

PROCESSING AND UTILIZATION OF COIR FIBERS

By

Mat Daham Mohd Daud*

Summary

Coconut industry in Malaysia is traditionally confined to the smallholders. Area planted under coconut has been declining from 315,000, hectares in 1985 to 286,000 hectares in 1990. Consequently, production of fresh coconuts has also declined and Malaysia has to import from neighbouring countries in order to supplement domestic requirements for fresh nuts and processing activities.

Very small quantities of coir fibres are produced in Malaysia. There are about 3 - 5 small-sized coconut husk mills producing 2 - 3 tonnes of coir fibres per day. Most of the coir fibres produced are consumed locally by coir fibre factories producing rubberised fibre sheets for spring mattresses and moulded car seats. Other products produced are orthopedic mattress, fibre pole for plant support and fibre container. Coir fibre produced locally is insufficient to meet the local demand, as such some coir has to be imported from neighbouring countries. In 1990, Malaysia imported about 2600 tonnes of coir fibre.

Coconut smallholders are encouraged to further Utilize coconut by-product in order to increase the value-added of coconut products. The industry not only generates economic activities but also helps solve problems of waste in coconut growing areas which at present are mostly left to rot in coconut plantations.

Among potential end-products that could be manufactured from coir fibre are fibre cups for nurseries, fibre pots, hanging basket for hanging plants, fibre poles for plant support, hydroponic growth media and fibre sheet for erosion control. The products listed are identified as having immediate demand in many countries.

In view of the above, research efforts, though still at the initial stage, are being undertaken by the Malaysian Agricultural Research and Development Institute (MARDI) aimed at expanding and improving current technologies of the domestic coir fibre processing for the enhancement and development of the domestic coir fibre processing industry.

* Director, Agricultural Engineering Division, Malaysian Agricultural Research and Development Institute, Malaysia.

Coconut Industry in Malaysia

The area under coconut in Malaysia has decreased from 315,100 hectares in 1985 to 286,000 hectares in 1990. The decrease in coconut area indicates that there is a lack of interest in coconut cultivation recently. This is especially true in Peninsular Malaysia where there existed a substantial coconut area. Majority of coconut area in the country is under small holder which accounts for about 92% of the total coconut area in 1988. There is a significant drop in area under estate management and an increasing trend in small holder sector from 1986 onwards. The reduction in coconut area in the estate sector is mostly due to conversion to oil palm and other developments. In East Malaysia where coconut cultivation is exclusively in the hands of small holders, there has been a marked increase in area. In Peninsular Malaysia, the states with substantial areas of coconut estates exist only in Johore, Perak and Selangor. A significant factor in the development of coconut smallholdings in Peninsular Malaysia has been the launching of the coconut Replanting and Rehabilitation Scheme.

The main coconut products in Malaysia are copra, coconut oil and coconut cake. A considerable part of coconut production is also utilised as fresh nuts for

domestic consumption. Recently, a campaign was launched by the Ministry of Agriculture to increase consumption of coconut by consuming coconut water from young coconuts. The campaign was so successful that young coconut water is served in most restaurants and hotels in the country. This has helped the farmers improve the price of their coconut, thus increasing their income.

Although a considerable part of coconut production is utilised as fresh nuts (young or old), no statistics are available. In Malaysia, the production of copra has dropped from 95,309 tonnes in 1985 to 67,590 tonnes in 1989, that of coconut oil from 47,612 tonnes to 38,500 tonnes and copra cake from 35,003 tonnes to 23,112 tonnes during the same period.

Malaysia has remained an importer of coconut oil and coconut cake. In 1989, the quantity of imports was 15,204 and 5,344 tonnes, respectively. The quantity and value of copra exported has remained small. This is also true with fresh coconuts. A very small quantity of coir and desiccated coconuts are produced and exported. A certain amount of manufactured coir products such as mattress and some products for agricultural applications are exported. The statistics on the exact amount exported are not known.

Coir Fibre Industry in Malaysia

Coconut husk is a valuable by-product which has not been fully utilised in Malaysia. Coconut husk is the fibrous mesocarp which lies between the tough exocarp or center covering and the endocarp, or hard shell. It is for the most part a by-product of copra production and large heaps of husk are often found in coconut plantations. The main value of coconut husk lies in its fibre content. Coconut fibre from the husk is now more commonly known as coir fibre..

