BIOPROCESSING AND CHEMICAL COMPOSITIONS OF MALAYSIA PALM SUGAR: A REVIEW

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Abstract: Palm sugars had been traditionally used as a sweetener for decades in Malaysia. Palm sugars are produced by heating the filtered palm sap until it becomes concentrated and the desired colour and aroma are obtained. Then, the concentrated sap will be moulded, cooled for about an hour, and lastly, it will be packed. Their popularity is increasing globally due to their natural properties, minimal processing steps, and health benefits. Palm sugars typically do not undergo any purification process or use any synthetic chemical in their production. Although they are suggested to be a better sweetener than refined cane sugar, a comprehensive review of their nutritional qualities and product characteristics is not widely covered. Hence, this paper review aimed to explicate the chemical compositions and functional properties of Malaysia palm sugars as a potentially nutritious alternative sweetener. This paper was carried out by reviewing previously published studies on chemical compositions and functional properties of palm sugars. The key finding from this review unveiled that the bioprocessing of palm sugar highly affected the characteristics of the finished product. The two important processes that occurred during the heating stage of palm sap are the Maillard reaction and caramelisation process. These two processes greatly influenced the colour, flavor, and aroma of palm sugars. Palm sugars are considered nutritious because they contain adequate moisture, ash, protein, and fat. The chemical compositions of palm sugar are also a result of the minimal chemical processing of palm sugar.

Keywords: Palm Sugar, bioprocessing, flavour, colour, chemical compositions

1. Introduction

Palm sugar such as nipa palm sugar (gula apong), coconut palm sugar (gula melaka), and palm sugar (gula enau) is one of the various types of natural food resources that can be found in Malaysia. These palm sugars are produced from different species of palms, such as nipa palm (*Nypa fruticans Wurmb*), coconut palm (*Cocos nucifera*), sugar palm (*Arenga pinnata*), and palmyra palm (*Borassus flabellifer Linn*) (Phaichamnan et al., 2010; Saputro et al., 2019). Locals often made palm sugars from scratch without the addition of any artificial food additives or other refining processes. Palm sugar has been traditionally used as a sweetener for a long time in Malaysia, and it typically does not undergo any purification process or use any synthetic chemical in its production (Victor & Orsat, 2018). As a result, it is easier to be digested than refined sugar. However, limited research has been carried out to highlight the nutritional qualities and product characteristics of local palm sugars since they are still a niche product in many countries. Therefore, this paper aimed to review the bioprocessing and chemical compositions of palm sugar,

including its health benefits and risks as a potentially nutritious and healthy alternative sweetener. As a result, the paper review can help increase awareness about the health benefits of palm sugar among Malaysians.

2. Discussion

Conventional palm sugar production involves heating the filtered palm sap in a big wok at about 100ºC for several hours until it becomes concentrated and a typical aroma is obtained. For food safety reasons, the concentrated total soluble solids of palm sap should be at least 65 °Brix or higher (Phaichamnan et al., 2010). After the heating process is completed, the hot viscous brown sugar is poured into a plastic container or bamboo mould, and then the sugar will be cooled down for about an hour before being packaged. Palm sugar typically will last up to two years if stored properly. It should be tightly wrapped in plastic or an airtight container and kept in a cool, dark, and dry place. Maillard reaction and caramelisation, which occur during the heating process of palm sap, are responsible for producing the taste and colour of palm sugar (Saputro et al., 2019). Many studies (Ho et al., 2007, 2008; Naknean et al., 2010; Saputro et al., 2019) have claimed that the flavour of palm sugar is influenced by the presence of volatile compounds in palm sugar such as furans and pyrazines, which are formed during the thermal processing (Lee et al., 2019). The nutty and roasted flavour of palm sugar results from the high total concentration of pyrazines, while a higher ratio of furans derivative leads to sweet caramelize-like and burnt flavour (Naknean et al., 2010). The sugar colour can vary from light to dark brown due to Maillard reaction and caramelisation (Saputro et al., 2019) and the heating period during palm sugar processing (Wrage et al., 2019). Their influence on palm sugar colour can be proved by the decrease in L* value and an increase in a* value in the CIE colour system (L*, a*, b*) with the increased temperature and heating time (Naknean et al., 2013). Higher temperatures may cause more reducing sugar to react with amino acids during the Maillard process, resulting in brown pigment or melanoidin, contributing to the dark brown hue.

Palm sugars are generally considered nutritious because they contain adequate chemical compositions, including moisture, fat, protein, fibre, and carbohydrate content. These attributes are influenced by the minimal processing of palm sugar (Saputro et al., 2019). According to Choong et al. (2016), the increase in the total soluble solids heating temperature and time would reduce the water content of the sugars. Moreover, moisture content and water activity are used to monitor the shelf-life of sugar during storage because water can increase stickiness, microbial deterioration, and biochemical degradation reactions (Choong et al., 2016). The protein content which was reported by the previous literature is based on the Kjeldahl method. However, the principal of this method that measures total nitrogen, will overestimate the protein value in sugar. Thus our current review suggested that a more reliable method such as liquid chromatography should be employed to determine the protein value in palm sugar. According to nutrition facts, the fibre content of sugar is expected to be low as fibre, and most of the other nutrients in the plant are extracted during the processing (Choong et al., 2016). Therefore, the low content of crude fibre found in sugars could be due to the residue of the fibre left during sap collection, which was not filtered adequately during the manufacturing process. Ash content determines the total mineral content by oxidizing organic matters in sugar. A high carbohydrate content in palm sugar was attributed to the simple carbohydrate units, which allowed glucose to form long-chain polymer molecules such as starch, cellulose, and dextran, which might be linear or branched (Choong et al., 2016).

3. Conclusion

Maillard reaction and caramelisation are the two reactions that occur during the heating stage of palm sugars which contribute to their flavour and colour. As palm sugars are processed minimally, they retain various natural constituents that possess a wide range of biological actions advantageous to human health. These can be proven by the significant amount of chemical compositions, including ash, fat, protein, moisture, fibre, and carbohydrate found in palm sugars. Further research should be carried out to determine the ability of active ingredients of Malaysia palm sugar to perform various biological functions such as antibacterial and anticancer properties.

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