第２２回農学部賞　受賞者

・Yang Yiqi
　国際コース　合成生物学研究室

第２２回生物資源環境科学府賞
受賞者

・LARAS PUTRI WIGATI　（博士後期課程）

環境農学専攻　　農産食料流通工学分野

「Development of starch based edible coating enriched with essential oil for fresh strawberry preservation（生鮮イチゴ貯蔵のための精油添加デンプンベース可食コーティング剤の開発）」

Name : Laras Putri Wigati

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Category : Kou

Thesis Summary

Films and coatings for edible packaging have been implemented to extend the shelf life of fresh fruit products. The characteristics of the materials and the intended purpose of the application determine how edible packaging is developed. The objectives of this study were to (1) develop edible coating formulated from jicama corn starch, Indonesia-origin agarwood *bouya* essential oil, and calcium propionate. (2) characterize the functional properties of the coating film. (3) apply the edible coating on fresh fruit and characterize the effects. The finding expected that it may facilitate the development of food-grade coating for agriculture products.

In the first work, the film was prepared by adding agarwood *aetoxylon bouya* essential oil and calcium propionate to investigate its properties as an edible coating for fruit or vegetables. The microstructure of the edible film was observed using scanning electron microscopy. The three main materials mostly had significant effects ($P < 0.05$) on the properties of the sample films, and starch film incorporating essential oil-calcium propionate showed optimum properties as an edible coating material because it had the highest elongation of 10.81%, the lowest stiffness with a Young's modulus of about 2.53 MPa, the lowest of water vapor transmission rate and permeability of 0.117 g h^{-1} m^{-2} and 3.092 g mm h^{-1} m^{-2} KPa^{-1}, respectively, and the lowest weight loss of 75.30%. It was also found that the microstructure of starch-essential oil-calcium propionate film had a homogeneous surface, and the presence of essential oil droplets was not visible.

Further work, the effect of edible coatings made from yam bean starch (ST), agarwood *bouya* essential oil (ES), and calcium propionate (CP) on strawberry fruit in cold storage for 16 days was investigated. Strawberries coated with four different coating formulations and uncoated fruits were packed in sealed containers and stored at 4°C with 85% of humidity. Antifungal evaluation was conducted on the coating solution (membrane permeability and germination of Botrytis cinerea) and edible film (microstructure analyzed using atomic force microscopy), as well as testing at 4-day intervals on fresh fruit (weight loss, surface color, firmness, microstructure using scanning electron microscopy, and antifungal activity) and physicochemical analysis of strawberry juice (total soluble solid, citric acid, ascorbic acid, pH, and titratable acidity). Each result was then tested using TOPSIS-Shannon entropy analysis. From these tests,

the edible coating treatment with ST-ES was the best treatment in this study (has Ci 0.839 as the highest of all untreated and treated sample) and better than fruit without coating, demonstrating that the coating was able to maintain the quality of strawberries during storage. At the final day of storage ST-ES samples has L* 30.9, a* 26.65, b* 16.36, total soluble solid 3.98 Brix/%.

Lastly, strawberry may lose their physical properties during storage, also undergo changes in color and biochemical properties, e.g., anthocyanins, flavonoids, phenols, and antioxidants. These natural substances in strawberry are important for human consumption to achieve nutritional needs and prevent diseases. This study investigated the effect of edible coating treatment on changes in the biochemical content of strawberry. The edible coating used in this study has three main components, namely a combination of jicama starch (ST), agarwood *bouya* essential oil (ES), calcium propionate (CP). The results were analyzed using the TOPSIS Shannon Entropy method to find the best treatment. With a ranking of 0.717, the ST-ES edible coating had the best color stability and performance in preventing the loss of biochemical contents in strawberry during storage, especially the average of change of color density (10.26 %), polymer color (9.27 %), percent of polymer color (23.51 %), total flavonoid content (16.18 %), and antioxidant content (3.57 %).