Coir fibre industry in Malaysia is divided into two categories, coconut husk milling and coir fibre Processing.

Coconut Husk Milling

Very small quantity of coir fibre is produced in Malaysia, from about three to five known coconut husk mills. The mills are small in size producing 2-3 tons coir fibre per day. Among the many grades of coir fibre, Malaysia produces only a single grade, i.e., decorticated coir fibre.

Most of the coconut husk milling in Malaysia is done using "Dry Milling" which involves bursting or exploding the husks through impact; without soaking of husk to obtain an unseparated brown fibre and coir dust (waste product).

Depending on the quality of the fibre (good quality = no pith and dust completely removed) and moisture content, the present market price for 1 ton of fibre is between US\$166 to US\$ 185. Moisture content of the fibre varies from bale to bale and can be as high as 40%. The acceptable moisture content of the coir fibre from the bale by the factory is about 25%. Most buyers demand full discount for moisture content.

Coconut husk (raw material) is a very bulky material for transportation. A one-ton lorry can be loaded with only about 1,000 pieces of whole coconut husk. It is estimated that about 10,000 whole pieces of coconut husks make one ton of fibre. As such, a major portion of the cost of raw material is from transportation cost and handling. In some cases, the cost of the coconut husk is very minimal or free because it is considered as a waste product to the farmers. In fact, the husk millers are doing them a favour for removing the coconut husk from their farms. The husk millers pay between US\$ 9.60 to US\$ 10.70 per one ton lorry load of coconut husk to be transported to the mill. Most of the coconut husk mills are located in major coconut growing areas of the Peninsular Malaysia to avoid high transportation cost of the bulky raw material.

Coconut husk milling produces a lot of dust (cocopeat), making the environment in the vicinity of the mill not very attractive to workers. The ratio of fibre to dust in coconut husk is 50-50. This means that if 3 tons, of fibre is produced per day from the -mill, 3 tons of cocopeat will also be produced. Cocopeat has become a major problem in coconut husk mills and it is very common to see big heaps of cocopeat in the compound of the mills. Cocopeat has been found to have some agricultural value. It is known to be useful soil mulch, particularly in citrus culture. The material is also known to absorb as much as eight times its weight in water, with which it release fairly slowly. Two percent mixed with sandy Soilhas been found to increase the water holding capacity of the latter by 40 percent (Nathanael, 1960).

At present, very little of the cocopeat is utilized in Malaysia. Some are used in nurseries and in one or two plantations as mulching material. and also a small portion is exported. Since this by-product is posing a problem in the mills, their utilization should be given due consideration, to solve the environmental problem and at the same time to increase income of the coconut husk millers.

Most husks milling factories are usually very dusty and most workers are covered from head to toe with dust. It is now becoming increasingly difficult to attract young people to work in the dirty environment. This situation is further aggravated with the opening-up of factories in the vicinity of the mills where working conditions are more conducive. The fibre milling factory also does not offer many job openings. Usually, less than ten workers are needed per factory.

Due to high cost of production and competition from imported coir fibre, many husk milling factories in Malaysia have closed down. Those who manage to remain in business are the operators who are long enough in that line of business to have the necessary experience. They are noted to have their own metal workshop to fabricate their own machine parts, know their machines very well, able to get cheap labour and are mostly owner-operators.

Coir Spinning And Curling (Twisting)

There are a number of advantages in producing partially processed products such as curled fibre in rope form, instead of baled fibre. Although the production of curled ropes requires additional machinery, the product brings a higher price and can therefore bear higher freight costs.

Some coir milling factories also have coir spinning and curling facilities to produce curled coir. Curled coir is used for local manufacture of rubberised coir which has a wide variety of uses such as for car seats, upholstery, mattress, etc. Spinning and curling of coir is carried out to impart a permanent curl. The curl will give the springness effect to the coir. To do this, the coir is usually first moistened to about 25% moisture level so as to remove the brittleness and stiffness. The curled coir which is turned into rope form is automatically wound onto the drum of the machine. When full, the drum is removed and the curled coir rewound into coils of about 19, 23, 30 and 50 kilograms, depending on the requirements of the buyers. Coir fibre processing factory buys the coir rope at about US\$ 320 per ton at a moisture content of about 18%. Due to insufficient supply in the country, most of the coir ropes are imported from Thailand and Sri Lanka.

