

# **Desk Study**

**on**

**National Woodfuels and Wood Energy Information Analysis**

**MALAYSIA**

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## **Fuelwood in Malaysia**

Fuelwood resources in Malaysia are mainly from the by-products of the forestry and rubber industries. There is no reliable data on the actual use of fuelwood but the principal users are the tobacco, rubber, charcoal, kiln drying and brick industries mainly in the rural areas. (Hoi, 1991) With the urbanisation of the population and an increasing standard of living, the energy shift is towards more convenient fuels viz. kerosene, gas and electricity. However, the charcoal industry has kept its own ground partly due to its constant demand and the availability of sustained resources. This is especially so in the Matang mangrove area in Perak where the forest is specially catered for the traditional firewood and charcoal industry.

## **The Firewood Industry and Market**

The utilisation of bakau (mangrove) for firewood as a source of efficient fuel in the last domain of the local domestic market has been on the decline. A few factors have contributed to this:

- a) The improving standards of living of the general population who regard firewood as being too traditional and a thing of the past.
- b) Direct competition from a cleaner and more efficient fuel like gas.
- c) Firewood are cumbersome to handle and require a large storage area.
- d) Being a poor man's fuel, it can not command inflationary fair price
- e) The increasing cost of production as a direct result of the higher cost of labour.

In recognising this trend, the Forest Department has decided to discontinue the traditional allocation of forest areas for firewood production. Firewood coups which in the past were given the choice of the best forest areas, then the poorer areas when charcoal were given greater prominence, is not allocated any areas in the present working plan for the mangrove forest reserve. In the previous working plan, only 70% of the total allocated areas of 960 hectares were actually worked by the end of the plan and the poor areas were abandoned in favour of better areas in the following year. This trend clearly defeats the original intention of expecting the contractors to work in the poorer and less productive areas. It has become a common practice for the contractors to obtain approval from the forest department to sell the produce to the charcoal contractors with the excuse that they can not dispose of their firewood and at a fair price. With such constraints, the forest department decided to terminate all the previous firewood contractors and offer them options to enter the departmental tender on an open basis at par with the charcoal contractors. Production of firewood is thus expected to be low and minimal. There is a possibility that firewood contractors will turn to smaller size billets obtained from trimmings of larger length and large size poles from the second thinnings. The present market price is RM 50.00 (US 13.15) per tonne and is expected to increase marginally to RM 62.00 (US 16.32) per tonne. Demand is mainly from the traditional market of Penang and Butterworth at approximately 1000 tonnes annually. ( Gan, 1995)

## The Charcoal Industry and Market

Utilisation of the mangrove wood resources in the production of charcoal still remains the mainstay of the economy and the management of the Malaysian mangroves. This is attributed to the good management and consistency in quality and supply of the produce. Charcoal as compared to firewood is definitely a more efficient fuel producing less smoke and a strong even heat. All the same, charcoal is also facing stiff competition from fuel such as gas, kerosene and the convenient availability of electricity supplied to almost all the major household even in the rural areas. Though the industry has lost some traditional markets but it has also found new ones. At present, the only dependable market still exists within the state of Perak and neighbouring states of Selangor, Penang and Kedah. This market is adequate for the present and whatever produce is totally absorbed. It is expected to grow very slightly every year in keeping with the population increase. The major threat to the industry is the over importation of Thailand and Indonesian charcoal, which are of poorer quality but are very much cheaper. The surplus from the import will force the present price of RM 413.00 (US 108.68) per tonne to dip lower. The break even price for charcoal produced is around RM 330.00 (US 86.84) per tonne. The coup for charcoal and yield for 1995 to 1999 are given in the following table.

**Table: Charcoal Coup**

Year	1995	1996	1997	1998	1999
Area opened (hectares)	796.4	792.9	798.6	799.4	802.7
Charcoal Yield (tonnes)	129,834	132,400	129,540	133,388	136,899

Source: Gan, 1995

## Wood Production from the Mangrove Forest

### Exploitation for Firewood

In the Matang mangrove, the manner of harvesting firewood is essentially the same as that of charcoal wood except that debarking of billets is not necessary and billets are bucked into 1.5 m lengths instead. Billets landed at the jetty have to be split into two or four before they are sold at about US\$25 per tonne. There is now a demand for mangrove firewood since they have been found to be an excellent fuelwood for roasting pigs.

