Abstract No: 113 ***Physical Sciences***

INVESTIGATING THE SOUND ABSORPTION CHARACTERISTICS OF COCONUT SHELL-BASED STRUCTURES

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This study investigates the sound absorption characteristics of structures developed using two filler materials: coconut shell powder and charcoal powder, with natural liquid rubber as the binder. Selected filler material and the binder are readily available in Sri Lanka. The sound absorption coefficient, defined as the ratio of absorbed energy to incident energy indicating the amount of sound being absorbed by a material, was experimentally studied using the impedance tube method in the frequency range of 1000-3500 Hz. Samples were prepared by varying the volume ratio of the binder and the filler. The sound absorption property of the prepared samples was tested by using the impedance tube for different frequencies within the range. The structures were further improved by increasing their thickness and changing the surface roughness by introducing holes with different depths to improve sound absorption. The coconut shell powder structure of 50% volume ratio with 1.5 cm thickness and hole depth of 1.1 cm showed a sound absorption coefficient in the range of 0.80-0.83 for 2500 Hz and the range of 0.85-0.93 for 3000 Hz. This implies that the coconut shell powder structure absorbs over 80% of the incident sound energy with a 2500 Hz or 3000 Hz frequency. Further, the charcoal powder structure of 66% volume ratio with 1.5 cm thickness and hole depth of 1.1 cm exhibited sound absorption of over 60% beyond 2000 Hz within the tested frequency range. Both structures are versatile, cost-effective, and eco-friendly sound absorption structures for various acoustic applications for high frequencies due to their flexibility, ease of preparation, and thin profile.

Keywords: Acoustic foam, Sound absorption, Sound absorption coefficient, Sound absorption material, Waste material