Malays. Appl. Biol. (2018) 47(1): 89–95

MAXIMISING PRODUCTION OF PREBIOTIC SUGAR (CELLOBIOSE) FROM SAGO FROND

DYG SALWANI AWG ADENI[1*], MUHAMMAD NORHELMI AHMAD[1] and KOPLI BUJANG[1]

[1]Resource Biotechnology, Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
[*]E-mail: dayangsalwani@gmail.com

Accepted 23 February 2018, Published online 31 March 2018

ABSTRACT

Numerous fronds are discarded as waste upon harvesting of sago logs for starch production. Currently, these fronds are left to degrade in sago estates which potentially pose fire hazard in the dry season, concomitantly accommodating various pests that endanger the livelihood of the sago farmers. The objective of this study is to utilize the frond for the production of cellobiose, a non-table sugar known to harbour various prebiotic properties. Enzymatic hydrolysis was performed on treated sago frond fibre utilizing the cellulolytic enzyme Celluclast 1.5L. Characterization of the lignocellulosic component revealed that adolescent sago fronds have the highest cellulose content (41.43%) which is beneficial for high yield of cellobiose. Pruned sago fronds have the highest lignin (40.63%) which hinders the hydrolysis process. Nevertheless the hemicellulose content was found to be approximately similar (between 15 to18%) which promotes the production of cellobiose. Optimum enzymatic hydrolysis was achieved at 6% (w/v) sago frond powder coupled with 10% (v/v) enzyme and incubated for 48 hours, producing a maximum recovery of cellobiose at 25.5%.

Key words: sago frond, lignocellulosic, cellobiose, glucose, Celluclast 1.5L

INTRODUCTION

Sago palm is one of the most important commodities in Sarawak, Malaysia. In 2013, the area of sago palm involves 54,000 ha of plantation mainly in the districts of Mukah, Dalat, Igan and Pusa. Sago palm requires up to 10 years to mature before it can be harvested (Bujang, 2015). The long waiting period together with the absence of other products from the sago farm that can be obtained as passive income to the farmers is two of the biggest challenges to the sago industry.

In the district of Mukah there are 8 large-scale sago factories which operate daily in producing sago starch. Each day, at least 500 sago palms will be harvested to feed these factories. Each palm has about 7 to 24 fronds, thus approximately 7,500 fronds are discarded, every day. Some of these are used to make crude path layers to roll sago logs out from the farm to the nearest road or river while the remaining are abandoned. According to Hirst (2014) the length of the sago frond is between 5-8 m. The sago fronds may be armed with short spines along the margin and the main vein (Mc Clatchey *et al*., 2006), while those in Mukah are essentially smooth or unarmed. Each sago frond weighs between 5 to 7 kg upon cutting, contains 80-82% moisture content as well as starch in the form of amylopectin. It was shown earlier that each fresh sago frond can produce between 1 to 1.4 kg dried fibre which is enzymatically digestible to yield sugars and other products (Ahmad & Bujang, 2014).

Our preliminary studies have shown that enzymatic hydrolysis of the cellulose component in sago fronds can produce cellobiose, a type of pre-biotic sugar (Ahmad *et al*., 2016). Cellobiose is a disaccharide which consist of two glucose molecules linked through a β-1,4 bond. It is an important ingredient in food, animal feed, cosmetics and pharmaceutical products. It can be produced by chemical and biochemical treatments of polymeric cellulose from the biomass, which will lead to its economic production at large-scale processes.

This project attempts to study the potentials of sago fronds in the production of sugar through enzymatic hydrolysis using Celluclast 1.5L. Optimization of the process was achieved by

* To whom correspondence should be addressed.