Wood Energy in Malaysia

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ABSTRACT

Wood is an important traditional fuel in Malaysia. It is utilised as domestic fuel in the rural areas. It is also used in some important industries such as the smoking of rubber sheets, the curing of tobacco and the manufacture of bricks. Charcoal, a secondary fuel from wood is also used in the domestic sector but its most important use is in the steel and cement industries. In this paper we re-evaluate the importance of wood as a source of fuel and explore the possibilities of its utilisation in the long term.

INTRODUCTION

Wood has been an important domestic fuel in Malaysia since time immemorial. In the rural areas today wood still is the major domestic fuel, sometimes complemented by kerosene.[1,2] In the industrial sector wood is an important fuel in the smoking of rubber sheets, the curing of tobacco, the manufacture of bricks, traditional pottery making, and small-scale food manufacturing. Charcoal, a secondary fuel produced by the carbonization of wood is also an important domestic fuel in the urban areas. Use of charcoal in the steel and cement industries is also very significant so much so that Malaysia has to import annually almost 50% of her charcoal requirement from neighbouring charcoal producing countries, Indonesia and Thailand. It is envisaged that wood fuel will still play an important role until the end of the century.

The sources of wood in Malaysia are the rubber plantations, where rubberwood is made available through the replanting process, the timber industry, where waste wood from the sawmilling process is available for fuel, and the mangrove swamps, which produce high quality fuel wood for primary wood fuel as well as feedstock for charcoal production. In the rural areas domestic fuel is normally obtained from rubber plantations and secondary forests. The latter produce a variety of wood suitable for burning.

Although Malaysia has sufficient wood resources the harvesting of fuelwood, especially from the mangrove swamps has been tightly controlled by the Forest Department, hence the increasing imports of charcoal. With proper management and planning wood fuel can be maintained as an important resource in the long run. Table 1 shows the recorded production of fuelwood in the forms of firewood and charcoal for the years 1975 to 1985. It can be seen that the production of firewood and charcoal increased steadily until 1978 and remained more or less constant since 1979. This is because of the control mentioned above. There is no estimate of the amount of wood fuel used domestically in the rural areas.

Table 1. Production of fuelwood in Peninsular Malaysia (1975 - 1985).

Year	Firewood (m^3)	Charcoal (m^3)
1975	74,000	449,000
1976	109,000	267,000
1977	251,000	343,000
1978	377,000	453,000
1979	450,000	278,500
1980	450,000	243,500
1981	450,000	255,500
1982	450,000	267,500
1983	450,000	285,000
1984	450,000	294,500
1985	450,000	312,500

Source: Peninsular Malaysia Forestry Annual Reports.

Energy is obtained from the combustion of wood or charcoal. The gross calorific value of oven-dried wood averages 17.9 MJ/kg while that of charcoal is 27.9 MJ/kg. Table 2 lists the calorific values of the wood and the charcoal for some species of wood which are important sources of wood fuel in Malaysia.

Table 2. Calorific values of some species of woods and their charcoal.

Species	Calorific value (MJ/kg)	
	Wood[3]	Charcoal[4]
Bakau Minyak *(R. apiculata)*	18.5	27.5
Bakau Kurap *(R. mucronata)*	18.0	27.3
Pine *(Pinus caribaea)*	18.0	27.8
Eucalypt *(Eucalyptus deglupta)*	17.9	27.8
Acacia *(Acacia mangium)*	17.7	28.5
Rubberwood *(Hevea brasiliensis)*	17.6	28.3

WOOD ENERGY RESEARCH IN MALAYSIA

Most of the research on wood energy in Malaysia is carried out at the Forest Research Institute of Malaysia (FRIM) under the institute's Wood Waste Utilisation Programme. Some important research work has recently been started in the universities.

The objectives of the wood energy projects carried out in FRIM and in the universities are:

i) To study and develop the technology for the conversion of wood waste into solid, liquid or gaseous fuels.
ii) To develop cheap industrial and domestic fuels based on wood and other agricultural wastes.

Some aspects of wood energy studied in these projects include charcoal production, wood and charcoal gasification, wood briquetting and stove design.

