Sago Bark as Renewable Energy

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Abstract - Much research has been done on the determination of the heating value of biomass waste, but currently no research is being done on the heating value of sago bark. In Malaysia, sago bark is an abundant waste product from sago starch extraction. This study presents the moisture content and heating value determination of paddy straw, empty fruit bunch (EFB), sago bark, oil palm kernel shell (OPKS), and wood chips. The moisture content and heating value of the investigated biomass were determined according to the British Standard EN 1477-2:2009 and bomb calorimeter, accordingly. It was observed that paddy straw recorded the highest moisture content at 97.75% wt. This was followed by EFB 95.34% wt., sago bark 96.05% wt., OPKS 95.28% wt. and wood chips 11.61% wt. In the dry state, wood chips had the highest heating value, with a value recorded as approximately 22.41 MJ kg^{-1}, followed by OPKS 21.40 MJ kg^{-1}, sago bark 19.56 MJ kg^{-1}, EFB 17.82 MJ kg^{-1} and paddy straw 15.33 MJ kg^{-1}. Current experimental trials suggest that the heating value of sago bark makes it suitable for use for co-firing with coal power generation.

***Keywords*:** Sago bark, Heating value, Moisture content, Bomb calorimeter, Biomass

I. INTRODUCTION

THE world oil crisis of the 1970s highlighted concerns over the scarcity of resources [1]. The rapid depletion of the fossil fuel reserve, as well as climate change and the over-dependence on oil, has driven the world to renewable energy sources, which are abundant, untapped and environmentally friendly [2]. Biomass offers important advantages as a combustion feedstock because of the high volatility of the fuel and the high reactivity of both the fuel and the resulting char [3]. Co-firing of biomass residues mitigates greenhouse gases by avoiding CH_4 release from the landfilled biomass [4]. In Malaysia, it is estimated that potentially 1340 MW of energy can be generated from biomass by 2030. As of July 2009, there is 39 MW installed capacity under construction under the Biogen Project. The biomass involved is palm oil waste (empty fruit bunch-EFB) and agricultural waste (wood chips, rice husk, etc.) [5].

Currently, Malaysia has huge resources of biomass from the palm oil industries, which contribute 85.5% of the more than 70 million tons of biomass [6]. The palm oil plantations generate a huge amount of waste, such as chopped trunks, dead fronds, empty fruit bunches, shells and fibres. There were about 4.08 million hectares of palm oil plantations in Malaysia in 2009. In 2009, it was estimated that around 747.20 million tons of empty fruit bunch and oil palm kernel shell (OPKS) were being collected during the pressing of sterilized fruits [7]. Wood waste in Malaysia is mostly found in the logging industries. The total land area in Malaysia is 32.98 million hectares. In 2009, the total production of logs based on the total land area was 18.27 million m^3 [8]. In March 2005, the Cabinet tasked the Ministry of Plantation Industries and Commodities to pursue an aggressive program for the development of forest plantation in Malaysia. Under this program, the Ministry has planned to develop 375,000 hectares of forest plantation at an annual planting rate of 25,000 hectares per year for the next 15 years. Once successfully implemented, every 25,000 hectares of land planted is expected to produce 5 million cubic meters of timber [9]. Therefore, this program will increase the quantity of wood residue every year, which can be used for bio-energy. In Malaysia, rice is the main food crop and is grown on small farms. According to Wong and his team, there was an increase in rice production from 2004 to 2009 of about 7.88% [10]. Due to the demand for rice, the paddy plantation area and yield of paddy per hectare has also increased consistently every year. In some countries, paddy straw is used for co-firing with coal power generation [11], [12].

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