# EFFECT OF DIAMETER AND LOG SHAPE ON THE VENEER RECOVERY RATE IN A PLYWOOD PLANT

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*Abstract:* Wood veneer is the main input for plywood manufacture and plywood is a value added product of veneer. A study to determine the recovery rate of logs that was to be converted into plywood was done at a local factory in Kuala Terengganu, Terengganu. The objectives of the research was to determine the effect of diameter and log shape on the recovery rate in five early stages of the veneer production line. The five stages of veneer preparation studied were logyard/deck, debarker, rotary lathe, dryer and core builder/composer. The results showed that the recovery rate of logs with a diameter above 50 cm was 58.81% and diameter below 50 cm was 55.98 percent. The difference as observed in the analysis was not significant. On the other hand, the recovery rate for log shape factor for straight logs were 62.83% and curved logs were 51.96 percent. This showed that the log shape factor significantly affected recovery rate. When analysed based on the diameter, it is concluded that diameters above 50 cm generated a higher recovery rate than diameters below 50 cm. In terms of production based on the diameter, it was indicated in this study that the diameter did not influenced significantly the veneer recovery, although there was a trend that larger log diameter resulted in higher veneer output. The difference as observed in the analysis was not significant at the 0.05 percent significant level. This study confirms the general believe that higher percentage veneer recovery is attainable with straight log shape than curved log. Higher percentage veneer recovery was attained by straight logs than curve log. The straight logs were easier to handle by the machines such as peeling by the rotary lathe during the initial stages.

## INTRODUCTION

In Malaysia, plywood industry was established in the pre-war days, but it was only the late sixties that expansion of plywood industry really began [1]. However, Lian [5] mentioned that the first mechanized plywood mill in Peninsular Malaysia was erected in 1956.

Plywood manufactures in Peninsular Malaysia currently rely on the supply of a limited number of traditional species for the production of face veneer [8]. Face veneers of plywood should have a uniform colour and for core veneers, the species are not rated because it is to utilize any species that can be peeled. The species recommended for the manufacture of structural plywood should have high strength and stiffness and should be easily glued [1]. But, with some wood species, it is better to optimize the maximum value of the veneer instead of maximizing veneer volume.

Baldwin [3] indicates that the quality of logs that are acceptable will vary according to the cost of the logs at the plywood mill. If this is high from a combination of stumpage, felling, and transport charges, then only selected qualities can usually be accepted. As the percentage recovery of plywood from the log becomes very important. This is particularly true for logs imported from overseas, because ocean freight may add from 50 to 100 percent to the cost. If logs are inexpensive then quality requirements may be lowered because losses caused by rounding and veneer clipping may be compensated by the log price. However it must be taken into account that the use of lower qualities involves extra labour, often with some lowering of grade of the finished product.

Wood veneer is the main input for plywood manufacture. Various forms of wastes/residues are inevitably generated. The plywood and veneer manufacturing industry is unique in which each process results in diminished veneer volume. Since plywood and veneer manufacturing industry result in diminished veneer volume at each point of production, applying a method of quantifying the wood residue is desirable to increase the recovery rate. In general, these residues take the form of lilypad, round-up, spur trim and peeler core. Due to increasing cost of raw material, the direction of growth of plywood and veneer industry should be towards achieving a higher rate of recovery from logs used, as well as utilizing the log cores and other wastage to manufacture additional timber products [6]. The

objective of this study was to determine the effect of diameter and log shape on the recovery rate of veneer.

## MATERIALS AND METHODS

*Selection of Sample*

The veneer recovery study was conducted with the aim of quantifying the recovery rate of selected wood species commonly used for the manufacture of plywood veneer. The number of treatments used was 16 treatments with 3 replications (4 x 2 x 2 x 3 replications), as indicated in Table 1.

