

**UNIVERSITI TEKNOLOGI MARA**

**PROPERTIES AND  
MORPHOLOGICAL  
CHARACTERIZATION OF  
HDPE/KENAF/NANOCLAY  
COMPOSITES BY USING SINGLE  
SCREW EXTRUDER**

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## ABSTRACT

Biocomposites or green composites are formed by a biopolymer matrix and reinforcement of natural fibers. Increasing concerns for the environment is a major driver of the bio composite market. Most previous publications focused only on the blending of polymer with natural fiber using coupling agent and stabilizer but still lacking of desired properties approached. Therefore, the main goal of this research is to investigate and approve new promising using nano size particle to enhancing properties of bio-composites product. The blending of high density polyethylene (HDPE)/kenaf fiber (ranges of 10-50 wt. %) and HDPE/nanoclay (range of 1-5phr) were prepared as preliminary study to select formulation for HDPE/kenaf fiber and nanoclay composites by melt compounding using single screw extruder followed by compression molding. Formulation of (HDPE/kenaf = 70/30 wt. % and 60/40 wt. %) were blended with 1 phr, 2 phr and 3 phr nanoclay (MMT) in the presence of TP01 (1.5 phr) and TP10 (1 phr) as processing additives to become nano hybrid biocomposite. The mechanical properties of the samples; tensile test and flexural test were measured by the universal tensile machine. Impact test was measured using Izod Impact Tester and bending temperature was measured by Heat Deflection Temperature (HDT). Besides, swelling behavior test was measured using water absorption and mass swell in Sodium Hydroxide (NaOH) test. X-ray diffraction (XRD), scanning electron microscopy (SEM) and transmission electron microscope (TEM) were used for function of nanoclay morphological characterization in HDPE/kenaf/nanoclay hybrid nano bio-composite. The result revealed that tensile strength, tensile modulus, flexural strength, flexural modulus and impact strength (HDPE/kenaf = 70/30 wt. % and HDPE/kenaf = 60/40 wt. %) were increases with the increasing of nanoclay loading up to 3 phr. Also, the bending temperature on HDT test of HDPE/kenaf composite filled with nanoclay was increase than without nanoclay. From XRD measurement, there were exfoliated and intercalated during melt processing using nanoclay based on small shifted angle happen. Based on micrograph of SEM, addition of nanoclay helps to improve adhesion between HDPE and kenaf fiber supported by mechanical test results. The presence of kenaf fiber in composite greatly increase water absorption and mass swell. Nanoclay was help to reduce the percentage of swelling behavior on (HDPE/kenaf = 70/30 wt. % and 60/40 wt. %) composite. Increases loading of nanoclay up to 3 phr decrease the percentage of water absorption and mass swell of composites.

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