

# Mechanical and Thermal Properties of Calcium Carbonate filled Kenaf Reinforced UPE/EPO Composite

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**Abstract.** Commercialized unsaturated polyester resin which being used as a matrix system in composite materials is petroleum based and not environment friendly. Towards the sustainable green technology era, an advanced green composite materials have widely being studied using natural and renewable source materials such as vegetable oil and natural fibre. In line with the stated issues and needs, this study presents the development of advanced green composites made from a mix of non-renewable based unsaturated polyester (UPE), renewable based epoxidized palm oil (EPO) and natural calcium carbonate (CaCO<sub>3</sub>) filler onto Kenaf (*Hibiscus cannabinus*) mat. Palm oil based unsaturated resin is the latest advanced green composite that has been explored by researchers nowadays. According to the previous study, the addition of palm oil decreased the tensile modulus and strength of UPE resin. Thus, this study was conducted to explore the potential of adding CaCO<sub>3</sub> as filler to enhance the modulus and strength properties of the UPE/EPO blend resin. In this study, UPE were firstly mixed with EPO at a ratio of 80/20 with addition of CaCO<sub>3</sub> at different loadings (3 phr, 5 phr, 7 phr and 9 phr) and benzoyl peroxide initiator (1.5 phr). The resin was then hand layed-up onto the kenaf mat, further undergo hot pressed and curing process. The composite was characterized using Fourier-Transform Infrared Spectroscopy (FTIR). The thermal and mechanical properties of the composite were studied by Thermogravimetric Analysis (TGA), Universal Testing Machine (UTM) and Izod impact test. The findings revealed that the addition of CaCO<sub>3</sub> had maximally improved the Young's modulus and strength of the composites at 5 phr CaCO<sub>3</sub> loadings. Increased the stiffness and strength properties due to the addition of CaCO<sub>3</sub> also has proven by the decreasing of elongation at break and Izod impact strength properties. In addition, incorporating CaCO<sub>3</sub> in UPE/EPO resin also improved the thermal properties of the resulted UPE/EPO/kenaf composite. It can be concluded that addition of natural filler, CaCO<sub>3</sub> in UPE/EPO resin is a promising steps to produce high performance UPE/EPO/kenaf composite.

**Keyword:** Calcium carbonate, Epoxidized palm oil, Unsaturated polyester, Biothermoset resin, Kenaf fibre

## INTRODUCTION

Unsaturated polyester (UPE) resin is a synthetic polymer resin that derived from petroleum and natural gas. There are more than 2 million tonnes of unsaturated polyester (UPE) resins are used globally for the production of a large assortment of products, including composites, pipes, storage tanks, boats, aircraft and also automotive parts due to the excellent balance between their mechanical, electrical, chemical properties and their low cost. In addition, UPE resin