

EFFECTS OF HEIGHT PORTION AND DISTANCE FROM PITH ON THE DENSITY OF OIL PALM TRUNK

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ABSTRACT

Two 25 year old oil palm trunks were obtained from Manjung, Perak. Disks of 20 mm thick were obtained from the stem at 1m (bottom), 4m (middle), and 7 m (top) heights. Sample pieces of 20mm x 20mm x 20mm were cut for density measurement. The samples for each disc was divided into three zones namely near bark, middle and near pith. The highest oven-dry density (0.47 g cm^{-3}) was observed from samples near the bark at the bottom portion while the lowest (0.13 g cm^{-3}) was at the top portion near pith sample. The oven-dry density of oil palm trunk increases from the near pith towards the bark and decreases from bottom towards the top of the plant. Height portion and distance from the pith significantly affect the oven-dry density.

Keywords: *Oil palm trunk, density, height portion, distance from pith*

Introduction

The importance of knowing and assessing the physical properties of woody material is reflected by the end-use of the material itself. Oven-dry density helps to determine the physical and mechanical properties of cellulosic materials and also plays a role in their intended usage (Gurfinkel, 1973). This paper reports the findings on the effects of height portion and distance from the pith on the oven dry density of 25 year-old oil palm trunk.

Materials and Methods

Field Procedure

The oil palm trunks were obtained from Manjung, Perak. The age of the palms was averaged about 25 years old and was ready to be cut for the replanting of new palms. A total of 15 oil palm trees were cut down. All the palms were then further cut into approximately 2.7 meter billet and transported to the Wood Composite Workshop in Universiti Teknologi MARA (UiTM) Pahang, Jengka.

Sampling for Density Analysis

Two palm trees were used for this experiment. The average stem height of the palm was 11.2m. Disks of 20 mm thick were obtained from the stem at 1m (bottom), 4m (middle), and 7 m (top) heights. The heights were chosen because the stem could be cut into 2.7m length logs for easy transportation to the processing plant. Sample pieces of 20mm x 20mm x 20mm were cut for sample density and moisture content measurement. The samples for each disc were divided into three zones namely near bark, middle, and near pith. A total of 12 sample pieces were obtained for each disc.

Oven Dry Density

The weight and density measurements were carried out at green and oven-dry conditions. The volume of samples was measured by water displacement of the green samples before drying. Oven drying was carried out at $103 \pm 2^\circ\text{C}$ until constant weight was achieved. The testing procedure was determined by using ASTM D 2395-93, 1997. The result was then used to calculate the density as oven-dry density at green volume.

$$(2) \quad \text{Oven-dry density (gm/c.c)} = \frac{\text{Oven-dery weight (gm)}}{\text{Weight of displaced volume of water (c.c)}}$$

Results and Discussions

Physical Properties

The oven dry density of oil palm trunk according to height portion and distance from pith is shown in Table 1. Oven dry density of oil palm stem decreases with stem height and towards the center of the oil palm stem. The highest oven-dry density (0.47 g cm^{-3}) was observed from samples near the bark at the bottom portion while the lowest (0.13 g cm^{-3}) was at the top portion near pith sample. In general, the oven-dry density of oil palm trunk increases from the near pith towards the bark and decreases from the bottom towards the top of the plant.

Table 1. Oven dry density of oil palm trunk according to height portion and distance from pith

Height portion	Dist. From pith	Oven-dry Density (g cm^{-3})
Bottom	NB	0.47
	M	0.24
	NP	0.17
Middle	NB	0.44
	M	0.21
	NP	0.15
Top	NB	0.40
	M	0.18
	NP	0.13

Notes: Values are averages of six replicates, NB- Near bark, M- middle, NP- Near pith

Table 2. Analysis of variance on the oven-dry density of oil palm trunk

SOV	Oven-dry density
Portion (P)	26.40*
Distance from pith (D)	804.73*
P x D	0.90ns

Notes: SOV- Source of variance, ns- F-value are not significant at $p < 0.05$, * significant at $p > 0.05$.

Effect of Height Portion

Figure 1 shows the effect of height portion on the oven-dry density of oil palm trunk. The oven-dry density of oil palm trunk was observed to decrease significantly from the bottom towards the top portion (about 17%). However, the correlation analysis (Table 2) shows that the decrease in density is not significant ($r = -0.18\text{ns}$). The decrease in oven-dry density can be

associated to the vascular bundles as being young at the top end of the palm (Khoo et. al, 1991). Although the vascular is higher in number per area, the bundles are however small and the cell walls are thinner.

