

UNIVERSITI TEKNOLOGI MARA

**MECHANICAL, PHYSICAL,
ANTIMICROBIAL AND
FEASIBILITY STUDY OF PLA-
BASED NANO BIO-PLASTIC FOR
FRUIT PACKAGING**

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ABSTRACT

The emergence of many new food products on the market has led to food spoiling during its shelf life and many food packages being thrown away. Therefore, nano bio-plastic packaging has been introduced in the packaging industry. Nano bio-plastic packaging helps to prolong the shelf-life of products through the use of nanoparticles and essential oil. In addition, nano bio-plastic packaging was made from biodegradable polymers that can be decomposed. Nano bio-plastic films made from polylactic acid (PLA) and nanoclay were produced using a solvent casting method with addition of 1.0%, 3.0% and 5.0% (wt.) nanoclay and a constant volume of lemongrass essential oil were added to the PLA solution. The mechanical, physical, chemical, and antimicrobial properties of the nano bio-plastic films were investigated. To analyses the film samples, tensile testing, FTIR analysis, UV-barrier testing, and scanning electron microscopy (SEM) were performed. The feasibility study on the using of nano bio-plastic as fruit packaging was done on red grapes for 14 days. The weight loss and firmness of red grapes were measured. Mechanical test showed the nano bio-plastic films with 3.0 wt. % nanoclay has optimum mechanical properties with tensile strength (TS) 30.36 MPa and elongation at break (EAB) 7.05%. The increment in TS and EAB are 20% and 80% respectively, over the pure PLA film. The transparency of the PLA film was not significantly affected by the addition of nanoclay and interestingly, 1.0 wt. % and 3.0 wt. % nanoclay showed approximately the same value of light transmission which are 84.86% and 83.95%, respectively. The incorporation of lemongrass essential oil (LgEO) shows antimicrobial properties of PLA nano bio-plastic against *S. aureus* and *E. coli* with 14.30 - 18.40 mm inhibition zone. The feasibility study resulted the red grapes packaged with nano-bioplasic packaging shows better physical appearance as compared to the grapes packaged with control PLA film. From this study, PLA nano bio-plastic films shows the best properties at 3% nanoclay and have proven to have anti-microbial ability to prolong the freshness of fruit, thus could be a good alternative material in food packaging.

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