

MANGROVE-BASED PRODUCTS

Raja Abdul Azim Raja Azmi & Mohd Hambali Mohd Jailani



Introduction

Mangrove commonly refers to two different things such as a tidal swamp ecosystem found in tropical deltas, estuaries, lagoons or islands, and the characteristic tree species populating this ecosystem. Mangrove forests only grow at tropical and subtropical latitudes near the equator because they cannot withstand freezing temperature.

There are around 80 different species of mangrove trees. All of these trees grow in areas with low-oxygen soil, where slow-moving water allows fine sediments to accumulate. The harsh conditions of coastal environments have developed unique adaptation for mangrove trees. They survive in high amounts of salinity either by excreting salt through their leaves, or simply by safely keeping it within their tissues. Many of mangrove forests can be recognized by their dense tangle of prop roots that make the trees appear to be standing on stilts above the water. Mangrove tree root systems are shallow and partly exposed to the air, which allow them to breathe in an environment that is frequently flooded and low in oxygen. This tangle of roots allows the trees to handle the daily rise and fall of tides, which means that most mangroves get flooded at least twice per day. The roots also slow the movement of tidal waters, causing sediments to settle out of the water and build up the muddy bottom.

Mangrove forests stabilize the coastline, reduce erosion from storm surges, currents, waves, and tides. Mangrove swamps are unique ecological communities that link freshwater and oceanic ecosystem and host a rich diversity of animal species. The intricate root system of mangroves also makes these forests attractive to fish and other organisms seeking food and shelter from predators.

The mangrove forests in Malaysia, occur mainly along the west coast of Peninsular Malaysia, at the estuaries of Sarawak (1st Division), Rejang (6th Division) and Trusan-Lawas (5th Division) rivers of Sarawak and along the east coast of Sabah.

Less than 2 % of the total land area of mangroves is in Malaysia. The area of mangrove forests in Malaysia amounted to 641,886 ha, of which 57% in Sabah and 26% in Sarawak and the remaining 17% in Peninsular Malaysia. Out of total, only 441,092 ha or 69% have been gazetted as forest reserves. There are a total of 112 mangrove forest reserves in the country until nowadays.

Tannin

According to Howes (1962), the extraction of tannin or the use of the bark for tanning is one of the major uses of mangrove trees, especially species from *Rhizophora*, *Bruguiera*, *Ceriops* and *Xylocarpus*. There are two kinds of tannin: pyrogallol- and pyrocatechol-tannin; many mangrove species having the latter, but *Laguncularia* and perhaps *Ceriops* also possess the former (Gnam, 1925) which does not impart such a good colour in tanning. The extract from *Ceriops* is very hard to filter, it is not readily soluble in water and it 'muddies'. Buckley (1929) defines that extracts from *Rhizophora*, *Bruguiera* and *Xylocarpus* are easily filtered and remain clear.

As found by Hillis (1956) in Indonesia, Borneo, New Guinea and the Philippines are the main use of the forests in the production of tannin, generally in the form of the concentrate 'cutch', which is exported to Europe and the U.S.A. Dey (1958) reported that 5000 tons of bark were exported from Borneo alone.

Table 1: % Tannin in bark of mangroves from different localities (from Howes, 1962)

	<i>Rhizophora mucronata</i>	<i>Rhizophora apiculata</i>	<i>Ceriops tagal</i>	<i>Bruguiera gymnorhiza</i>
Tanganyika	27-45		24	28-43
India	25-45	25-36	29-41	28-42
Malaya	30-40		24	
Borneo	25-30	25-30	25-35	25-30
Philippines	27.6			
Australia	27-39		21-34	29-36

Fuel

A source of fuel for household and commercial purposes is fairly widespread and known as one of the use of mangrove wood. *Heritiera*, *Avicennia*, *Ceriops*, *Xylocarpus* and *B. gymnorhiza* are all used as a fuel in the Bay of Bengal and particularly in the Sunderbans where coal would have to be transported in great distances (Patil, 1962; Ahmad 1964). Mangrove wood was widely used on the early railway system as firewood for the locomotives since Malaysia known as Malaya. As it became gradually replaced by coal, the deadline was made good by increased uses for charcoal manufacture and as firewood for rubber extraction. The various mangrove woods for fuel have been classified by the former workers as follows:

First Class	<i>Rhizophora</i> <i>Bruguiera</i> <i>Ceriops</i> <i>Heritiera littoralis</i> <i>Cynometra ramiflora</i>
Second Class	<i>Lumnitzera</i> <i>Sonneratia alba</i> <i>Scyphiphora hydrophyllacea</i>
Third Class	<i>Xylocarpus</i> (does not burn well) <i>Aegiceras corniculatum</i>
Fourth Class	<i>Avicennia</i> <i>Sonneratia spp.</i> <i>Excoecaria agallocha</i> <i>Cerbera odollam</i>