Coir Fibre Processing

Rubberized Coir

Rubberized coir is formed by spraying coir fibre which has been loosened and laid into shape with rubber latex, dried, and vulcanized. Usually, it is necessary to spray from both sides of the pad to improve bonding between fibres. The continuous rubberized coir fibre sheet that comes out of the machine are cut into pads of the required size depending on the final application. Thicker pads are formed either by stacking layers of thinner pads. When vulcanized, the latex forms bonds between the rubber coated fibres. The coating on the fibres also helps improve resilience. The coir could either be in the form of loosened coir from bale or from the rope which has been untwisted by untwisting machine before being led into the rubberized coir machine.

It is quite feasible to produce rubberized pads by hand methods. This is done by hand filling the mould (which has a wire mesh at the bottom), hand spraying with a spray gun, and then drying and vulcanizing. This method is not very efficient, slow and requires more labour. The resulting pad has poor mechanical properties, there is high wastage of latex, and the ammonia in the latex solution gives a bad effect on the hands and eyes of the operators.

Most rubberized coir is produced on large automatic machines which generally has the sequence of operations as follows:

1. The baled coir is loosed from bale and fed into a machine which automatically feeds a constant weight fibre into a picker, which further loosens the fibres and throws them in random manner to form a fleece or sheet.
2. This randomised sheet of coir is passed on to the first spraying station, where latex solution is applied to the top side of the sheet.

3. The sheet passes through a drying tunnel, after which is reversed and sprayed on the other side and returned to the drier for a second and third time.
4. The finished sheet is then vulcanized and cut into the required lengths. If mouldings are required such as for automobile seats and horticultural pots, the rubberized fibre sheet is cut to size, placed in the Moulds and vulcanized.

Schematic layout of a rubberized coir processing plant is as shown in Figure 1.

Application of Rubberized Coir Fibre

Global realization of the pollution problems and hazards created from the wide spread use of polyurethane in industries and homes has prompted revival of the use of more products made from natural substances. Products made from natural substances are known to be more environmental friendly and posed less hazards to the customer. One of the natural substances that should be encouraged for use as substitute to polyurethane where applicable is coconut fibre.

Coconut fibre has been successfully used in making a wide range of products which are acceptable to the consumers. In Malaysia, major applications of coconut fibre in the form of rubberized coir fibre are for making car seats, overlay on spring mattress and orthopedic mattress. Gradually, the use of polyurethane foam in making these products are being reduced or in some cases substituted wholly with coir fibre. This is more in response to consumer requirements after realising the advantages in the use of coir fibre.

An increasing number of other products are being made commercially from rubberized coir fibres. Among the products that have been introduced to the market are:

- Door mats and carpet underlays
- Flower and nursery pots
- Hydroponic growth media
- Accoustic and heat insulation material for buildings
- Erosion control on steep slopes
- Upholstry for furniture
- Plant stands
- Hangging flower baskets.

