UNIVERSITI TEKNOLOGI MARA

THE MECHANICAL AND THERMAL PERFORMANCE OF CHICKEN EGGSHELL FILLED UNSATURATED POLYESTER COMPOSITE

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Thesis submitted in fulfilment of the requirements
for the degree of
Master of Science

Faculty of Applied Sciences

July 2011

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Thesis Title	THE MECHANICAL AND THERMAL PERFORMANCE OF CHICKEN EGGSHELL FILLED UNSATURATED POLYESTER COMPOSITE.

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Date: 22 JULY 2011

ABSTRACT

The development of new polymer composite by incorporated chicken eggshell (Es) with thermosetting unsaturated polyester (PEs) was developed. Es is known to be one of waste material which being dumped into landfill. In Malaysia, 28k tonne per year of Es being dumped to the landfill and causes serious ground and underground water pollution. Es composed mainly of 94% of the most stable natural calcium carbonate ($CaCO_3$) in the form of calcite crystal. Calcite crystal was found to have higher density and crystallinity which expected to yield excellent mechanical performance when it used in the fabrication of chicken eggshell filled unsaturated polyester composite (EsPEs). On the other hand, calcite posse's high thermal degradation temperature in which it can sustain its original molecular structure at very high temperature. In this particular project, Es particulate were subdivided into three difference particulate sizes (more than 200 μm, in between 100-200 μm and less than 100 μm) and each of the particulate size would further divided into 30, 40, 50, 60, and 70 % of filler loading to be incorporated into PEs resin. The composite was fabricated using cold press machine in room temperature. The project flow involves material collection, washing and drying, material processing, sample fabrication and testing/analysis. The mechanical test such as tensile, flexural and drop weight impact test was conducted to EsPEs composites. Thermal test was also conducted to determine the k-value or thermal conductivity of the sample and further analyzed to determine samples' thermal performance. As for the physical test, density measurement and water absorption test were also conducted. The mechanical properties of EsPEs composite were determined by tensile, flexural and impact test. By increasing amount of Es filler loading, the tensile and flexural modulus of EsPEs increase due to nature of Es particulate which provide rigidity and stiffness to the composite. The smaller size of particulate used in fabrication of EsPEs composite yielded higher tensile and flexural modulus compared to larger Es particulate size due to evenly distribution of small Es particulate in the composite. As for the thermal performance, higher filler loading and smaller Es particulate size used in EsPEs fabrication lead to the decreasing k-value of the composite (good as thermal insulator). The density of EsPEs samples increase proportionally with increasing amount of Es filler and smaller Es particulate would resulted in higher density value of EsPEs composite. The ability of EsPEs composite to absorb water increased as the amount of Es loading increased. Larger particulate filler of Es would assist water absorption rate by providing countless micropores for water to easily penetrate the composite.

ACKNOWLEDGEMENTS

In the name of Allah, The Most Gracious and The Most Merciful. Sholawat and salam to the Messenger of Allah, Muhammad SAW. First and foremost, greatest praises and thanks to Allah, For Him the One I depend on when the path seems hard and winding. I am in particularly indebted to Associate Professor Dr. Mohd Hanafiah Bin Abidin for his guidance, supervision and valuable advice throughout the work of this thesis. Sincere gratitude and appreciation are also due to Dr. Ahmad Zafir Bin Romli for his attention and time he had put upon me.

My appreciation also goes out to my parent, Mr. Kamarudin Bin Jazuli and Mrs. Hammidah Binti Yahaya who generously provided helpful assistance throughout the project and for all the good and difficult times. Not to forget to Universiti Teknologi MARA (UiTM) especially Polymer Technology Department and Polymer Composite Research Laboratory (PoCRe Laboratory) staffs for providing me calibrated testing machines and the opportunity of realizing my second degree.

Lastly to all my colleagues, thank you for all the supports, advices, and skills provided to me throughout the entire project. To Mr. Rassimi Bin Abdul Ghani, thank you for sharing the knowledge together and nothing can show my appreciation and describe my satisfaction.

Mohd Hariz Bin Kamarudin

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