



Review of Edible Packaging from Durian Seed Starch with Kesum (Polygonum minus Huds) Leaf Extract as Active Food Packaging

Cahyaning Rini Utami^{1*}, Muh. Aniar Hari Swasono²

^{1,2}Food Science and Technology Study Program, Faculty of Agriculture, Universitas Yudharta Pasuruan, Pasuruan, West Java, Indonesia.

Email: rini@yudharta.ac.id

ABSTRACT

Edible packaging, crafted from edible materials like starch, proteins, and fats, ensures safety and consumability. Durian seeds emerge as a promising base material, offering robust protection against environmental factors. Additionally, Kesum leaves harbor antimicrobial compounds, enhancing packaging efficacy. This study utilizes a literature review with content and bibliometric analyses, referencing journals and Google Scholar for secondary data. Findings reveal the potential of incorporating edible coatings from durian seeds and Kesum leaf extract into products stored at freezing temperatures. This application extends shelf life, curbs lipid oxidation, and prevents rancidity despite quality decline. Harnessing the natural properties of durian seeds and Kesum leaves, this research presents an innovative solution to packaging challenges. Edible materials not only enhance safety but also bolster sustainability by reducing waste and environmental impact. The inclusion of antimicrobial compounds ensures product integrity during storage. This study highlights edible packaging's transformative potential in food preservation and sustainability, promising benefits for consumers and the environment alike.

Keywords: durian seed, edible packaging, kesum leaf.

INTRODUCTION

Indonesia is the second largest country after China which is the largest contributor of plastic waste in the world. About 30% of plastic in Asia is consumed by Indonesians which is used as packaging material in various industrial sectors. Plastic has the potential to be a source of environmental pollution because the decomposition process lasts a long time until it reaches 12 years (Rahmawati et al., 2021). Plastic consumption in large quantities is based on the advantages of plastic as a packaging material that is flexible, not easily broken, strong, transparent, and economical (Hahladakis & Iacovidou, 2018; Handayani & Wijayanti, 2015). So it is necessary to strive for the use of packaging materials other than plastic to reduce the

quantity of plastic waste and environmental pollution (Bening et al., 2021; de Mello Soares et al., 2022).

Edible packaging is packaging made from edible materials such as starch, protein and fat so that it can be eaten by consumers (Mohamed et al., 2020; Petkoska et al., 2021; Rahmawati et al., 2021). There are two types of edible packaging, namely edible coating and edible film. Edible coating is usually directly applied as additional protection on the surface of food products. Meanwhile, edible film is applied to food products after being printed in sheet form (Lestari et al., 2020). Starch sources that have been used in making edible packaging in previous studies are cassava, sweet potatoes and potatoes (Hartati et al., 2020).

Durian seed waste can be used as a new product that is more economically valuable. Durian seeds are chosen as raw materials for making edible packaging because they contain carbohydrates (66.49%) and proteins (5.08%) (Hartati et al., 2020). The development of edible packaging has now arrived at improving the quality of products packaged with the addition of active ingredients or also called active packaging (Kerry et al., 2006; Oladzadabbasabadi et al., 2022; Ribeiro-Santos et al., 2017). The added active ingredients have properties that can improve the quality of both edible packaging and applied food products such as antioxidants, antimicrobials, and others.

Kesum leaves (*Polygonum minus* Huds) are known by the people of West Kalimantan as the spice of Bubur Padas, one of the typical foods of the Sambas Malay tribe (Abdullah et al., 2017; Rahim et al., 2022; Rahnamaie-Tajadod et al., 2019; Vikram et al., 2014). Sum leaves have active compounds that are used as good antimicrobial agents. The main compounds of Kesum leaves are dodecanal, decanal, and 1-decanol. Decanal and dodekanal are derivative compounds from aldehydes that are effective in improving the taste and aroma of Kesum leaves (Lestari et al., 2022). Based on previous research, antimicrobial bioactivity in essential oil of marrow leaves can inhibit the growth of *E. coli* and *Bacillus subtilis* bacteria (Lestari et al., 2020).