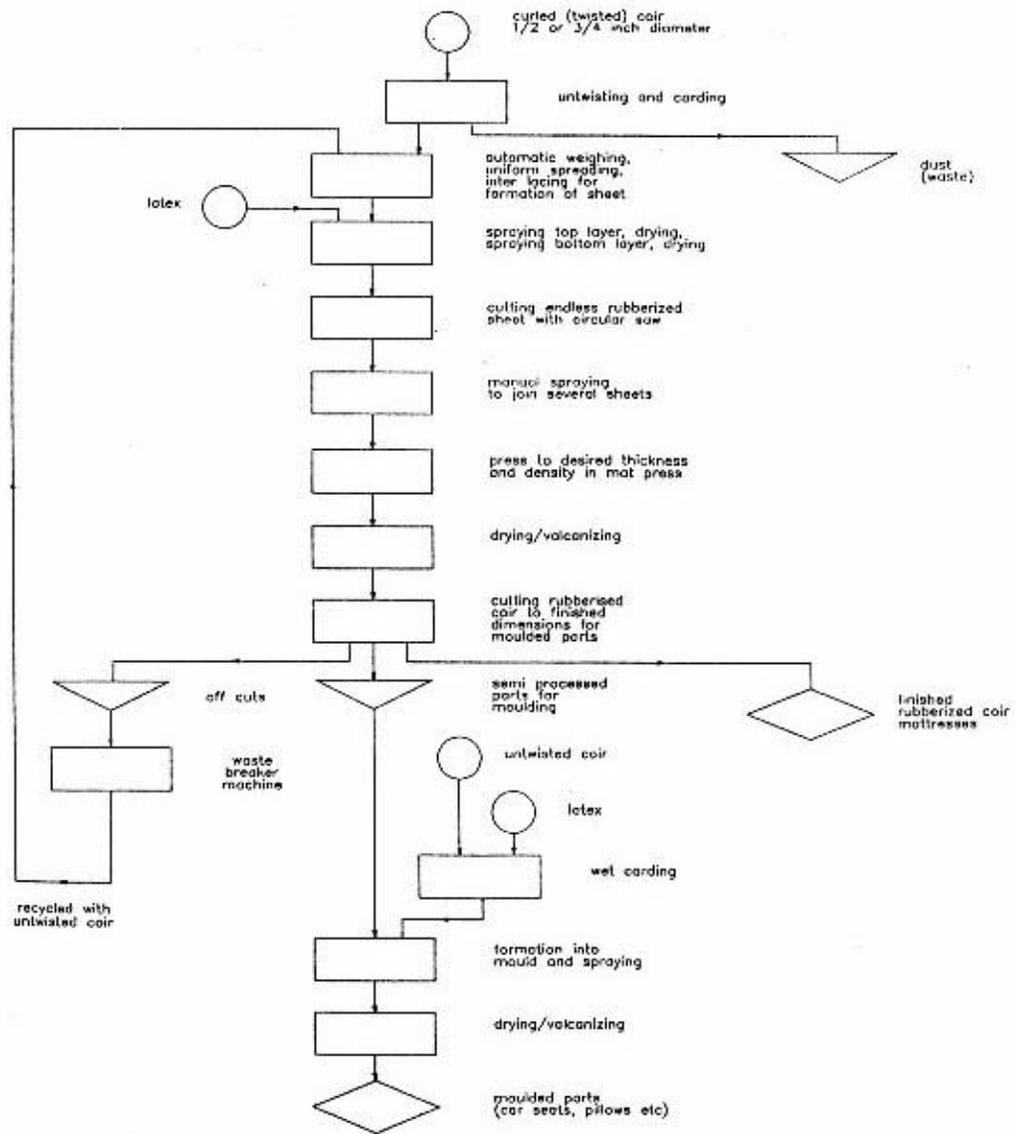


Figure Schematic layout of a rubberized coir processing plant

The applications of coir fibre in industry and agriculture are vast. Their application depends on the continuing research and development in the area to find more uses for the natural fibre. Increased utilization of coir fibre in every day life should be encouraged not only for economic reasons but also for the sake of environment and mankind.

Promotion of Coir Fibre Industry

At present, most of the coir fibre processing factories belong to big companies mostly on joint venture basis with foreign companies. One of the companies is involved in large scale manufacturing of car seats for the Malaysian car manufacturing company and a number of other Japanese and European cars assembling factories. The company is also involved in the manufacturing of orthopedic mattress which is mostly exported. Local demand for this, type of mattress is still small and the company is still trying to promote the product in Malaysia by stressing the health aspects of the products. Other smaller coir fibre factories are mostly involved in producing overlay for spring mattress which are sold to mattress manufacturing factories, and limited amount of products for horticultural applications such as plant stands and seedling pots. Some mattress manufacturing companies are also involved in processing of coir fibre solely for their own consumption.

There are still a number of other products that could be manufactured from coir fibre. However, due to limited capacity of the existing factories, they are not manufactured even though there are big demands for some new products locally and abroad. There are no known new factories being set up for processing coir fibre in the country lately, in spite of interest shown by some local entrepreneurs in the industry. The main reason mentioned is the difficulty in getting the needed technology and machinery for coir processing particularly on a small scale. This is also partly true with coconut husk processing.

