

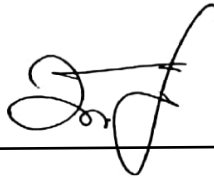
**UNIVERSITI TEKNOLOGI MARA**

**EFFECT OF VARIOUS LOADING OF  
TREATED CLAM SHELLS (tCS-CaCO<sub>3</sub>)  
FILLED ACRYLONITRILE BUTADIENE  
RUBBER (NBR) COMPOSITES ON CURE  
CHARACTERISTIC, PHYSICAL AND  
MECHANICAL PROPERTIES**

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**Final Year Project Report Submitted In Fulfillment  
of the Requirements for the  
Degree of Bachelor of Science (Hons.) Polymer  
Technology  
In the Faculty of Applied Sciences  
Universiti Teknologi Mara**

This Final Year Project Report entitled “**Effect Of Various Loading Of Treated Clam Shells (tCS-CaCO<sub>3</sub>) Filled Acrylonitrile Butadiene Rubber (NBR) Composites On Cure Characteristics, Physical And Mechanical Properties**” was submitted by Nur Aliyyah Binti Yunus, in fulfillment of requirements for the Degree of Bachelor of Science (Hons.) Polymer Technology, in the Faculty of Applied Science and was approved by



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## ABSTRACT

Clam Shells treated silane coupling agent reinforced nitrile butadiene rubber composites were successfully prepared by incorporation of different loadings of clam shells on its cure characteristics, physical and mechanical properties. Meanwhile, clam shell (CS) and calcium carbonates ( $\text{CaCO}_3$ ) were characterized by using the fourier transform infrared (FTIR). From this FTIR result, it was showed that there was same functional group between the CS and  $\text{CaCO}_3$ . The curing characteristics of the composites on optimum cure time ( $T_{c90}$ ) were determined which the higher filler loading of tCS- $\text{CaCO}_3$  resulted in higher cure time and it were vulcanized at  $150^\circ\text{C}$  using hot press.

Furthermore, the mechanical properties of the NBR composites such as tensile strength had optimum value 4.736 MPa, while for the elongation at break the optimum value was 614.747 %. Both mechanical properties was increased by increasing the amount of filler loading. Other than that, for the hardness, swelling percentage (%), crosslink concentration (g/mol) and density ( $\text{g/cm}^3$ ) were studied which gave value of 51.4, 3.64%, 1.68 (g/mol) and  $1.28 \text{ g/cm}^3$ . The good dispersion of clam shells and nitrile rubber were enhanced by treated of silane coupling agent (Si-69) that had been added in rubber composites. The presence of coupling agent also gave good curing time as well as enhanced the mechanical and physical properties of NBR composites.