

**UNIVERSITI TEKNOLOGI MARA**

**MECHANICAL AND THERMAL  
PROPERTIES OF BIODEGRADABLE  
COMPOSITE FROM KENAF FIBRE  
AND POLYLACTIC ACID POLYMER**

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## ABSTRACT

Natural fibre (kenaf fibre) reinforced natural polymer, polylactic acid (PLA) was used for production of composites, where end life disposal is harmful to human and environment and able to self degraded. It is due to abundance of solid waste accumulation especially from plastic materials that seriously has taken numerous attentions. Kenaf bast and core fibre was separated and treated similarly to reinforce PLA. The effect of preparation condition such as acid hydrochloric concentration, extrusion rotation speed and amount of fibre loading was used to investigate composites properties. While the effect of natural weathering and landfill burial on composites properties was investigated for its degradation. Kenaf fibre was treated at 6% w/w NaOH followed by various HCl concentrations (0.5 M, 1.0 M, and 1.5 M). Fibres were then cryo-crushed to reduce size and compounded with PLA at various rotation speed (60, 70, and 80 rpm) and fibre loading (2, 4, and 6%) to determine the optimum parameter. Mechanical properties (flexural and impact), thermal properties (TGA and DSC), microscopic observation (SEM and TEM), Fourier Transform Infra-Red (FTIR), X-Ray Diffraction (XRD) were done for the investigation of the composites properties. Results reveal that treatment at 1.0 M HCl, with 60 rpm extrusion speed and 2% fibre loading has optimum properties for both KBC and KCC. Interestingly, KCC has comparable strength with KBC where statistical analysis shows no significant difference in the value of most mechanical properties. Although KCC present slightly lower thermal stability than KBC, temperature difference was in smaller range. It is proved that reinforcing ability of kenaf core fibre is as similar as kenaf bast fibre. In addition, reinforced composites (KBC and KCC) have shown positive self-degradation compared to neat PLA and more degradation was visible using landfill burial than natural weathering condition with almost 15 - 19% and 2 - 4% weight loss respectively after 6 month exposure. Due to slow degradation on natural weathering condition, KBC and KCC are useful for self-degraded materials for outdoor application against Malaysian weather.

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