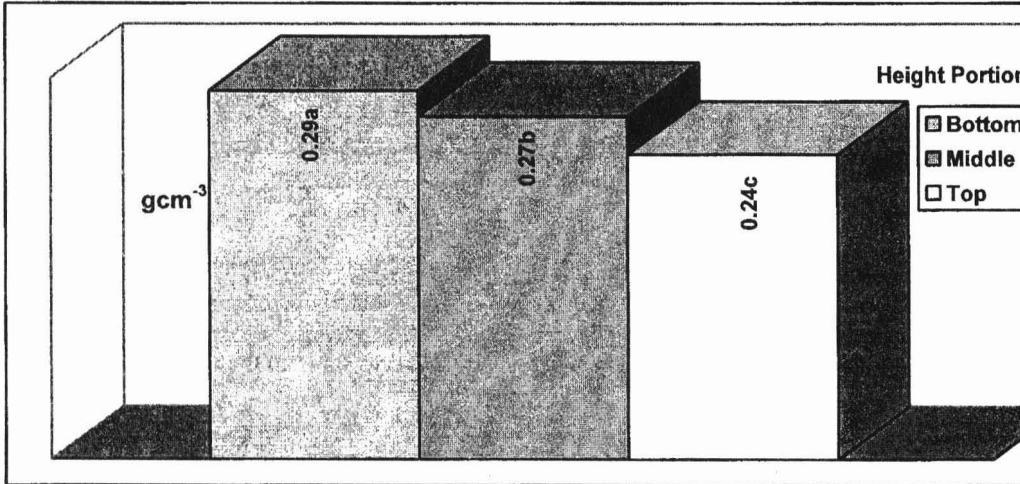


Figure 1. Effects of Height Portion on the Oven-dry density

Effect of Distance from the Pith

Oven-dry density of the oil palm trunk was observed to decrease significantly with distance from bark. The decrease in oven-dry density was about 66% from the NB value. The correlation analysis (Table 2) shows that the distance from pith has a negative correlation ($r = -0.93^*$) with the oven dry density. The higher oven-dry density in the peripheral zone is due to number of vascular bundles per square unit which decreases towards the pith (Khoo et al, 1991). The other reasons are (1) presence of radially extended fibrous sheaths, (2) lesser number of vessels (3) progressively thicker walls of ground parenchyma cells from inner to outer zone and (4) presence of better and developed secondary walls in the fibers.

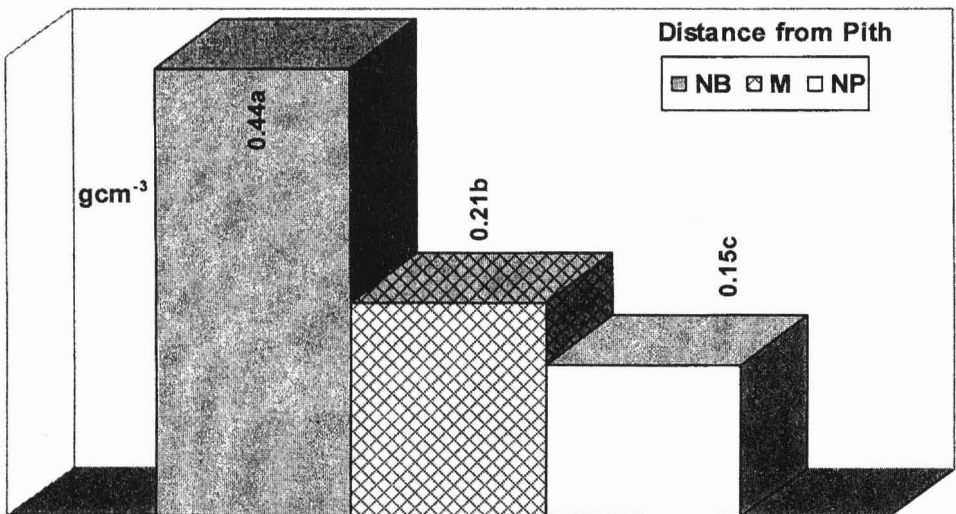


Figure 2. Effect of Distance from Pith on the oven-dry density

Table 2. Correlation analysis of the effects of height portion and distance from pith on the initial moisture content and oven-dry density

SOV	Oven dry density
Portion	-0.18ns
Dist	-0.93*

* Correlation is significant at $p < 0.01$

Conclusion

The oven-dry density of oil palm trunk was observed to decrease significantly from the bottom towards the top portion by about 17%. The density was also observed to decrease significantly with the distance from the pith by about 66% as compared to the bark region.

References

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