UNIVERSITI TEKNOLOGI MARA

THE EFFECTS OF DIFFERENT IMMERSION MEDIA AND TEMPERATURES ON THE COMPRESSIVE BEHAVIOUR OF ARENGA PINNATA – SILICONE BIOCOMPOSITE

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of the requirements for the degree of
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AUTHOR'S DECLARATION

I declare that the work in this dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Arenga Pinnata (AP) is one of many natural fibres around the world which gained popularity among composite material researchers in 21st century. Being a bio-based material, the fibre's biodegradability possesses strong potential in replacing synthetic fibres in the future. By employing AP as a reinforcement for silicone rubber, results showed promising values in terms of sealing and cushioning applications. High elastic property of silicone rubber paired with the excellent seawater resistance of AP fibres further proves the statement. Taking sealing and cushioning into statement, recent studies in regard to the compressive behaviour of Arenga Pinnata – Silicone biocomposite (AP-Sil) were only limited to oily and unsoaked conditions. Scarcity of research of this biocomposite results in compressive behaviour of AP-Sil not being well understood. This research aimed solely to determine the compressive behaviour of AP-Sil in various immersion media and temperature exposure. Firstly, AP-Sil samples ranging from 0wt.%, 4wt.%, 8wt.%, 12wt.% and 16wt.% were prepared. The samples were then soaked to different immersion medium (water, seawater, engine oil) while at the same time exposed to 0°C, room temperature, and 50°C. They were then tested in two types of compressive mechanical test; compression set and compression test. Both tests follow ASTM D349 and ASTM D575 respectively. Since this is a soft composite, hyperelastic constitutive models; Neo-Hookean, and Mooney-Rivlin were also adopted using Excel Solver tool. In compression set test, this study displayed when at greater temperature condition, compression set ratio values are higher. This indicates lower recoverability for high-temperature-exposed AP-Sil samples. Similarly, high temperature condition also allowed AP-Sil to withstand greater compressive force. Among the immersion media used, water-soaked samples proved to withstand greater compressive stress while engine oil-soaked AP-Sil samples displayed the highest compression set ratio. Through numerical study, Mooney Rivlin model showed the best performance to accurately curve fit the experimental data of all samples in comparison with Neo-Hookean. This can conclude that the objectives of the study were well achieved and the effect of different immersion medium and temperature on the compressive behaviour of AP-Sil was well understood.

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