Pulp

The development of the pulp industry in Malaysia is still in its infancy and is not carried out on a large scale. New development in this field is the possibility of producing a viscose grade rayon pulp high in α cellulose from the wood of Sundri (*Heritiera fomes*) (Latif, 1965). This could well result in the development of a major industry. In the light of this work, it would seem that the other species of *Heritiera* should also be examined. Along with the development of the timber industry and the manufacture of paper, there are a number of researchers have conducted a study on nine genera of 7 families mangroves for dissolving pulp. Kai et al. (1975) evaluated that wood from mangroves in the Meliaceae, Verbenaceae, Euphorbiaceae and Sterculiaceae did not pulp easily, or gave poor quality pulp while the wood from *Bruguiera spp.*, *L. littorea* and *S. alba* yielded satisfactory pulps. This shows that the research on mangrove pulp is important to meet the criteria for the papermaking industry. Therefore, the processing of pulp from mangroves to some extent can improve the local economy not only in Malaysia, but throughout the world.

Charcoal

Malaysia is the principal region of the world in which mangrove is primarily used for the production charcoal. Some use is made of the forest in Colombia for the same purpose because charcoal is there the common household fuel (West, 1963). In other parts of the New World Moldenke (1960) reports that the timber of *A. germinans* is also used for charcoal production. Charcoal manufacture seems to be a minor in the Bay of Bengal (Patil, 1962).

In Malaysia the process of charcoal burning, using primarily species of *Rhizophora* and *Bruguiera*, varies from area to area. Kilns are square on the outside (20 - 25') but the interior is circular, the intervening walls being of clay. The nature of the clay is important because upon it depends the life of the kiln which can be anything from 5 - 50 years. The hollow central portion is filled with wood and built up to give a hemispherical dome. Logs are either placed on a wood staging or on bricks in order to get complete carbonization and the bark is generally removed. Clay is plastered on top of the wood, the door bricked up and the wood ignited from the firing tunnel. In old kilns the fire can be started by glowing charcoal which removed after 2 weeks and the kiln then closed (Noakes, 1950). A kiln will burn for about 2 months. The amount produced is very considerable, over 27,000 tons being produced in Matang in 1948. In all felling programmes at least two chains have to be left as a protection belt on the seaward side.

Building Materials

Since centuries ago, people were exploiting the coastal swamp forest to get wood. Mangrove wood from mangrove species like *R. apiculata*, *B. cylindrica* and *Api-Api* (*Avicennia spp*) used to create beams and pillars in building houses. The wood of *L. racemosa* is hard and durable and so finds a use as posts for house building. It is used for the same purpose in Malaysia as well as for wharf piles, through *Rhizophora* poles are also used here. Stakes made from *Rhizophora* trees and also from *Bruguiera* are used as a source of fishing stakes. These have a life of about 9 months and since the number of traps comprise many hundreds and as there are several thousand fishermen who use mangrove wood for their houses, the building timber need can be substantial. Timber characters and yields for certain Indo-Malaysian mangroves are given in Tables 2.

Table 2: Yield (cu m) for timber in relation to diameter class (cm) (after Becking *et al.*, 1922)

Species	Diameter (cm)						
	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	40 - 45	45 - 50
<i>B. gymnorhiza</i>			0.335	0.52	0.71	0.90	1.08
<i>B. sexangula</i>	0.11	0.18	0.26	0.33			
<i>B. parviflora</i>	0.16	0.29	0.42				
<i>R. apiculata</i>		0.28	0.41	0.57	0.79	1.07	

Wood Vinegar

Wood Vinegar compounds were obtained from the evaporation when burning mangrove wood for processing wood charcoal. This vinegar is categorized as organic materials which are used by some farmers and nursery plants to remove pests such as snails, worms and so on. It also acts to prevent fungal infection on the leaves and stems which can cause poor growth and quality of crops. It is the best alternative to replace the use of chemical pesticides on crops.

From a medical aspect, the mangrove wood vinegar can be used to treat bone fractures, diarrhea and to stop bleeding in wounds. While the cosmetic aspect, it can be used to avoid being bitten by mosquitoes, reduce acne and so on.

Conclusion

Mangroves are examples of areas that show the development of human activities, particularly related to methods of collecting revenue sources available there. Among the activities that are clearly related to mangroves is the technique of fishing, collecting resin and production of mangrove-bases products such as charcoal, fuel, vinegar, pulp and other. These activities are examples of activities that can best ensure the continued production of valuable resources. Given mangrove ecosystem is a suburban agriculture and estuaries in tropical regions that have grown from time immemorial, so it can be used as a reference source and geographical and ecological development in the past and even now.



Mangrove wood pile before being burned



Mangrove charcoal



Mangrove charcoal



Red tannin inside the mangrove rot



Building structure from mangrove wood

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Authors:

Mr. Raja Abdul Azim Raja Azmi
Science Officer

Laboratory of Sustainable Bioresource Management
Institute of Tropical Forestry and Forest Products (INTROP)
Universiti Putra Malaysia
Email: radzim91@gmail.com

Mr. Mohd Hambali Mohd Jailani
Agriculture Officer

Laboratory of Sustainable Bioresource Management
Institute of Tropical Forestry and Forest Products (INTROP)
Universiti Putra Malaysia
Email: hambalij@gmail.com