

Discrimination of old oil palm trunks to maximize production of fermentable sugars in sap: A promising source of sugars for biofuels and biomaterials

Oil palm (*Elaeis guineensis*) is widely planted for its edible oil in tropical countries such as Malaysia and Indonesia. In general, the palm starts bearing oil-contained fruits 2.5 years after planting, but its productivity becomes lower after 20-25 years, making it necessary to cut the old palms and replant new seedlings at plantation sites.

In Malaysia, an estimated 120,000 hectares of oil palm were replanted annually (from 2006 to 2010) to maintain oil productivity (1, 2). When replanting, old palms are cut and most of them are discarded or burnt at the plantation site. Efficient ways of utilizing oil palm trunks (OPT) are desired for an ideal oil palm plantation and a sustainable palm oil industry, thus we investigated the amount and composition of sugars in the sap squeezed from felled trunks together with moisture content. We also examined the effects of storage of the felled trunks on sugars in the sap (1,2).

Free sugar content in OPT sap is at maximum level at 30-60 days of storage after logging, thus the sap should be squeezed during this period to obtain the highest sugar concentration for further utilization (2). In addition, there was an accumulation of free sugars depending on starch concentration in OPT, as observed by an increase in sugar content in OPT with high starch content, though it decreases after a certain period of storage (3). Thus, starch concentration in OPT is useful as a key indicator to discriminate OPTs that exhibit increasable fermentable sugars in the oil palm sap during storage of the trunks after logging. On the other hand, it may be difficult to discriminate an OPT that has high starch content from its appearance.

In this study, we reported a method to discriminate a promising OPT among felled OPTs using iodine solution. To easily determine the starch content in felled OPT, iodine solution was sprayed to its cross section. When iodine solution was sprayed to the cross section of OPT containing high starch content, a dark blue color immediately appeared on the surface of the cross section. In contrast, when felled OPT containing low starch content was sprayed with iodine, the color of the cross section did not change.

To confirm whether OPT with high starch content increases its free sugars in the sap during storage, the sugar concentration in sap was compared to sap from OPT with low starch content during storage. Results have shown that the increase of free sugar in sap was observed only in OPTs with high starch content, indicating that this phenomenon depends on starch content in OPT. This method, in which iodine solution is sprayed on OPT cross-section, is useful in the discrimination of promising OPTs that exhibit increasable free sugar content during storage.

- (1) Kosugi et al. (2010), J Biosci Bioeng. 110:322-325. doi: 10.1016/j.jbiosc.2010.03.001.
- (2) Yamada et al. (2010), Biomass Bioenergy 34:1608-1613
- (3) Abdul Hamid et al. (2015), Int. J. Green Energy, doi.org/10.1080/15435075.2014.910786

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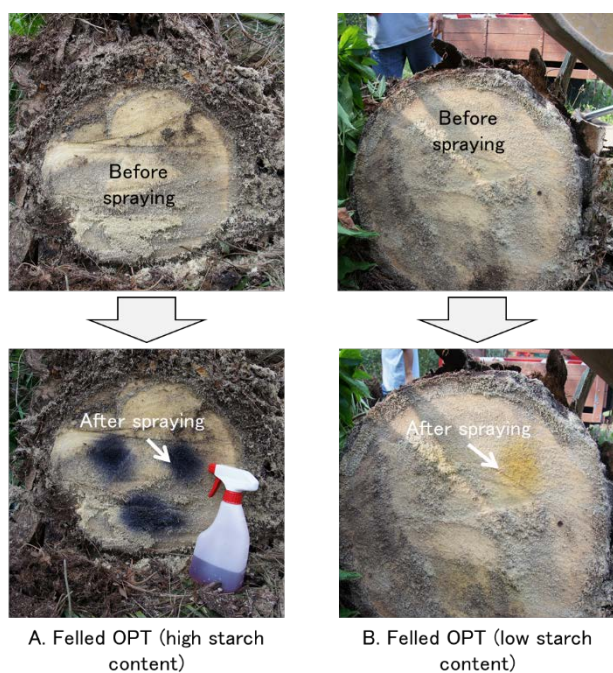


Fig. 1. Spray tests using iodine solution for felled oil palm trunk (OPT). OPT was obtained from a commercial oil palm plantation in Selangor, Malaysia. The starch content of OPT was measured using a total starch assay kit before the spray tests were carried out. The starch concentration of OPT containing high and low starch contents was 46.8% (w/w dry) and 7.1% (w/w dry), respectively.

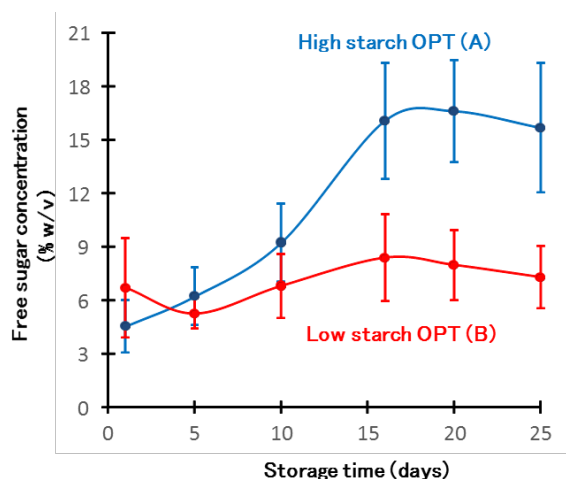


Fig. 2. Storage tests using high starch OPT (A) and low starch OPT (B). Free sugar was measured by high-performance liquid chromatography (HPLC) using squeezing sap of trunk samples obtained from each storage time. The total amount of glucose, fructose, and sucrose shows as free sugar in the sap.