ISETC2025

UNIVERSITI TEKNOLOGI MARA

ISETC2025

2 ND INTERNATIONAL SCIENCE, ENGINEERING AND TECHNOLOGY COLLOQUIUM



THE POWER OF SCIENTIFIC INNOVATION

INTELLIGENT SOLUTIONS FOR A SUSTAINABLE WORLD

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PREFACE

Welcome to the 2nd International Science, Engineering and Technology Colloquium 2025 (ISETC 2025)!

It is with great pleasure that we present this year's colloquium, a distinguished gathering of scholars, researchers, and professionals dedicated to the advancement of applied sciences. Held virtually on 9th July 2025, ISETC 2025 serves as a platform to highlight cutting-edge research, foster meaningful networking, encourage collaborations, and explore innovative solutions to global challenges.

This year's theme, "The Power of Scientific Innovation: Intelligent Solutions for a Sustainable World" highlights our shared goal to solve global challenges through applied science. It celebrates innovation as a key to building a more sustainable and resilient future. We're proud to feature keynote speakers and presenters who bring fresh insights, bold ideas, and breakthroughs shaping tomorrow's world.

We would like to extend our heartfelt appreciation to the Faculty of Applied Sciences, Universiti Teknologi MARA, Perak Branch, Tapah Campus, for their outstanding support and assistance throughout the planning and execution of the event. Their dedication has been instrumental to the success of this colloquium. We would like to sincerely thank all participants and researchers for their valuable contributions. We also appreciate the reviewers for their careful evaluations and helpful feedback. Your hard work and support mean a lot to us.

As editors, we are proud to present this collection of proceedings. It is an honour to bring together the interesting and meaningful work of our speakers and authors. We hope the ideas shared will lead to new discoveries, encourage more research, and help solve global challenges through science and innovation.

Warm regards,

Dr. Emi Norzehan Mohamad Mahbob
Dr. Saiyidah Nafisah Hashim
Ms. Lili Widarti Zainuddin
Ms. Nurul Nazwa Mohammad
Ms. Rozaina Saleh

ISETC 2025 Proceedings Editors

TENSILE FRACTURE OF EGGSHELL-SILICONE BIOCOMPOSITION WITH MOLD STAR

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Abstract: This study focused on the fabrication of the eggshell-silicone biocomposite and the evaluation of its tensile properties. Eggshells, as a major waste product, were incorporated with silicone elastomers (Mold Star) in 4%, 8%, and 12% weight ratios to improve mechanical strength and reduce environmental impact. The biocomposites were tested for tensile fracture using the INSTRON 3382 Universal Testing Machine based on the ASTM D412 standard. A stress-strain graph was plotted to observe the behavior. The results showed that the material became stiffer as eggshell content increased, but tensile strength and Young's Modulus decreased. The maximum Young's Modulus observed was 0.943 N/mm² for 4 wt.% eggshell and decreased to 0.797 N/mm² for 12 wt.%. These results are aligned with other bio-fillers such as kenaf and Hevea Brasiliense in silicone composites. The experiment concluded that increased filler content resulted in stiffer but more brittle material behavior.

***Keywords*:** *Eggshell, silicone, biocomposite, tensile fracture, mold star, ASTM D412*

INTRODUCTION

Silicone, often used in synthetic skin production, appears in the dermatology industry with the current trend for the care of burn wounds or skin damage (Patar et al., 2024; Mohd Noor et al., 2014). Moreover, the composition of silicone or polyurethane is highly used as a skin substitute. One ideal quality feature searched in synthetic skin is the durability of silicone itself, which this study focuses on. Eggshell, on the other hand, has great potential in the making of the perfect substitute in synthetic skin production as it is one of the main environmental biomaterials wastes and is strong due to its similarity in composition to limestone and cement (Ajala et al., 2018; Murthi & Poongodi, 2023). Therefore, eggshells can be an eco-friendly composite in silicone production to increase the tensile strength of silicone to mimic the properties of synthetic skin. Silicone is a synthetic polymer with a chemical bond of silicon to oxygen (Azmi et al., 2017). From long-term durability to high biocompatibility, silicone is used in personal care, pharmaceutical, and medical applications (Hidzer et al., 2025). This study experiments with a mixture of eggshell and silicone, expecting enhanced tensile strength, using ASTM D412 standards to evaluate tensile fracture behavior.

MATERIALS AND METHODS

Eggshells were sourced, cleaned, dried, and ground. Biocomposites were fabricated using Mold Star parts A and B mixed with 4%, 8%, and 12% eggshell powder. The mixture was poured into dog-bone-shaped ASTM D412 molds and cured. Tensile tests were conducted using the INSTRON 3382 machine. Stress, strain, and Young's Modulus were calculated for each sample.

