

# A Study on a Higher Heating Value of Agricultural Waste in Malaysia

Cindy Olin<sup>1</sup>, Hassan Ibrahim<sup>1</sup>, Azri Alias<sup>1</sup>, Ahmmad Shukrie Md Yudin<sup>1</sup>, Firdaus Basrawi<sup>1</sup>

<sup>1</sup>Energy Sustainability Focus Group, Faculty of Mechanical Engineering, Universiti Malaysia Pahang, mfirdausb@ump.edu.my

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**Abstract** Fuel properties are the fundamental parameters which are often required in order to choose the suitable technology for the combustion process of a fuel. The fuel property focused in this study was higher heating value which is the energy content of agricultural waste. An experimental study was carried out to obtain higher heating value of a few waste samples. The higher heating value was obtained through calorimetric experiment using a bomb calorimeter. The results indicate that coconut husks has the highest heating value with 21.3 MJ/kg while paddy straw has the lowest heating value of 15.6 MJ/kg. Results obtained also have consistent value with other research findings.

**Keywords** Biomass, fuel property, higher heating value, bomb calorimeter

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## 1.0 Introduction

Nowadays fossil fuel sources are depleting and their price constant variability has led to intensive search for an alternative fuel resource. According to the world energy council projections, if the adequate policy initiatives are provided, 30% of the direct fuel use and 60% of global electricity supplies would be met by renewable energy sources within 2025 [1].

In Malaysia, it is estimated that 93% of the energy derived in the form of petroleum and electricity produced in this country still rely dominantly on fossil fuels [2]. According to [3], the increase in energy demand in Malaysia between 1999 and 2002 is reaching to 20%. In addition to that, it is estimated that the energy demand is increasing to 18,000 MW by 2010. The sources limitations of fossil fuel encourage the government to shift the energy policy towards renewable energy source. Besides that, environmental concerns has also lead the societies to utilize various sources of renewable energy. In this country, biomass has the most potential to be used to overcome the increasing energy demand [3] due to the biomass indigenous nature, abundant availability and its low cost.

Fuel properties are the fundamental parameters which is often required in order to choose the suitable technology for the combustion process of a fuel. The origin of the biomass has strong influenced on the biomass characteristics, resulting in a wide variety of fuel properties [4]. The fuel property focused on this study is the higher heating value of the biomass fuel.

Heating value which is also known as calorific value can be defined as the energy content of the fuel [5]. The higher heating value can be determined through the calculation from proximate or ultimate analysis or experimentally using bomb calorimeter. The energy in

biomass can be exploit by burning it and thereby turning the chemically bound energy into heat and then power. The efficiency of the equipment that involves in the combustion of a fuel can be determined based on the heating value of the fuel [6].

Heating value is among the fuel properties with fundamental importance since the design of a biomass combustor rely strongly on the heating value of the biomass [7], [8]. Fuels with lower amount of heating value generates less power hence more amount of fuel is required to produce the same amount of energy. This will have influence on the combustor size required for the combustion. Therefore, the knowledge of the heating value is important as the designer need to consider on the different types of biomass fuels which is suitable for specific biomass power technologies and the also the benefits of each fuel.

The fuel focused in this study is solid fuel from agricultural waste. Sugarcane or scientifically known as *Saccharum officinarum* mainly produces residue called bagasse. Bagasse is the residue that is left after the crushing and extraction of sugar juice from the sugarcane. In 2009, Malaysia produces about 700,000 ton of sugarcane with a moisture content of 50% [3]. It is estimated that the heating value for dry sugarcane bagasse to be 14.4 MJ/kg [9]. Various research has been done to study the energy content and the composition of sugarcane bagasse. Table 1 shows the summary of proximate and ultimate analysis of sugarcane bagasse reported by several authors. The bagasse is classified as a fuel with high reactivity due to its high content of volatiles and low ash content [10].

Previous study also had been done on coconut residue and it is found that the heating value of coconut fibre dust is 17.79 MJ/kg [11]. The fibre dust is reported to have more than 97.1% combustible components with 70.3