The use of edible packaging from durian starch-chitosan seeds can maintain the quality of food products in preventing oxidation, but pathogenic bacteria carried by food products can damage the edible packaging. Therefore, the addition of Kesum leaf extract is expected to increase the effectiveness of durian seed starch as a matrix-forming edible packaging, antimicrobial and antioxidant to food products to be applied. This study aims to determine the potential of durian seeds as edible packaging with the addition of marrow leaf extract as an antimicrobial in food packaging.

RESEARCH METHODS

The research design used in this study is literature study research with a qualitative descriptive approach using content analysis methods that refer to the analyzed journal manuscripts. The data source used is a secondary data source, which is data obtained from

the review literature of several journals related to the topic to be discussed. The keyword used in the journal search is "Edible Packaging of Durian Seed Starch with the Addition of Kesum Leaf Extract". In making it easier to find journals, you can use the keywords Durian Seeds, Kesum Leaves, Edible Film and Edible Coating. The literature was then analyzed using bibliometric methods using Publish or Perish software and VOSviewer.

RESULTS AND DISCUSSION

The Potential of Edible Packaging from Durian Seed Starch

The potential of durian seeds as a source of starch for making edible packaging is shown by its high starch content, which is around 66.49%. According to Cornelia et al (2013), based on color tests with chromameters show that durian seed bioplastics have a browner color than sago bioplastics because the durian seed starch used has not gone through the bleaching and refining process. This is shown by the protein content in durian seed starch which allows the maillard reaction to occur.

Variations in durian seed starch concentration in edible film making can affect film thickness. Cornelia & Tandoko (2017) stated that the higher the concentration of durian seed starch, the thicker the edible film produced. This is because the higher the starch content used, the higher the total solids in the edible film and the higher the viscosity of the solution will make the resulting edible film thicker. The thick and dense film matrix can also reduce the rate of moisture transmission caused by high starch levels which will increase the amount of film-forming polymers.

Based on research by Sulistriyono et al (2014), edible film with a composition of 1 g of durian seed starch, 20% glycerol and 1.0 ml star fruit pectin is the optimum composition that produces tensile strength reaching 8.516 mpa, elongation of 1.43% and edible film thickness of 0.11 mm. The resulting edible film is in the form of a slightly yellowish transparent sheet, not rigid, shiny, homogeneous and relatively safe to use as food wrapping because it is non-toxic and hydrocolloid. Durian seed biodegradable plastic has a tensile strength range between 1032.035-1187.732 N/m² and elongation ranges from 5.66% and 7.547% at the same composition level. The tensile strength value increases at 800c stirring process temperature and decreases at 900c. This is caused by polysaccharides that experience excessive swelling so that they experience a decrease in mechanical properties in biodegradable plastic durian seeds. Handayani & Wijayanti (2015) stated that the increase in temperature in the stirring process did not have much effect on the percentage of elongation. The elongation value on the plastic film can be affected by the level of plasticizer added, so temperature variations are not a big influence on the biodegradable plastic durian seeds.

Table 1. Edible packaging of Durian Seeds and Their Applications

Edible Material	Additives (additives)	Film Results/Characteristics	Application	Reference
10%, 30% and 50% durian seeds	Wheel bolt plastic LDPE	Color more brown, Does not change color during immersion test	-	Cornelia <i>et al</i> (2013)
Husband Durion 6%	2nd Plasticizer gliserol	Thickness 0.06 mm, Water vapor transmission rate 26.55 mm.m2/h, Elongation value of break 44.31%	Edible coating on red wine	Cornelia <i>et al</i> (2017)
Husband Distances 1G	BG Glycerol plasticizer 20% 1.5 g and star fruit pectin 1 mL	Rated tensile strength 8.516 MPa, Thickness 0.11 mm, Elongation 1.43%	Wingko wrapper	Sulistriyono <i>et al</i> (2014)
Husband Distances 10G	BG 25% glycerol plasticizer and 2% chitosan solution 50 mL	Tensile strength 1187.732 N/m2, Elongation 7.547%	-	Handayani & Vijayanthi (2015)

Kesum Leaf Extract as Active Packaging

Supplementation of kesum leaf extract in edible coating of durian seed starch has a major influence on the growth inhibition of *E. coli* and *S. aureus* shown in Budi Lestari *et al* (2018). The inhibition of bacterial growth in edible coatings added to perse leaf extract ranges from 3,432–4,344 mm (*S. aureus*) and 2,233–3,596 mm (*E. coli*). This shows that the active compounds in the leaves of the sum are more in line with gram-positive bacteria than gram-negative bacteria, because the inhibitory power in *S. aureus* bacteria is greater than that of *E. coli*. Active compounds in mum leaves that are known to have antimicrobial properties are phenolic group compounds, terpenoid-steroids, flavonoids and alkaloids. Flavonoids cause damage to the permeability of bacterial cell walls, lysosomes and microsomes because they interact with bacterial DNA, and alkaloids have anti-bacterial properties.

