CHEMICAL COMPOSITION AND POTENTIAL COMMERCIAL VALUES OF RAMBUTAN (*Nephelium lappaceum*) PEEL: A REVIEW

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Abstract: Rambutan (*Nephelium lappaceum*) peel will be discarded upon processing or consumption but due high antioxidant content, it could attract the interest of experts in related fields. This study summarised the findings on the colouring compound, antioxidant and antimicrobial properties of rambutan peel, as well as the applications of rambutan peel in both food and non-food industries. It showed that flavonoid and anthocyanin are among the natural colouring compounds found in rambutan peel but due to instability on the fabrics, mordant was used for this purpose. On the other hand, a high amount of phenolic content has proved that rambutan peel is high in antioxidants and geranin was reported to be the highest contributor. Antioxidant extraction using methanol reported the highest yield, 67.57% followed by ethanol and water. While phenolic content was employed to determine the antioxidant capacity, ABTS, FRAP, and DPPH assays were used to measure the antioxidant properties of the rambutan peel extract. In addition, the rambutan peel extract also possesses the antimicrobial properties towards gram-positive bacteria such as *Staphylococcus aureus*. The objective of this paper is to discuss the research findings on the chemical composition and potential commercial values of rambutan (*Nephelium lappaceum*) peel.

Keywords: Rambutan peel, antioxidant, phenolic compounds, antimicrobial, application

1. Introduction

Rambutan (*Nephelium lappaceum*) is a tropical fruit native to Southeast Asia, particularly Malaysia, Thailand, and Indonesia. It is also one of the Sapindaceae family (Sekar, 2020). Rambutan fruit consists of peel, seed and pulp. Rambutan peels contribute to 50% of its total weight depending on the maturity of the cultivar. It is abundant in phenolic compounds such as geranin, ellagic acid, rutin, quercetin, and corilagin (Phuong, Le, Dang, Van Camp, & Raes, 2020). Besides, it is also known as rich source for natural dye compounds including anthocyanin and flavonoids (Amalia, Paramita, Kusumayanti, Sembiring, & Rani, 2019) while having antimicrobial properties (Sekar, 2020). Thus, due to the benefits and bioactive compounds in rambutan peel, the waste of rambutan peel from processed rambutan can be utilized in food and non-food applications (Mahmood et al., 2018).

2. Discussion

2.1. Colouring compounds in rambutan peel

Rambutan peel extract contains colouring compounds such as anthocyanin and flavonoids yet they are unstable on fabric (Amalia et al., 2019). Thus, a few methods were established to stabilize the colour by adding some chemicals such as mordant, blanching (Aadil, Roobab, Sahar, ur Rahman, & Khalil, 2019) and preservative compounds (Amalia et al., 2019). However, mordant is the most common method that has been used by researchers due to mordant being water insoluble and results in colour retention on fabric.

2.2. Antioxidant in rambutan peel

Besides that, in order to obtain the bioactive compounds in the rambutan peel, these peels need to be extracted. Most of the rambutan peel extraction was using methanolic, ethanolic and aqueous (Phuong et al., 2020). Based on the study, the highest yield was 67.57% by using methanol extraction (Mahendra, Lestari, & Aprillia, 2020) then ethanol extraction to which give a yield 33.2% (Palanisamy et al., 2011) then lastly aqueous extraction 29.97% (Yunusaa, 2018). The different yield produced from rambutan peel extraction due to the different types of solvent and technique which are affected by their solubility in the solvent used for extraction (Phuong et al., 2020). Phenolic compounds found in rambutan peel are geranin, ellagic acid, rutin, quercetin, and corilagin. The total phenolic compounds were determined by using Folin-phenol Ciocalteu's reagent (FC). The highest total phenolic content found in rambutan peel is 781.84 mg/g and geranin is the highest phenolic compound found (781.84 mg/g) (Phuong et al., 2020). However, different concentrations and types of solvent give different amounts of phenolic content in rambutan peels. To obtain a greater level of phenolic content, it is critical to use the appropriate extraction process.

Antioxidant capacity in rambutan peel was studied through DPPH, ABTS and FRAP assays. The ABTS test has been commonly used to assess the antioxidant activity of aqueous and lipophilic systems in vitro, whereas the DPPH assay has been used to examine the scavenging activities of antioxidants in lipophilic systems, while FRAP effective in screening antioxidant capabilities and comparing the efficacy of various substances (Phuong et al., 2020). One of the analysis from shows that the result for DPPH assay is 46.38 ± 0.31 g/100 g for soluble phenolic, while ABTS assay is 54.09 ± 2.40 TE/100 g dm for soluble phenolic and FRAP assay is 66.05 ± 2.74 Fe^{2+}/100 g dm for soluble phenolic (Nguyen et al., 2019).

2.3. Antimicrobial properties of rambutan peel

Study shows that rambutan peel extract inhibits gram-positive bacteria such as *Staphylococcus aureus*, *Streptococcus mutans*, *Bacillus subtilis*, and *Staphylococcus epidermidis* while insensitive most of Gram-negative bacteria such as *Escherichia coli*, *Candida albicans*, and *E. faecalis* (Sekar, 2020; Sukatta et al., 2021). This is because RPE is more efficient against Gram-positive bacteria than Gram-negative bacteria, which have a more complex cell wall. (Sukatta et al., 2021).

2.4. Applications of rambutan peel

There are several examples for applications of food and non-food application. Rambutan peel extract was added into oil to improve the shelf life and flavour retention (Mei et al., 2014). Besides that, anthocyanin in rambutan peel extract is used as a colour change indication for increased meat pH owing to chicken meat deterioration (Mahendra et al., 2020). On the other hand, rambutan peel also benefits in non-food applications such as in filler in packaging which can lower the cost of manufacture or to provide a specific function (Nadhirah, Sam, Noriman, Ragunathan, & Ismail, 2015). Rambutan peel was reportedly utilized in whey protein isolate film due to bioactive compounds such as corilagin, ellagic acid, geranin and gallic acid which exhibited antioxidant and antimicrobial activities. The film was dark-brown, which is appropriate for a food packaging application with UV light sensitivity (Sukatta et al., 2021).

3. Conclusion

In conclusion, it is proved that rambutan peel provides beneficial applications either in food or non-food areas because of its significant amount of colouring compound, antioxidant and antimicrobial properties. However, there are still limited resources on the comparison study between different species of rambutan especially in Malaysia and further study can be carried out to fulfil this gap.

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