Faculty of Mechanical and Manufacturing Engineering Technology

RESEARCH AND DEVELOPMENT OF IMPACT ABSORPTION FOAM MADE FROM KENAF CORE

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Bachelor of Manufacturing Engineering Technology (Process and Technology)

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in fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering Technology (Process and Technology)

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DECLARATION

I hereby, declared this report entitled "Research and Development of Impact Absorber Foam Made by Kenaf Core" is the results of my own research except as cited in references.

Signature	:	…………………
Author's Name	:	LEE SET FOON
Date	:	…………………

APPROVAL

I hereby declared that I have read this thesis and in my opinion this thesis is sufficient in term of scope quality for the award of Bachelor's degree of Bachelor of Manufacturing Engineering Technology (Process and Technology)

……………………………………………………………………………………….

(ASSOC. PROF. IR. TS. DR. MOHD YUHAZRI BIN YAAKOB CEng MIMechE)

DEDICATION

Dedicated to

my beloved father, Lee Pion Hua

my appreciated mother, Lucy Tan

my adored siblings, Lee Foo Khiong, Lee Foo Soon and Lee Foo Jong

for giving me moral support, cooperation, encouragement and also understandings.

Thank You So Much & Love You All Forever

ABSTRACT

Nowadays, nature fibre tends to replace the synthetic fibre use in the composite field. The reason behind this is the natural fibre has comparable mechanical properties compare to synthetic fibre. Besides that, the rise of environmental awareness of public about the used and advantages of the natural fibres such as biodegradable, low density and low cost has attracted the interest of many researchers to do an investigation on natural fibre. However, most of the researchers are focus in the use of the natural fibre as reinforcement to study the energy absorption of composite materials instead of using the core particles as reinforcement. As a result, there are no any reference regarding the relationship of different mesh size of kenaf core and its bonding structure when it has been used as reinforcement. Besides that, based on previous studies, there has conflict finding about different mesh size of particles use as reinforcement towards the energy absorption ability of composite foam. Therefore, the aim for this research was to investigate the impact energy and vibration energy absorption of composite foam with different size of kenaf core as reinforcement and different type of resin used. There were two types of resin used in this research, that was Polyurethane (PU) and Soft Epoxy (SE). Furthermore, the kenaf core particles with 3 mm mesh size was represented by alphabet A, 20 micron mesh size was represented by alphabet B, and 40 micron mesh size was represented by alphabet C. The objective of this study is to investigate highest impact and vibration energy absorption of composite foam according to the different layup sequence. There were 57 layup sequence has been investigated with two types of resin used. The composite foam was fabricated by using simple mixing process and cold press process to ensure the equivalent thickness of composite foam formed. In order to evaluated the impact energy and vibration energy absorption performance of the fabricated composite foam with different layup sequence, ASTM standard testing were conducted and scanning electron microscope (SEM) was used to analysed the bonding structure of composite foam. The best layup sequence for impact absorption properties was ACC with SE resin used. This ACC layup sequence specimen was able to absorbed 9.90 J of impact energy, that was 33.9 % lower compared to pure SE specimen. CAA with PU resin used was the best layup sequence for vibration energy absorption. The magnitude rms value obtained by the CAA layup sequence was 7.298, that was 255.47 % increasing in value compared to pure PU specimen. The better performance of energy absorption can be obtained when the composite foam has higher porosity. This is further developed into motorcycle seat cushion due to its better vibration energy absorption performance. Lastly, the kenaf core particles used as reinforcement can reduced the weight of motorcycle seat cushion and more environmentally friendly.

ABSTRAK

Pada masa kini, serat semula jadi semakin cenderung untuk menggantikan penggunaan serat sintetik dalam bidang komposit. Hal ini disebabkan serat semula jadi mempunyai sifat mekanikal yang setanding dengan serat sintetik. Selain itu, peningkatan kesedaran alam sekitar tentang penggunaan dan kelebihan serat semula jadi seperti kemesraan alam, kepadatan yang rendah, dan kos yang rendah telah menarik minat ramai penyelidik untuk melaksanakan penyelidikan atas serat semula jadi. Namun begitu, kebanyakan penyelidik menumpukan perhatian dalam penggunaan serat semula jadi sebagai bahan pengukuhan untuk mengkaji tahap penyerapan tenaga bahan komposit daripada menggunakan zarah teras. Akibatnya, tidak ada rujukan mengenai hubungan antara saiz mesh teras kenaf terhadap struktur ikatan apabila ia digunakan sebagai bahan pengukuhan dalam bahan komposit. Di samping itu, berdasarkan kajian terdahulu, terdapat keputusan kajian yang bercanggahan tentang saiz mesh zarah yang berbeza terhadap keupayaan penyerapan tenaga bagi busa komposit. Oleh itu, tujuan penyelidikan ini adalah untuk mengkaji tahap penyerapan tenaga impak dan tahap penyerapan tenaga getaran bagi busa komposit dengan menggunakan saiz mesh teras kenaf yang berlainan sebagai bahan pengukuhan dalam jenis resin yang berlainan. Dua jenis resin yang digunakan dalam kajian ini, iaitu Polyurethane (PU) dan Soft Epoy (SE). Tamabahan pula, zarah teras kenaf yang bersaiz 3 mm mesh diwakili oleh abjad A, teras bersaiz 20 mikron mesh diwakili oleh abjad B, dan teras bersaiz 40 mikron mesh diwakili oleh abjad C. Objektif kajian ini adalah untuk mengkaji tahap penyerapan tenaga impak dan tenaga getaran yang paling tinggi bagi busa komposit berdasarkan urutan susunan yang berlainan. Sebanyak 57 urutan susunan telah dikaji dengan penggunaan 2 jenis resin yang berlainan. Busa komposit telah dibuat dengan menggunakan proses pencampuran mudah dan proses tekanan sejuk untuk memastikan ketebalan busa komposit yang sama dibentuk. Bagi menlai prestasi tahap penyerapan tenaga impak dan penyerapan teneaga getaran untuk busa komposit, ujian berdasarkan piawaian ASTM telah dijalakan dan mikroskop elektron (SEM) telah menggunakan untuk menganalisis struktur ikatan zarah teras kenaf dalam busa komposit. Urutan susunan yang terbaik untuk sifat penyerapan tenaga impak adalah ACC dengan resin SE sebagai pengikat. Spesimen urutan susunan ACC ini dapat menyerap 9.90 J tenaga impak, iaitu 33.9 % lebih rendah berbanding dengan spesimen SE tulen. Manakala, urutan susunan CAA dengan resin PU sebagai pengikat adalah urutan susunan yang terbaik untuk menyerap tenaga getaran. Nilai magnitud rms yang diperolehi oleh urutan susunan CAA ialah 7.298, iaitu sebanyak 255.47 % peningkatan nilai berbanding dengan spesimen PU tulen. Busa komposit mempunyai leliangan yang banyak, prestasi penyerapan tenaganya lagi baik. Ini kemudiannya berkembang menjadi kusyen kerusi motosikal kerana prestasi penyerapan tenaga getarannya yang lebih baik. Akhir sekali, penggunaan teras kenaf sebagai bahan pengukuhan dapat mengurangkan berat kusyen kerusi motsikal dan lebih mesra alam.

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