COMPARISON OF CHEMICAL COMPOSITION OF JUVENILE AND MATURE GIGANTOCHLOA ALBOCILIATA

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COMPARISON OF CHEMICAL COMPOSITION OF JUVENILE AND MATURE *GIGANTOCHLOA ALBOCILIATA*

By

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DEDICATION

Dedicated to:

My beloved family

To all my batch mates

and also

To everyone who gave full support to accomplish my Final Year Project successfully.

ABSTRACT

Gigantochloa albociliata is commonly consumed as edible shoots in some countries, including Malaysia. The study aimed to identify the chemical composition of juvenile and matured *G.albociliata* according to the parts and also to compare the chemical composition of juvenile and matured *G.albociliata.* Total of seven test have been conducted to check the chemical composition of bamboo which are hot water solubility, cold water solubility, alcohol acetone extraction, lignin content, holocellulose content, cellulose content and ash content. There are no significant difference within the parts (top, middle, and bottom) of juvenile and bottom *G.albociliata.* Top portion of both juvenile and mature bamboo have the highest content of cold water solubility, hot water solubility, alcohol acetone solubility, holocellulose content, cellulose content, and ash content. Bottom part of both juvenile and mature bamboo have the highest lignin. However there are significance difference of chemical composition between juvenile and mature *G.albociliata,* except for hot water solubility, lignin and holocellulose content. Hot water, cold water solubility, and ash content are higher in juvenile bamboo. Alcohol-acetone solubility, lignin, holocellulose and cellulose content are higher in mature bamboo.

ABSTRAK

Gigantochloa albociliata biasanya digunakan sebagai pucuk yang boleh dimakan di beberapa negara, termasuk Malaysia. Kajian ini bertujuan untuk mengenal pasti komposisi kimia *G.albociliata* muda dan matang mengikut bahagian-bahagian dan juga membandingkan komposisi kimia *G.albociliata* muda dan matang. Tujuh ujian telah dijalankan untuk memeriksa komposisi kimia buluh yang kelarutan air panas, kelarutan air sejuk, pengambilan aseton alcohol, kandungan lignin, kandungan holosellulosa, kandungan selulosa dan kandungan abu. Tidak terdapat perbezaan yang signifikan dalam bahagian (atas, tengah, dan bawah) daripada *G.albociliata* muda dan matang Bahagian atas kedua-dua buluh muda dan matang mempunyai kandungan kelarutan larut air tertinggi,kelarutan air panas, kelarutan aseton alkohol, holocellulose kandungan kandungan selulosa dan kandungan abu. Bahagian bawah kedua-dua buluh muda dan matang mempunyai lignin tertinggi .Walau bagaimanapun terdapat perbezaan ketara komposisi kimia antara *G.albociliata* muda dan matang, kecuali kelarutan air panas, kandungan lignin dan holoselulosa. Air panas, kelarutan air sejuk dan kandungan abu adalah lebih tinggi pada buluh muda. Kandungan kelarutan alkohol-aseton, lignin, holosellulosa dan selulosa lebih tinggi pada buluh matang.

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APPROVAL SHEET

I certified that this research project entitled “Comparison of Chemical Composition of Juvenile and Mature *Gigantochloa albociliata*” by Alexander Mathew a/l Innasemuthu has been examined and approved as a partial fulfillment of the requirements for the Degree of Bachelor of Wood Science and Technology in the Faculty of Forestry, Universiti Putra Malaysia.

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LIST OF ABBREVIATION

ANOVA	Analysis of variance
C	Celcius
G	Gram
G.albociliata	*Gigantochloa albociliata*
hr	Hour
min	Minute
%	percentage
NaOH	Sodium hydroxide
NWFP	Non-Wood Forest Product
TAPPI	Technical Association of the Pulp and Paper Industry

CHAPTER 1
INTRODUCTION

1.1 Background

Malaysia is a country enriched with abundant of forest resource which makes it a unique tropical country with multi-potentials to be discovered and to be utilized. As such, non-wood forest product are also being used widely now. In fact, non-wood forest product (NWFP) contributes to many uses such as medicine, foods, construction material and raw material. In conjunction with that, bamboo is also considered as non-wood forest product. Bamboo is a giant grass belonging to the family Poaceae (Gramineae) and from the tribe Bambuseae of the subfamily Bambosoideae). Bamboos are traditionally described as heterogeneous group of mostly perennial, rhizomatous forest grasses with broad, pseudopetiolate leaves, chlorenchyma with arm and fusoid cells, often bracteates synflorescences, and trimerous flowers. Estimation of about 1250 bamboo species in 75 genera have been identified all over the world. The fastest-growing land plant on the earth has been identified as bamboo since culms of some species, in just four months, can reach 40 m in height and 30 cm in diameter.