Technology for coir fibre industry in Malaysia is a closely guarded secret, which is still the sole right of the private sector. If this state of affairs is to continue, the country will lose and the industry will remain in the hands of a few individuals who monopolise the market. To overcome this situation, it is essential that relevant government institutions should take steps to acquire the technology for dissemination to interested parties. Since the basic technology is already available through the international body such as APCC, the technology should be made more freely available to member countries. As for research on new products development from coir fibre, this could be done by research institutes in the country. Malaysian Agricultural Research And Development Institute (MARDI) has already taken steps to promote this industry by the setting up of a special research programme on processing of non-food substances. One of the highest research priority in this programme is to research on the development of products from coir fibre and their manufacturing techniques. It is hoped that closer cooperation should be established among research institutions in APCC member countries for mutual benefits.

Conclusion

Coir fibre industry should be further developed in view of the environmental friendly nature of the materials, pollution removal in coconut plantations and revival of coconut industry in Malaysia which is considered a "Sunset" industry. Efforts should be made to develop more products from coir fibre through scientific research and development. The R & D should be geared not only towards development of new products but also in substituting the artificial materials which have replaced coir fibre lately. Introduction of local Manufacturing of coir processing machineries should be encouraged to reduce their price. The latter would encourage more local people to venture in the industry. The industry should also be promoted as a small

scale industry by developing simple machines appropriate to the rural people so that they will also derive the benefits from the industry.

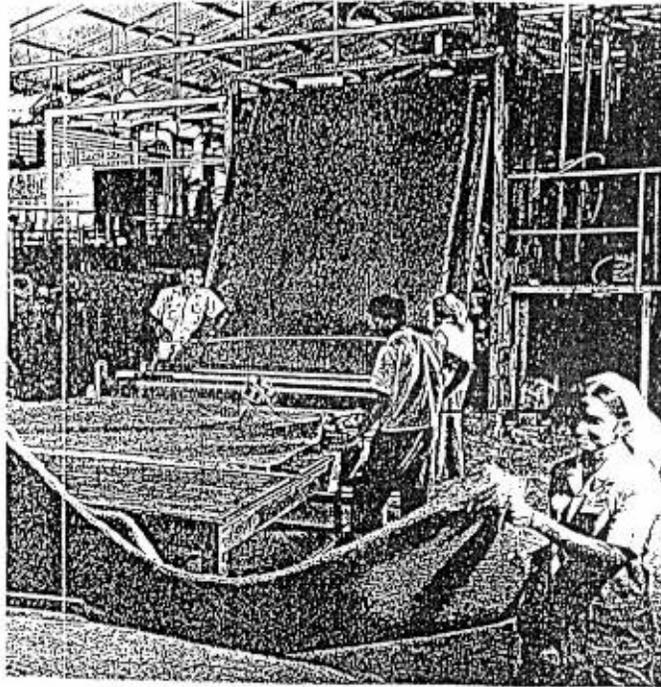


Plate 1. Rubberized coir fibre factory in Malaysia. (Coco Industry Sdn. Bhd)

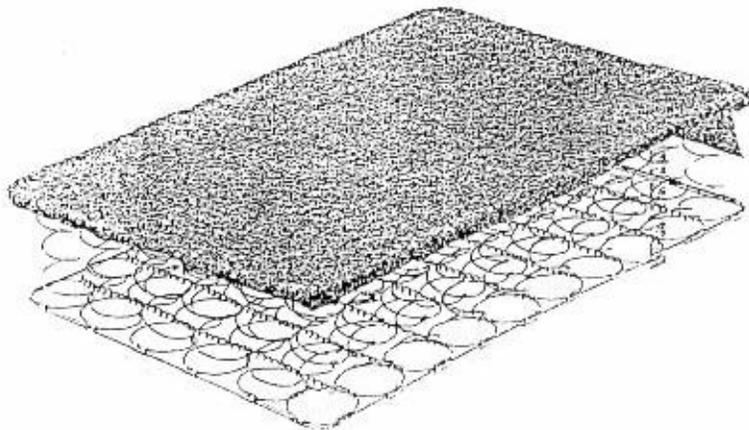


Figure 2. Spring mattress overlaid with rubberized coir fibre

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