

## Study of using *Tillandsia usneoides* L., case of heating value

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### Abstract:

Presently, the increasing of “Save the World” is higher popularity in the cities. Spanish mosses (*Tillandsia usneoides* L.) is a kind of decorative plants which is easy to find, cheap to buy, and not much maintenance required. Number of pieces which are trimmed from plants probably are increased and become rubbish. The aim of the study is to analyze properties and chemical components of *Tillandsia usneoides* L. The analysis parts was determined by calorific, gravimetric and dynamic flash combustion methods for heating value, moisture value and elucidation properties, respectively. The results showed that the heating value was  $14.64 \pm 0.27$  MJ/kg, the moisture value was  $58.74 \pm 1.06$  % and the chemical components was 0.76% (N), 42.86% (C), 5.65% (H), and 0.05% (S). *Tillandsia usneoides* L. is possibly used as biomass power plant in the future.

**Keywords:** Heating Value; Biomass; Spanish Mosses (*Tillandsia usneoides* L.)

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### 1. Introduction

The percentage of the household energy usage is about 45 of electricity production. Nowadays, houses are mostly constructed as townhouses, condominium, or mansion. So the green area covered by plant are less available. The green roof or vertical green seems to be the solution for increasing the green area. Interestingly the benefit outcome is the decreasing of heat inside/outside buildings because the plants can protect the building from sunlight by its leaves directly and plants also take heat for the photosynthesis pathway causes the energy saving in the air-conditioning system and also the reduction of heat island in big picture.

The green roof or vertical green can be made by many kinds of plants. Some of plants are uncontrolled in growing up or not suitable to make the shading. The air plant is focused because of the growing up characteristic which is not soil needed. The Spanish moss (*Tillandsia usneoides* L.) is recommended for the green roof or vertical garden because it is cheap and not necessary to do frequent maintenance. Spanish moss has been proved to be an efficient atmospheric accumulator of the aerosols by the mechanism of phytoremediation (Sutton et al., 2014). The aim of this study is to analyze properties and chemical components of Spanish moss if it is be able to be used further as biomass.

#### 1.1 Spanish Moss

Spanish moss (*Tillandsia usneoides* L.) is an angiosperm which belongs to Bromeliaceae family *Tillandsia* genus. It is colloquially known as “air plant” which grows upon tree branches, wire under the sun or partial shading. It originates from the southeastern United States and central Argentina. Fig.1 morphology of Spanish Mosses. It can grow to up 6 m in length (George et al., 2004). It is planted both by seeds and fragments that blow on the wind and stick to tree branches. The Spanish moss consists of a slender stem in curved or curly with scaled leaves. The length of stem could be 2–6 cm and 1 mm diameter (Benzing, 1976). Spanish moss has Trichome for absorbing moisture and nutrient in the air. Spanish moss is slow growing species plant and xerophyte which requires small amount of water for living. The photosynthesis is Crassulacean Acid Metabolism (CAM) as cactus which uses water very efficiently. Spanish moss can grow without soil or called epiphytism.

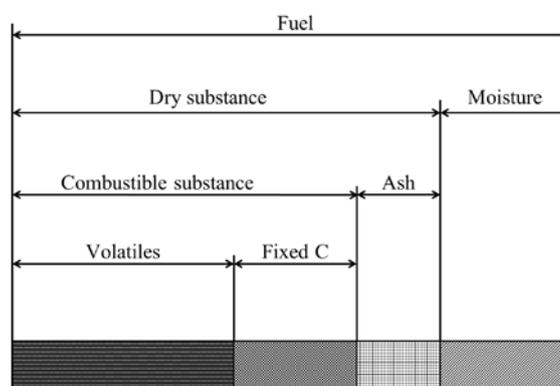
Spanish moss has benefit in various ways such as decoration, heat reduction curtain (Fanga et al., 2011), and bio-monitoring for heavy metal. The debris from trimming these plants could be used as biomass for co-firing if the heating value and feeding amount is enough.



**Fig. 1** Morphology of Spanish Mosses.

### 1.2 Composition of biomass

Many types of raw material can be used as sources of biomass for the energy production such as plant, animal, dung, waste from agriculture and garbage. Heating value is one of the most important parameters regarding the evaluation of competitive energy generation from biomass combustion. (Nhuchhen et al., 2012) For biomass fuel used in heating value and moisture present in Table 1 showing heating value and moisture of each biomass. There are three main parts in biomass: moisture, combustible substance and ash as shown in Fig 2. If biomass has high moisture content, it is not suitable for use for energy production. The lower heating value means the higher of ash after burning. The moisture content of the biomass fuel should not exceed 25 percent.



**Fig. 2** Composition of biomass.

**Table 1** Comparison of heating value and moisture of biomass each species.

Biomass fuel	Heating value (MJ/kg)	Moisture (approximately)%
Rice husk	14.27	12
Rice straw	12.33	10
Bagasse	14.40	51
Parawood	14.98	45
Palm fiber	17.62	39
Palm shell	18.46	12
Palm empty bunch	17.86	59
Corn cob	18.04	40
Tapioca rhizome	18.42	60

## 2. Methodology

This study analyzed the properties and chemical components of Spanish moss by measuring the heating value, the moisture, and the chemical component and also measured the growth of Spanish moss by reporting in length and weight every month in 1 year-growth, April, 2014 to April, 2015.

The set of Spanish moss 1 m length was hung along 1 m width on the rack. Each set of Spanish moss was placed at each side of the building of the faculty of environmental management, Prince of Songkla University, Hadyai, Songkhla, Thailand (4 sides around the faculty of environmental management i.e. front, back, left, and right side.) Fig.3 The sampled of Spanish moss will be analyzed and compared to the properties of other biomasses.



Fig. 3 Sample set of Spanish moss around the faculty of environmental management.

## 3. Results and discussion

### 3.1 Heating value and moisture of Spanish moss.

The heating value and moisture of Spanish moss from samples showed that the heating value is  $14.638 \pm 0.270$  MJ/kg for calorific method (approximation close to the rice husk and rice straw biomass). The moisture value is  $58.74 \pm 1.06$  % for gravimetric method (close to the moisture of wood chips).

### 3.2 Components of Spanish moss.

The chemical components of Spanish moss showed that there are 0.76% (N), 42.86% (C), 5.65% (H), and 0.05% (S) for dynamic flash combustion method. The ash of Spanish moss from samples is  $2.30 \pm 0.08$ % for gravimetric method.

## 4. Conclusion

Spanish moss has the feasibility to be used as biomass. The Spanish moss has properties and components that are suitable for the utilization. Nevertheless the study must know the amount of scraps of Spanish moss that occurs from the maintenance trimming in order to be the supply for a very small power plant or co-firing with other biomass. This research has just started for a few months. The growth rate is therefore not yet finished.

## 5. References

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