Table 1: The Experimental Factors and Treatment Levels

| Experimental Factors | Factor Levels |
|---|---|
| Wood Species | 1. Gerutu (*Parashorea spp*)<br>2. Meranti (*Shorea spp*)<br>3. Kapur (*Dryobalanops spp*)<br>4. Simpoh (*Dillenia spp*) |
| Log Diameter | 1. Above 50 cm<br>2. Below 50 cm |
| Log Shape | 1. Straight (3 replication)<br>2. Curve (3 replication) |

*Log Sampling*: In this study, a total of 48 samples of logs were selected according to the species, diameter and log shape. Four species was selected, where two species were from light hardwood and the other two were from medium hardwood . These species were the most commonly processed log species in the factory. The species are shown below :

a) Meranti (*Shorea spp.*)- Light hardwood.
b) Gerutu (*Parashorea spp.*)- Light hardwood
c) Kapur (*Dyrobalanops spp.*) - Medium hardwood
d) Simpoh (*Dillenia spp.*) - Medium hardwood

Each wood category consisted, of 24 samples, where 12 samples from each species were collected. These 12 samples were divided into two groups of diameter size which were *above 50 cm* and *below 50 cm*. Then, each diameter size group was divided into two groups of log shape. The log shapes were *straight* and *curve*.

*Data Collection*

Observations and measurements were carried out in each veneer production stage. The step by step process started from the log yard and ends at the composer and core builder sections. The production stages are as shown in Figure 1.

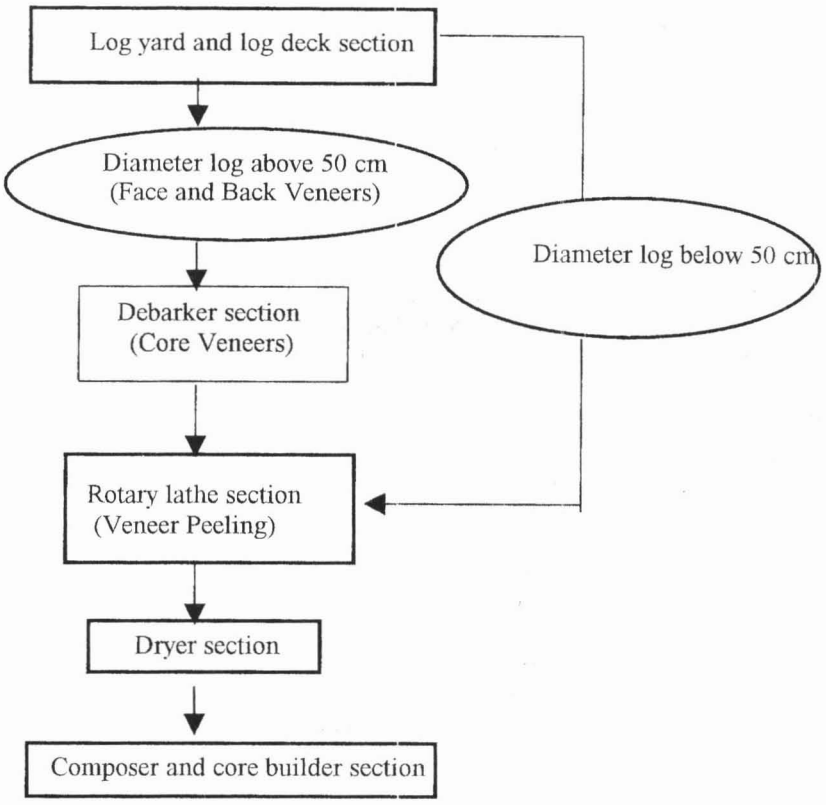


Figure 1: Five Early Stages of Veneer Production

## RESULTS AND DISCUSSIONS

*Recovery by Diameter and Log Shape*

According to Rast et. al. [7], the major factors that affected the quality (recovery) of factory-lumber logs were position of the log in the tree (butt or upper), size of the log (diameter), straigthness, amount and distribution of scalable defects and defect in the useable wood outside the heart center. Some tropical species are soft and easily workable, whereas others are so hard that they must be steamed prior to peeling. The great majority of standing timber in Southeast Asia is of the *meranti* group. However, there are a great number of other species [2].

