VARIATION OF MOISTURE CONTENT AND DENSITY IN BAMBOO (*GIGANTOCHLOA SCORTECHINII*) : EFFECTS OF AGE AND CULM HEIGHT

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ABSTRACT

From the study it was observed that three-year-old bamboo had the highest mean density (0.75 g/cm^3) and lowest mean initial moisture content (72.58%). Regardless of bamboo age, the top portion of the bamboo culm had the highest mean density and lowest mean initial moisture content. Initial moisture content was observed to decrease while oven dry density increased significantly with age and culm portion. Since three-year-old bamboo had the highest density and better qualities it should be selected and use for processing into bamboo products.

INTRODUCTION

The importance of knowing and assessing the physical properties of woody materials is reflected by the end-use of the materials itself. Basic density helps to determine the physical and mechanical properties of cellulosic materials and also plays a role in their intented usage (Gurfinkel, 1973). Moisture content affects the bamboo properties in the same way as it affects the properties of timber. Moisture content also influences the dimensional stability of woody materials and they are generally associated with toughness, density, strength, working properties and durability (Panshin and De Zeeuw, 1970; Hamdan and Abd. Latif, 1992). This paper reports the findings on the influences of bamboo age and culm portion on the variation of initial moisture content and oven-dry density of *Gigantochloa scortechinii*.

MATERIALS AND METHODS

Ten culms each from 1, 2 and 3-year-old *G. scortechinii* were harvested from the bamboo plantation of Forest Research Institute Malaysia (FRIM), Kepong, Selangor. All the branches present were removed. The clean culms were then divided into three equal portion; basal, middle and top portion. For the determination of initial moisture

content and density, specimen with sizes of 2 cm X 3 cm X thickness was taken from the first internode of each height portion. A total of 60 specimens were taken for each determination per age group. The method used for the determination of moisture content and basic density were based on TAPPI standard method (Anonymous, 1978).

RESULTS AND DISCUSSIONS

Moisture Content Variations

The initial moisture content of *G. scortechinii* according to age and culm portion is given in Table 1. It was observed that the initial moisture content showed a decreasing trend with increase in age but exhibited a decreasing trend with increase in culm height. The highest initial moisture content (131.38%) was observed in the basal portion of one-year-old culm while the lowest was at the top portion of the three-year-old culm (58.0%). The initial moisture content of *G. scortechinii* was significantly influenced by age and culm portion (Table. 2). Table 3 further revealed that the initial moisture content decreased with age (r = - 0.40). The decrease in moisture content with increased of age was explained in the sense that it was related to its growth establishment such as the developments of branches and leaves (Abd. Latif, 1995). Table 11 also indicated that the moisture content decreased significantly with culm portion (r = - 0.76). The lower moisture content at the top portion could be associated with the decrease in percentage of parenchyma cells (Abd. Latif and Mohd Zin, 1992; Liese, 1987). The higher moisture content at the basal portion, on the other hand, was probably due to the thin wall fibres and lower concentration of vascular bundles distributed per unit area of culm wall thickness thus gave rise to the higher percentage of parenchyma cells (site of water storage) (Abd. Latif and Mohd. Tamizi, 1992).

Table 1: Oven-dry Density and Initial Moisture Content According to Age and Culm Portion

Age (yrs)	Culm Portion	Oven-dry Density (gcm^{-3})	Moisture Content (%)
1	Basal	0.48	131.38
	Middle	0.60	89.75
	Top	0.72	69.71
	Average	0.60	96.95
2	Basal	0.53	117.48
	Middle	0.64	87.70
	Top	0.73	68.07
	Average	0.63	91.08
3	Basal	0.66	85.42
	Middle	0.75	74.33
	Top	0.83	58.00
	Average	0.75	72.58

Note : Values are average of 20 determinations

Oven-dry density

Table 1 gave the average values of oven-dry density according to age and culm portion. Oven dry density was observed to showed an increasing trend with age and culm portion. The results indicated that the highest and lowest average oven-dry density occured in the older than in younger culm and at the top than the basal portion, respectively. These were further revealed by the tendency of the oven-dry density to increased with age ($r = 0.55$) and culm portion ($r = 0.73$) as observed in the correlation analysis (Table 3). The increase of density with age could be due to the thicker fibre wall within the older culm while the increase in density with culm portion was probably due to the decrease in parenchyma cells (a higher frequency of vascular bundles distribution) (Espiloy, 1987; Liese,1987; Abd. Latif et al., 1996). Abd. Latif et al. (1996) and Jamaludin et al. (1994) also found a similar pattern of variation. Since the three-year-old bamboo had higher density, it was expected to have better processing qualities.

Table 2: Summaries of DMRT on the Effects of Age and Portion on Oven-dry Density and Initial Moisture Content

Age	Oven-dry Density	Initial Moisture Content
1	0.60c	94.94a
2	0.63b	91.08b
3	0.75a	72.58c
Portion	**Oven-dry Density**	**Initial Moisture Content**
Basal	0.55 c	111.42 a
Middle	0.66 b	83.93 b
Top	0.75 a	65.26 c

Note: Means with the same letter down the column are not significantly different at $p < 0.05$

Table 3: Correlation Coefficients of Density and Moisture Content with Age and Bamboo Portion

Properties	Age	Portion
Density	0.55 **	0.73 **
Moisture content	- 0.40 **	-0.76 **

Note: ** highly significant at $p < 0.01$

The physical properties of *Gigantochloa scortechinii*, namely the initial moisture content and oven-dry density varied significantly with bamboo age and height portion. The highest initial moisture content was observed in the basal portion of one-year-old culm while the lowest was at the top portion of the three-year-old culm. The highest and lowest oven-dry density occured in the older than in younger culm and at the top than basal portion, respectively. Initial moisture content showed a negative trend while oven-dry density exhibited a positive correlation with age and culm portion. Three-year-old bamboo with its high density is expected to performed ideally in the manufacture of bamboo products.

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