Charcoal Production

In Malaysia charcoal is produced in three types of kilns: the saw dust clamp, the beehive kiln and the transportable metal kiln.[5] In the saw dust clamp the charge, normally sawmilling wastes, is stacked in a pit, covered with a mound of saw dust and fired. After the exothermic stage is completed the holes are covered with sand to extinguish the fire. The charcoal produced by this method is of variable and low quality.

The beehive kiln is the most important method as almost 80% of the charcoal produced in this country is by this method. The charge in this method of production is mangrove wood (*Sp. Rhizophora*) and rubberwood. The charcoal produced by this method is of high quality with fixed carbon content between 70% and 80% and is suitable for industrial use. Studies has been carried out to determine the optimum carbonization process and to asses the suitability of using various types of wood as the feedstock. It has been established that most of the varieties of wood available in the country are suitable for producing high quality charcoal. This is discussed in reference 4.

The transportable metal kiln is a new development. It is expected to be increasingly used in the rubber replanting process because of its transportability. The kilns can be taken to the areas where the felling of rubber trees is in progress, hence saving in the cost of transportation of the raw wood. The kiln is also suitable for use in the vicinity of the sawmills as the volume of charge required is not too high when compared with the beehive kiln. Various types of material can be used as the feedstock in this kiln (Table 3).

Table 3. Carbonization data for the transportable metal kiln.

Feed material	Carbonization time (hr)	Conversion efficiency (%)	Fixed carbon content (%)
Rubberwood	24 - 61	19 - 23	75 - 85
Sawmill rejects	21 - 166	17 - 22	66 - 83
Coconut shells	12 - 36	20 - 25	70 - 75

The demand, production and import of charcoal in Peninsular Malaysia from 1980 to 1985 are shown in Table 4. It is noted that the demand is increasing steadily while production is static, hence the requirement for increasing imports.

Table 4. Demand, production and import of charcoal in Peninsular Malaysia (1980 - 1986).

Year	Demand (tonne)	Production (tonne)	Import (tonne)
1980	48700	31700	17000
1981	51100	32100	19000
1982	53500	31500	22000
1983	57000	31000	26000
1984	58900	30900	28000
1985	62500	31300	31200

Source: MIDA Report on Charcoal Tariff.

Gasification

Research on the gasification of charcoal is being carried out both at FRIM and at the Faculty of Mechanical Engineering, Technology University of Malaysia. FRIM has developed a lot of experience in running a diesel engine with a gasifier, whereas in the university gasification work was started only recently. In both institutions the fixed bed down drought gasifier is utilised. Pilot trials run by FRIM have indicated that small-scale gasification of charcoal has application potential, particularly in the remote areas of the country.[6] However, a lack of trained persons to operate the gasifiers must first be overcome.

Wood Stove

In the rural areas wood fuel is usually burned in the open burning three stone or triangular support hearth. The utilisation of fuel in this manner is inefficient. Such a burning system is also inconvenient because of the smoky fire produced. The efficiency of these open burning stoves is less than 7%. Research on stove design and characteristics is being carried out at FRIM and at the Department of Physics, National University of Malaysia. The objective of this project is to find the optimum stove design in terms of efficiency, ease of fabrication and ease of handling and operation. Tests have been performed on stoves available in the market. The efficiency of these stoves range between 12% to 19%. Field tests on these stoves will be carried out in the near future in order to asses their acceptability.

CONCLUSIONS

Wood fuel in the form of firewood and charcoal is still very important both for domestic and industrial use in Malaysia. Good quality charcoal can be produced by the beehive kiln and the transportable metal kiln. Use of the transportable metal kiln should be encouraged especially in the vicinity of the sawmills as the saw dust clamp which is widely practiced now produces low quality charcoal. Gasification of wood and charcoal has a potential for wider applications but

operator training has to be provided before this can be achieved.

In the rural areas firewood will be used for domestic fuel for a long time to come. The introduction of better and more efficient stoves will bring much relief to the rural housewives. Further research on stove design and field trials will have to be conducted.

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