Kong *et al* (2022) stated that chitosan films added with variations of 1.0% (w/v), 2.0% (w/v), 3.0% (w/v) and 3.5% (w/v) showed the diameter of the inhibitory zone formed against *S. aureus* and *Salmonella sp.* Significantly improved (Kong *et al.*, 2022). The increase in the inhibition zone is due to the increase in anti-bacterial properties of edible chitosan film with supplementation of marrow leaf extract. This anti-bacterial property is obtained from active

compounds such as phenolics and flavonoids with high concentrations that can inhibit the growth of pathogenic bacteria.

Lestari et al (2020) stated that the type of packaging and storage time of processed beef sausage food products affect the value of TBA (thio barbituric acid) which is a test parameter for the results of unsaturated fatty acid oxidation. Processed meats contain less protein and water, but more fat and minerals. Fat found in processed food products of beef sausages can cause rancidity due to the oxidation process. The edible coating applied to the cow sausage affects the TBA value of the product. It is proved that during the 4-month storage period at freezing temperatures, cow sausages have an increase in TBA values caused by the continuous fat oxidation process. During the storage period, there has been no proven rancid smell in beef sausage and still retains the characteristic smell of beef sausage. Beef sausage products packaged with edible coating without kesum leaf extract (K1) have significantly higher TVB-N values than beef sausages packaged using edible coating with kesum leaf extract (K2) and synthetic packaging (K3) after being stored for 4 months at freezing temperatures. The addition of kesum leaf extract to edible coating can extend the shelf life of beef sausage for 4 months of storage at freezing temperatures with a TPC value of 9.65×10^4 cfu / g and a TVB-N value of 23.96 mg n / 100 g.

Table 2. Advantages and Disadvantages of Durian Seed Meal Finishing

Pangan Finishing	Advantage	Weaknesses	Reference
<i>Edible coating of red grapes</i>	Low shrinkage rate and extended shelf life	Water vapor transmission rate is not good	Cornelia <i>et al</i> (2017)
<i>Edible coating buah markisa</i>	Low weight shrinkage value and high total dissolved solids value	-	Rahmadani <i>et al</i> (2021)
<i>Edible coating bolu kemojo</i>	Low water rate and TBA value	Slightly hard texture	Raharjo <i>et al</i> (2018)

Data in bibliometric analysis tend to be massive and objective, although their interpretation depends on objective and subjective evaluations used through informed procedures (Donthu et al., 2021). Bibliometric analysis using VOSviewer consists of 3 components, namely Network Visualization, Overlay Visualization, and Density Visualization. Network Visualization shows the relationship between research items and keywords that have been entered previously. A thick line connecting one item to another indicates that there is a relationship between one item and another. Overlay Visualization in the literature analysis that has been carried out shows the level of novelty of the literature and the traces or research

history obtained from the keywords that have been used (Hartati et al., 2020). The brighter the color on the line, the literature is a literature with a high degree of novelty. Density Visualization shows that almost all items related to keywords used have high color intensity, which means that the quantity of research with these items is fairly high (Nugraha, 2023).

CONCLUSION

The similarity of the results of the literature review of 6 reference journals is the discovery of the potential of durian seeds and Kesum leaves as edible packaging materials and active packaging of food products. In each journal there are advantages shown by the use of different methods and treatments, but still produce edible packaging that is feasible and has the potential to be applied to food products. It is hoped that the results of this literature review can be considered or compared to be used as improvements in the presentation of the final results and potential of edible packaging in the food industry, making it easier for readers to understand the essence of the research and know the potential of edible packaging in the food industry.

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