In Sabah, wood from the mangroves is still a vital source of fuelwood for the local communities which are located within easy reach of the mangrove forests. These communities find mangrove firewood as more reliable, cheaper and easier to obtain as opposed to other fuel alternatives. This is particularly true for the Bajau, Illanun and Brunei-Malay fishing communities at Kudat, Marudu, Kuala Ibai, Sulaman, Mengkabong, Rampayan Laut, Kuala Penyu and Weston along the west coast of Sabah. Here, the exploitation of firewood from the mangroves is a commercial venture which involves the entire cooperative effort of individual family units. Due to

the bulky nature of the product, transportation is a constraint and market outlets are restricted to adjoining villages located further inland. The preferred species for firewood is Rhizophora apiculata and poles with diameters ranging from 4 to 7 cm are felled using an axe. They are then transported back to the villages. At the village, the poles are bucked and split into halves or quarters by the womenfolk and children. Bark removal is done by beating with a wooden mallet. The splittings are heaped to dry in the sun for several days. They are then tied into bundles of 10 sticks each using climber cords or nylon strings. The daily outturn is about 50-100 bundles per person. Middlemen usually come to collect the firewood from the villagers paying only US\$0.10 per bundle. These bundles are then sold to consumers at US\$0.12 to \$0.15 each. Over the east coast, the wealthier Suluk fishing communities living in the Trusan Sugut, Kuala Labuk and Pulau Libaran region harvest mangrove firewood on a part-time basis and for subsistence use only.

### **Manufacture of Charcoal**

In Matang, the manufacture of charcoal from mangrove timber remains the most important traditional forestry industry. There are at present 55 registered charcoal contractors and about 316 kilns in operation in Matang. Charcoal batteries are usually constructed close to river or canal banks where transport boats can dock. The batteries are made of sawn timber, mangrove poles and nipa shingles and they each houses a row of about 10 to 12 kilns (dapur arang).

The type of charcoal kiln presently used is the Siamese beehive kiln (Plate 20) which was first introduced to Matang in 1930 by charcoal manufacturers from southern Thailand (Robertson, 1940). The Siamese kiln is a dome-shaped structure made of bricks, sand and clay. There are four vents in the vertical wall and a door which enables access to the kiln. It now costs about US\$400 to construct a kiln. The average life of a kiln is about 7 to 10 years if constructed on firm ground and regularly used.

Each kiln (usually 6.7 m in diameter) requires a charge of about 40 tonnes of greenwood per burn. They are normally operational nine times a year. This would mean that each kiln will require 2.8 ha of forest area each year for full operation (Haron, 1981). From the 40 tonnes of greenwood, an outturn of about 10 tonnes of charcoal can be obtained. Mangrove billets, on arrival of the tongkang at the battery site, are unloaded and stacked outside the battery. In cases when debarking is not done in the forest, charcoal producers would employ workers (often women and children) to debark the billets at a cost of about US\$0.04 each. Small diameter billets less than 10 cm are not debarked for they are used for firing the kilns instead. Debarking apparently fetches a better rate of conversion to charcoal. The debarked billets are then carried into the kiln and filled by vertical close packing. The bottom ends of each billet are placed over single bricks to ensure complete carbonisation. Only the base of the kiln is packed, leaving the upper portion of the dome empty. When the kiln is loaded, the entrance door is partially sealed to form a firing aperture at the bottom. Normally, small diameter mangrove billets are used for firing but due to the increasing difficulty in obtaining adequate supply, some operators have shifted to using rubberwood or timber

offcuts which can be readily and cheaply purchased from nearby sawmills. The firing schedules include the "big burn", "small burn" and the cooling down periods and the whole process usually takes 26 to 30 days. The timing of each process is determined by a headman based on the colour and odour of the smoke

The preferred slope angle of the pit is 30 to 35 degrees so as to reduce the risk of surface erosion and subterranean infiltration of rainwater. After the required depth of 3 m is attained, a hemispherical dome (made of clay and bricks) is built over the pit. The construction of a kiln involves 150 man-days. Each kiln has a loading capacity of 20 to 25 cu m of greenwood and stacking is usually carried out by two workers. Following stacking, the entrance into the kiln is partially sealed with bricks and clay. Firing then commences with all smoke vents open. Continuous burning is maintained for a period of 15 to 20 days. When carbonisation is almost completed (by either feeling the conducted heat on the sealed door or by inserting a stick into a tiny hole and observing the degree of charring), the vents are immediately sealed. The kiln is then allowed to cool for a period of between 10 to 15 days. Occasionally, a piece of wet cloth, which has been initially soaked in water mixed with clay and ash, is used to keep the kiln moist. It is claimed that this will hasten the cooling process and at the same time assists in plugging up cracks. Following the cooling period, the entrance is smashed down and the charcoal is removed from the kiln. The output per kiln is about two tonnes per burn. The wholesale price of charcoal on the west coast is about US\$0.14 to 0.18 per kilogram while the retail price is about US\$0.28 per kilogram.

On the east coast, charcoal is produced in Sg. Manila (Sandakan District), Sg. Kretam (Sandakan District) and Balong (Tawau District). The kilns in this region are larger in capacity (able to accommodate up to 30 cu m of greenwood), have a faster turnover rate (11 days for firing and four days for cooling) and a greater output of about three tonnes each per burn. The wholesale price of charcoal here varies from US\$0.05 to 0.19 per kilogram while the retail price is about US\$0.40 per kilogram.