*Recovery by Diameter*

The recovery of veneer after being classified into diameter classes were also measured. Below is the summary table for veneer recovery by diameter classes (Table 2).

Table 2: Veneer Recovery by Diameter Classes

| | Recovery (%) | | | | | |
|---|---|---|---|---|---|---|
| Diameter | Log Deck/ Yard | Debarker | Rotary | Dryer | Core builder/composer | Overall recovery |
| Above 50 cm | 98.48 | 96.78 | 82.47 | 75.32 | 58.81 | 58.81 |
| Below 50 cm | 97.96 | 97.96* | 83.45 | 77.80 | 55.98 | 55.98 |

Note : * Log below 50 cm was not debarked

The recovery of the core builder/composer section was the last stage in this study. The diameters above 50 cm recorded higher veneer recovery rate (58.81%) than diameters below 50 cm (55.98%) (Table 2).

The recovery for log above 50 cm in diameter at the log yard (98.48%) were higher than log diameter below 50 cm (97.90%). This was because, the number of cuttings from log into bolts were lower than log diameter below 50 cm. Normally, the length of bolts were from 6 ft to 8 ft. For log diameter below 50 cm, the length of bolts were cut into 3 ft to 4 ft. This cutting procedure resulted in higher number of cuttings for logs of diameter below 50 cm compared to those logs of diameter above 50 cm.

In a study to determine veneer yields of four southern hardwoods species, Clark and McAlister [4] found that the volume of wood converted into veneer increased with increasing log diameters. However, in this study it showed that the recovery percentage or veneer yield based on diameter was found to be insignificant.

*Recovery by Log Shape*

The recovery of veneer was also classified into log shape (Straight and curve). From the result, it showed that the recovery rate of the straight logs were higher compared to the curved log.

Table 3: Veneer Recovery by Log Shape

| | Recovery (%) | | | | | |
|---|---|---|---|---|---|---|
| Stages | Log Deck/ Yard | Debarker | Rotary | Dryer | Core builder/composer | Overall recovery |
| Straight | 98.60 | 97.47 | 84.62 | 79.23 | 62.83 | 62.83 |
| Curve | 98.20 | 97.36 | 81.29 | 73.59 | 51.96 | 51.96 |

Table 3 shows that, veneer recovery rate for straight logs were significantly ($p<0.05$) higher than curve logs from the early stages to the end of veneer processing. Straight logs generated more veneer recovery and less residue losses because they were easier to peel by the rotary lathe, especially at initial stages. The veneers produced were more continuous and contain least amount of defects. The percentage of wood lost through 'rounding-up' was also much less. The results showed that, there were significant differences between the recovery rates based on the shape of the logs.

## CONCLUSION

When analysed based on the diameter, it is concluded that diameters above 50 cm generated a higher recovery rate than diameters below 50 cm. In terms of production based on the diameter, it was indicated in this study that the diameter did not influenced significantly the veneer recovery, although there was a trend that larger log diameter resulted in higher veneer output. The difference as observed in the analysis was not significant at the 0.05 percent significant level.

This study confirms the general believe that higher percentage veneer recovery is attainable with straight log shape than curved log. Higher percentage veneer recovery was attained by straight logs than curve log. The straight logs were easier to handle by the machines such as peeling by the rotary lathe during the initial stages.

*Recommendations*

From the study the following recommendations were drawn ;

i. Since the raw material is expensive, it is recommended that the logs be purchased in multiples of block length with minimum allowance. Thus reducing the end-cutting loss in mill yard. The large volume of end-cutting available was currently being used as solid fuel to generate steam for the veneer dryer.

ii. Increased attention should be devoted to the problem of storage of logs. Defects that occur at the log yard or log storage, will affect the quality and quantity of veneer yield.

iii. Mills should be using recovery lathe with small chuck diameter in order to extract more veneers from the large peeler cores.

iv. For futher studies, there is a need to analyse the residue losses from the initial stages to the end stages. This is because, not all the residue losses were wasted. Some of them are used as fuel, blockboard and etc. So, these kind of residue should be counted into the recovery rate as recoverable products and not as losses as commonly done.

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