INDONESIA

Antopack

Utilization of Sugarcane Bagasse with *Brassica oleracea var. capitata F. rubra* Extract as Biopolymer Film to Indicate Food Spoilage

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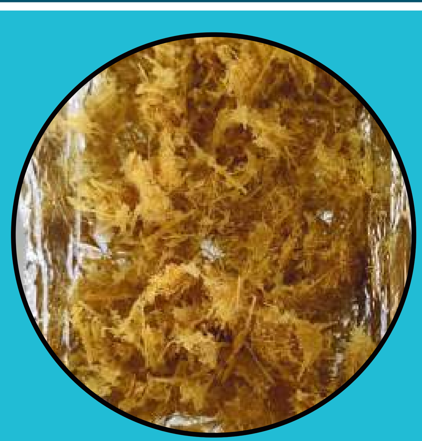
INTRODUCTION

Biosensors based on sugarcane bagasse have the potential to efficiently and environmentally detect spoiled food. Sugarcane bagasse, as an industrial waste, can be utilized to create economical and sustainable biosensors. Anthocyanins from purple cabbage serve as a color indicator sensitive to pH changes that occur when food begins to spoil. The combination of sugarcane bagasse and anthocyanins can produce an easy-to-use biosensor for detecting food spoilage. This approach also supports the principles of the circular economy by utilizing biomass waste, potentially offering a practical solution to ensure food safety.

DATA & DISCUSSION


Sugarcane Bagasse


Bagasse after delignification


Bagasse cellulose

Cellulose is obtained from hydrolyzing the sugarcane bagasse with NaOH, which aids in breaking down the lignin structure. The second stage of extraction involves bleaching the delignified bagasse with sodium hypochlorite (NaOCl) to disrupt the ether linkages in the lignin structure. Sodium hypochlorite can degrade and remove the remaining lignin. This procedure yields a white almost pale yellow residue that is the cellulose, indicating that lignin components are eliminated during the delignification process.

TENSILE STRENGTH

Parameter Bioplastik	Kuat Tarik (N/mm²)
F1	0.3675
F2	0.3731
F3	0.3992

The tensile strength of the biopolymer increases as the cellulose concentration increases. This is because the interaction between cellulose and chitosan is getting tighter, causing the resulting biopolymer to be strong and stiff. There is an interaction between chitosan and cellulose to form hydrogen bonds to so the more hydrogen bonds there are in the biopolymer will cause the polymer to be stronger and more difficult to break.

RECOMMENDATION

Based on our findings, recommendation for future research should:

1. Explore many other options of biopolymer base, such as alginate, starch, carrageenan, and other material with ability to make polymer.
2. Investigate its biodegradability to ensure it is completely biodegradable and to avoid adding non-biodegradable waste.

METHOD

CELLULOSE EXTRACTION

- The process involved 3 stages: delignification, bleaching, and drying.
- Cellulose was extracted from sugarcane bagasse, treated with sodium hydroxide, and bleached with sodium hypochlorite.

TENSILE STRENGTH

- The mechanical properties of the biopolymer were tested using a Universal Tensile Testing Machine.
- The test evaluated tensile strength and material durability.

BIOPOLYMER PREPARATION

- Cellulose was mixed with chitosan, glycerol, citric acid, and distilled water in various formulations, then heated and dried.
- Three different formulations were tested to determine the optimal composition.

ANTHOCYANIN EXTRACTION

- Ultrasound-Assisted Extraction (UAE) was used to enhance efficiency and yield.
- Red cabbage simplicia was extracted with ethanol, heated, and concentrated.

PH TEST

- Anthocyanins were tested with a pH 1-14 buffer solution to observe color changes.
- The color changes demonstrated sensitivity to pH variations, critical for detecting food spoilage.

DATA & DISCUSSION

FORMULA

F	Chitosan	Cellulose	Glycerol
F1	2 gram	10 gram	19 gram
F2	2 gram	15 gram	19 gram
F3	2 gram	20 gram	19 gram

F2 produced the best balance in terms of texture, water resistance, and strength.

COLOUR ANALYSIS

The color change can be observed when the polymer is in contact with acidic or basic solution, in this case spoiled food

CONCLUSION

This research produced anthocyanin-based biopolymer sensors (ANTOPACK) that exhibited significant color changes within the pH range of 1-14. The biopolymer demonstrated elastic, strong, and pH-sensitive properties, that can withstand up to 0.2 kg of weight with the ability to detect spoilage in fresh food.

REFERENCES:

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