In Sarawak, the manner of constructing the kiln is similar to those on the west coast of Sabah. The kilns are made by building a hemispherical dome shaped roof over a pit excavated from sandstone hills. Each kiln has an entrance door, a separate tunnel-like opening for firing and three to four vent holes. The cost of constructing a kiln varied from US\$800 to \$1200 at the time of construction which is about 10 to 20 years ago. The whole process of charcoal conversion takes about a month. In the Rejang mangrove, the average monthly outturn of charcoal per manufacturer is about 18.2 tonnes. At the current wholesale price of US\$102 per tonne, his monthly outturn value is about US\$1850. After subtracting production costs his monthly nett income is about US\$300 to \$400.

### **Thinning for Poles**

In Matang, intermediate felling (thinning) for poles has been traditionally carried out since 1930 in mangrove forest stands which are 15 and 20 years of age (Noakes, 1952) An earlier described by Haron (1991) third thinning of 25-year-old stands was omitted

in the present Working Plan (1990-1999) since it has led to over-cutting and degradation of the residual stand during final felling for charcoal and firewood production. There are about 75 registered pole contractors in the Matang mangrove and the area allocated for thinning averages about 2,349 ha a year.

Normally, a pole contractor is allocated a forest area for Thinning I and another for Thinning II in a year, each of which is usually about 16 ha in area. An average of about 3,000 to 4,000 and 1,000 to 2,000 pieces of poles can be obtained from each of the two allocated areas, respectively. The number of standing residual trees following Thinnings I and II has been estimated to be about 3,400 and 1,600 trees per hectare, respectively (Haron, 1981).

For a given area, usually three to four workers are employed by the contractor to carry out the felling and extraction of poles. A headman is usually appointed amongst them to ensure systematic felling and fair allocation of individual working areas.

The felling of trees (usually Rhizophora spp.) is done using an axe starting usually from a selected river bank and progressively working inland. The process involves selecting a well formed Rhizophora tree and a stick is used to determine the trees to be felled. Straight trees within the stick radius, with the selected tree as the centre, are felled. This is then repeated the stick lengths from Thinning I and II are 1.2 and 1.8 m, respectively. The felled trees (usually 7.6 to 12.7 cm db) are then bucked into suitable lengths (usually 4.9, 5.5 and 6.1 m) using the axe as a measuring tool. The poles are then shoulder carried individually to the river bank where they are stacked, awaiting boat transport to the jetty. Often, extraction pathways are constructed by laying poles in twos or threes at a time in such a way that they lie end to end forming a rough track for carrying out the poles. The workers are paid a salary based on the number of poles stacked at the river bank. For trees near to the river banks, they are paid about US\$0.40 per piece and the rate increases progressively to US\$~0.60 per piece for inland trees. It is common to find inland areas inadequately thinned. This is particularly so when shoulder carrying becomes particularly so when shoulder carrying becomes increasingly tedious and when there is a need for transporting the poles along creeks using a small boat to the main stacking area. The additional work of loading and unloading often deter workers from working in such areas even when extracting such poles fetches higher wages.

A worker can cut and transport about 30 to 40 pieces of poles per day. In a month, he normally works for only 15 to 20 days since the transport boat is only able to dock at the stacking site during periods of high water. For nearby felling areas, the workers commute daily while for distant areas, they have to seek accommodation in temporary shelters at the logging site.

When sufficient poles have been stacked at the river bank, they are transported to the jetty, by boats (tongkang) which have a loading capacity of usually 200 to 300 pieces of poles. The boatman who is employed by the contractor is paid US\$0.10 for each pole transported to the jetty. At the jetty the poles are sold to consumers at US\$0.70

to \$1.50 per piece depending on the length, straightness and diameter size. With the rapid development in the housing industry, there is now a good demand for mangrove poles for piling purposes.

In Sabah, harvesting of mangrove poles for piling purposes can be considered the most important activity in terms of volume extracted and the number of workers engaged. This activity is mostly confined to the north eastern part of Sabah particularly in Trusan Sugut and Kuala Labuk .

## **References**

1. Gan Boon Keong (1995) A Working Plan for the Matang Mangrove Forest Reserve, Perak. The State Forestry Department of Perak Darul Ridzuan, Malaysia
2. Haron Hj. Abu Hassan (1981) A working Plan for the Matang Mangroves, Perak 1980 –1989. State Forestry Department Publication Perak
3. Hoi Why Kong (1991) Gasification of Rubberwood in a downdraft Gasifier, Ph.D Thesis (University of Aston, U.K)
4. Noakes, DSP (1950) The Mangrove Charcoal Industry in Matang. Malay. Forester 13: 80-83
5. Noakes DSP (1952) A Working Plan for the Matang Mangrove Forest. Forest Department Publication
6. Robertson E.D. (1940) Charcoal Kilns in the Matang Mangrove forest . Malay. Forester 9: 178-183