RESULTS AND DISCUSSION

Stress-strain graphs showed that higher eggshell content led to reduced maximum tensile stress and Young's Modulus, indicating increased stiffness and brittleness. The highest Young's Modulus (0.943 N/mm²) was observed at 4 wt.%, while 12 wt.% resulted in the lowest (0.797 N/mm²) as shown in Figure 1, Figure2 and Figure 3.

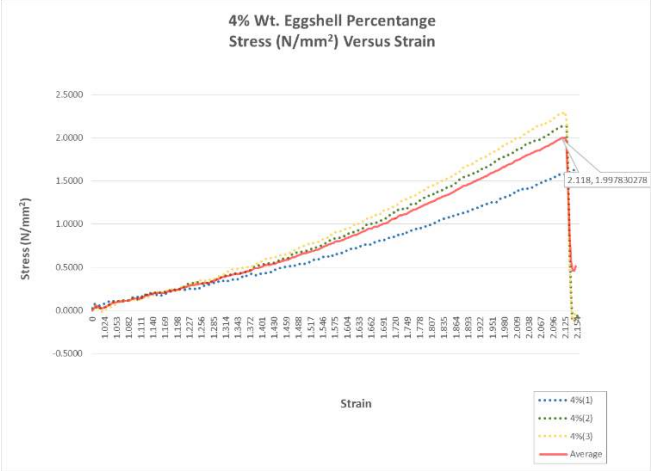


Figure 1. Eggshell-silicone Stress-strain Graph (4 Wt.%)

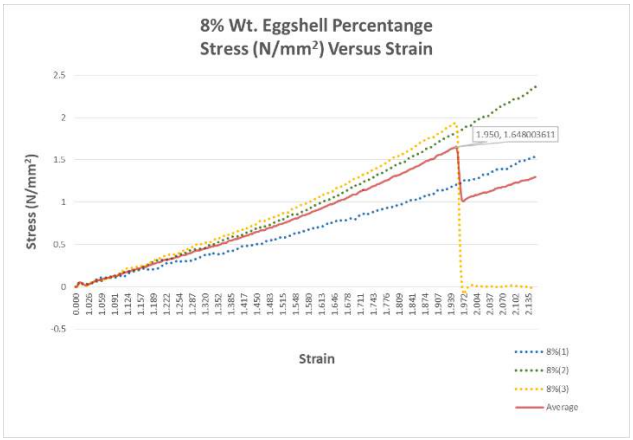


Figure 2. Eggshell-silicone Stress-strain Graph (8 Wt.%)

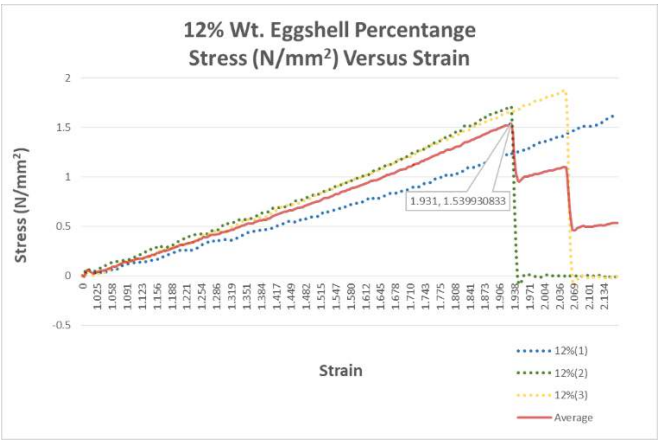


Figure 3. Eggshell-silicone Stress-strain Graph (12 Wt.%)

Table 1. Young's Modulus of Eggshell-silicone Biocomposite

	Eggshell Weight Percentage (Wt.%)	Maximum Break Strain	Maximum Break Stress (N/mm^2)	Young Modulus (N/mm^2)
Silicone-Eggshell Biocomposite with Mold Star	4	2.118	1.998	0.943
	8	1.950	1.648	0.845
	12	1.931	1.540	0.797

CONCLUSIONS

This study aimed to fabricate eggshell-silicone biocomposites with 4%, 8%, and 12% eggshell particles and evaluate their tensile properties based on ASTM D412. All objectives were achieved. As eggshell content increased, the biocomposite became stiffer but more brittle. The highest Young's Modulus and breaking stress occurred at 4 wt.% and decreased at higher contents. Mold Star-based silicone withstood more stress than EcoFlex, suggesting material selection influences performance. Eggshell acted as a stiffener, but excess filler reduced flexibility and strength. Recommendations include testing other silicone types, assessing degradation rate, and expanding sample variations to validate performance as a synthetic skin substitute.

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Kelulusan daripada pihak tuan dalam perkara ini amat dihargai.

Sekian, terima kasih.

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Setuju.

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