At the end of the piston's stroke an entry port from the feed hopper is opened so that the oilseed or the squeezed coconut gratings can enter the cage. When the piston is moved forward, the entry port is closed and the squeezed coconut gratings are compressed in the cage. The lever mechanism of the press is such that it can operate pressures greater than those obtained in most manually-operated presses, and as high as those in small scale expellers. While the Ram Press has a low seed throughput, it has the advantage of continuous operation.

Conclusion.

The extraction of oil is made either for domestic consumption or for export trade. In the rural areas, copra is still crushed in the primitive *chekku* mainly for domestic consumption. On a commercial scale, power-driven *chekku* or rotary mills, expellers and hydraulic presses are used for the crushing in the ascending order of efficiency and scale of production. In the modern industrial units, solvent extraction plants are linked with the rotaries or expellers or hydraulic presses for the optimum recovery of residual oil from the copra cake.

Drying technique is one of the important factors determining the final quality of oil. Copra quality, hygienic condition of drying environment, maturity of coconut at harvest, seasoning of coconuts and variety are the other factors influencing the quality of coconut oil. The large oil industries still prefer to expel oil using dry process because of its high oil expelling efficiencies.

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