Bamboo has wide range of distribution with a great variety of habitats. Besides, bamboo is also known as an adaptable plant which some species being deciduous, others are evergreen, and especially, some species seem to be able to change their habit when necessary. Generally the geographical distribution of bamboo depends on climate. Bamboos mainly grow in the

tropical, subtropical and temperate regions except Europe due to most of bamboo species require a warm climate. About 80% of bamboo forest land and species in the world is distributed in Asia and Pacific regions. The largest number of bamboo species is distributed in Asia, this continent has about 590 bamboo species in 44 genera. Australia and the Pacific islands have fewer bamboo species with more scattered distribution (Banik and Rao, 1995). America also has a high biodiversity of bamboos with approximately 400 – 500 species, among them about 300 species in 20 genera are woody (Fu et al., 2000) and the majorities are Chusquea Kunth. The island of 2 Madagascar has 6 genera with about 20 species. Africa has only 3 genera (Fu et al., 2000) with 3 species including *Arundinaria alpina* (in Kenyan mountainous area) (Banik and Rao, 1995), *Oreobambos buchwaldii* (in Uganda, Tanzania, Zambia, and Zimbabwe), and *Oxytenanthera abyssinica* Munro (throughout tropical Africa) (Ohrnberger, 1999).

1.1.2 Bamboos in Asia

Asia has many advantages for bamboo growth. Banik and Rao (1995) estimated that about 80% of the bamboos grow in India and in the Asian-Pacific region, including Japan. South and Southeast Asia have most of woody genera have been estimated by Banik and Rao (1995). Among of it, there are more than 150 species are tall and enormous, possessing high economic value. China, India, Myanmar, Indonesia, Thailand, and Vietnam which having labels as Asian countries are very rich in bamboo resources.

China is located from the subtropical zone to the cold temperate zone with a cliche monsoon climate. The largest number of bamboo species in the world can be found at China. Estimation of about 500 bamboo species of 40 genera have been found in China. According to Fu (1998), there are four types of bamboo forest to be found in China which are warm bamboo forest (Hilly - mountainous bamboo forest) temperate bamboo forest (Mountainous bamboo forest), hot bamboo forest (Hilly - mountainous bamboo forest), and valley (plain bamboo forest).

It is reported that in India, bamboo naturally distributes following the distribution of the rainfall and according to this concept, divided India into 7 principal regions and showed a list of total 16 genera with 115 species. India has about 9.6 million ha of bamboo forest which are 12.8% of the total area of 75 million ha. Myanmar, with coordinates from 92 to 102° E, and from 10 to 30° N, has a total land area of 676577 km^2 and about half of the area is covered by forest (Rao, 1998). There are approximately 100 bamboo species belonging to 17 genera distributed throughout the country. In Myanmar bamboo naturally grows in the forest but sometimes they are planted for aesthetic reasons only (Rao, 1998).Thailand is located in the central part of continental Southeast Asia, with longitudes from 97°30' to 105°45' E and latitudes from 5°35’ to 20°15’ N, and has the total area of 513115 km^2. Bamboo in Thailand is mostly of the sympodial type and commonly appears in mixed deciduous forest areas (Rao, 1998). The country has 60 species of bamboo in 13 genera.

Malaysia, a tropical country with coordinates from 100 to 119° E and from 1 to 7° N, has approximately 70 known bamboo species, 50 in Peninsular Malaysia, 30 in Sabah and 20 in Sarawak. Of these species, only 12 species are being commercially utilized (Enters, 1997). In this country, bamboo distributes from sea level to 3000 m above. Bamboos are ample and extensively located all over in Malaysia. Most of the Malaysia bamboos grow in a clump and it can be found in patches on river banks, distributed lowland forests and on hillside and ridge tops (Lessard & Chouinard,1980). Malaysia has around 70 species of bamboo where 50% in Peninsular Malaysia, 20% in Sarawak and 30% in Sabah (Lessard & Chouinard, 1980). There are 10 genera of bamboo available named such as *Bambusa, Chusquea, Dendrocalamaus, Dinochloa, Gigantochloa, Phylliostachys, Racemobambos, Schizostachyum, Thyrsostachys and Yushania* (Lessard & Chouinard, 1980). About 13 of bamboo species are commercially exploited such as *Bambusa blumeana* (buluh duri), *B. vulgaris* (buluh aur/minyak), *B. heterostachya* (buluh galah), *Gigantochloa scortechinii (*buluh semantan), *G. levis* (buluh beting), *G. ligulata* (buluh tumpat), *G. wrayi* (buluh beti) and *Schizostachyum brachycladum (*buluh lemang) (Nordahlia et a*l*., 2012).

1.2 Justifications

Wood and bamboo have several differences. Wood pieces can be easily joined together but bamboo is more difficult to assemble as its inner part is hollow. Bamboo has difference in chemical extractive if compared to wood. Chemical composition is one of the criteria to identify the future uses of bamboo. Bamboo

plays a significant role as a material for consumer products. With its high growth rate, a wide range of applications and renewability, bamboo resources occupy a noteworthy position in the twenty-first century as a versatile and vital raw material. Different bamboos have different chemical composition and different usage. For example, *Bambusa vulgaris* is used in paper production, construction and fishery equipment. Other than that, *Bambusa heterostachya* is used in construction, furniture making. *Gigantochloa levis* is used in shoot production, chopsticks, toothpicks and furniture making. In the midst of that *Giganthochloa albociliata* are normally used for foods. However, for the potential in wood industry are not yet been studied and discovered by people. Therefore by the study about chemical composition and determining the chemical composition, can further extend the usage of *Giganthochloa albociliata* for other uses such as raw material in wood industry.

1.3 Objectives

General Objective is to:

Study chemical compositions of juvenile and matured *Gigantochloa albociliata.*

Specific objectives are:

1. To determine chemical compositions of juvenile and matured *G*. *albociliata* according to the parts (top, middle, and bottom).
2. To compare chemical compositions of juvenile and matured *G. albociliata*.

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