Acoustic properties of recycled foam rubber waste and polyvinyl acetate composites

Jonas Tubelis[1]*, Tomas Astrauskas[2] Miķelis Dzikēvičs[3]

[1]Department of Environmental Protection and Water Engineering, Vilnius Gediminas Technical University, Saulėtekio al. 11, 10221 Vilnius, Lithuania

[2]Research Institute of Environmental Protection, Vilnius Gediminas Technical University, Saulėtekio al. 11, 10221 Vilnius, Lithuania

[3]Institute of Energy Systems and Environment, Riga Technical university, Azenes 12-1, LV-1048, Riga, Latvia

Contact information:

Saulėtekio al. 11, Vilnius, Lithuania

jonas.tubelis@stud.vilniustech.lt

The quantity of binding in the composite does not have negative impact on acoustic properties of composite material.

To test the influence of binding material on acoustic properties of recycled foam rubber waste and polyvinyl acetate composites a set of samples with different ratios were created. 10 mm thickness samples showed minimum sound absorption at 0,06 at 160 Hz frequency and maximum at 4000 Hz reaching 0.94. Sound absorption for 30 mm samples showed a range from 0.09 to 0.97, peaking at 1000 Hz. Lastly, 50 mm samples showed the best results, consistently staying above 0.7 sound absorption in frequency range from 500 Hz to 5000 Hz.

Transmission loss for 10 and 30 mm samples did not show great results, maxing out at 5.36 dB for 10 mm samples and 15.72 dB for 30 mm. 50 mm sample showed the best results once more, peaking at 28.90 dB in 5000 Hz frequency and bottoming out at 160 Hz frequency with 6.08 dB.

The results of this study show that quantity binding material in the composite do not have significant impact on sound absorption and sound transmission loss properties of composite material.

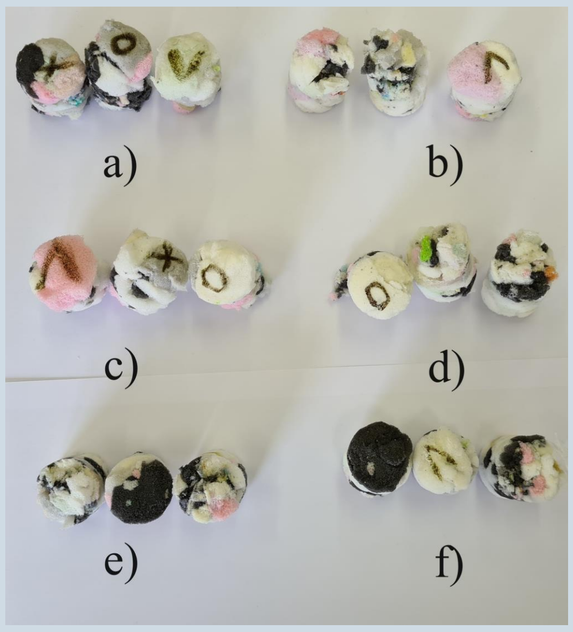


Fig. 1. Samples of 30 mm thickness. a) 1:1 ratio; b)1:2; c)1:3; d) 1:0,5; e)1:1,5; f) 1:2,5

Introduction

According to a report by the European Commission, around 675,000 tonnes of flexible polyurethane foam waste is generated annually in Europe. The disposal of rubber foam waste can have a significant impact on the environment, particularly if the waste is not managed properly.

Rubber or polyurethane foam has been known for its acoustic properties for many years now. Knowledge about the use of foam rubber waste with different binders and the influence of their ratio on acoustic properties is still not sufficient. On top of that, only around 11 % of foam rubber waste is recycled and adding more ways to recycle this type of waste is beneficial to everyone.

Methods

The methodology has been prepared by using standard LST EN ISO 10534-2:2023 "Acoustics. Determination of sound absorption coefficient and total resistance by impedance tube (Fig. 1). 2nd part. Transfer function method (ISO 10534-2:2023)" and ASTM E2611-19 "Standard Test Method for Normal Incidence Determination of Porous Material Acoustical Properties Based on the Transfer Matrix Method" guidelines.

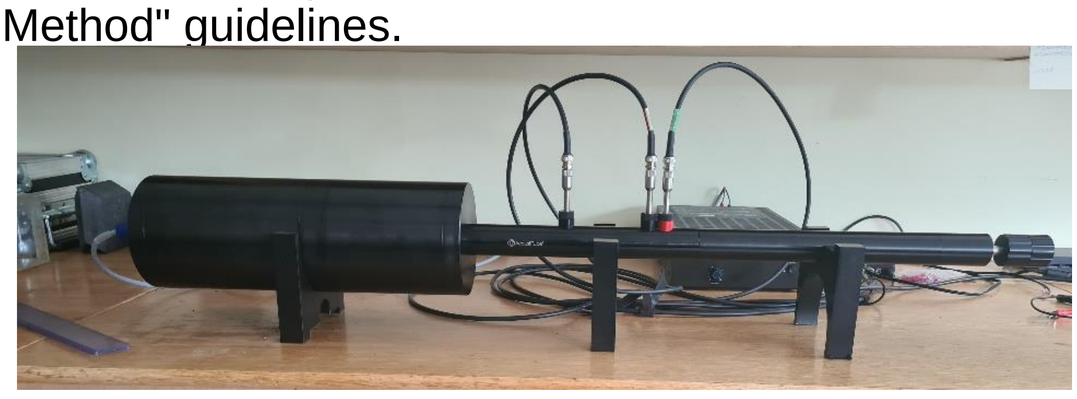
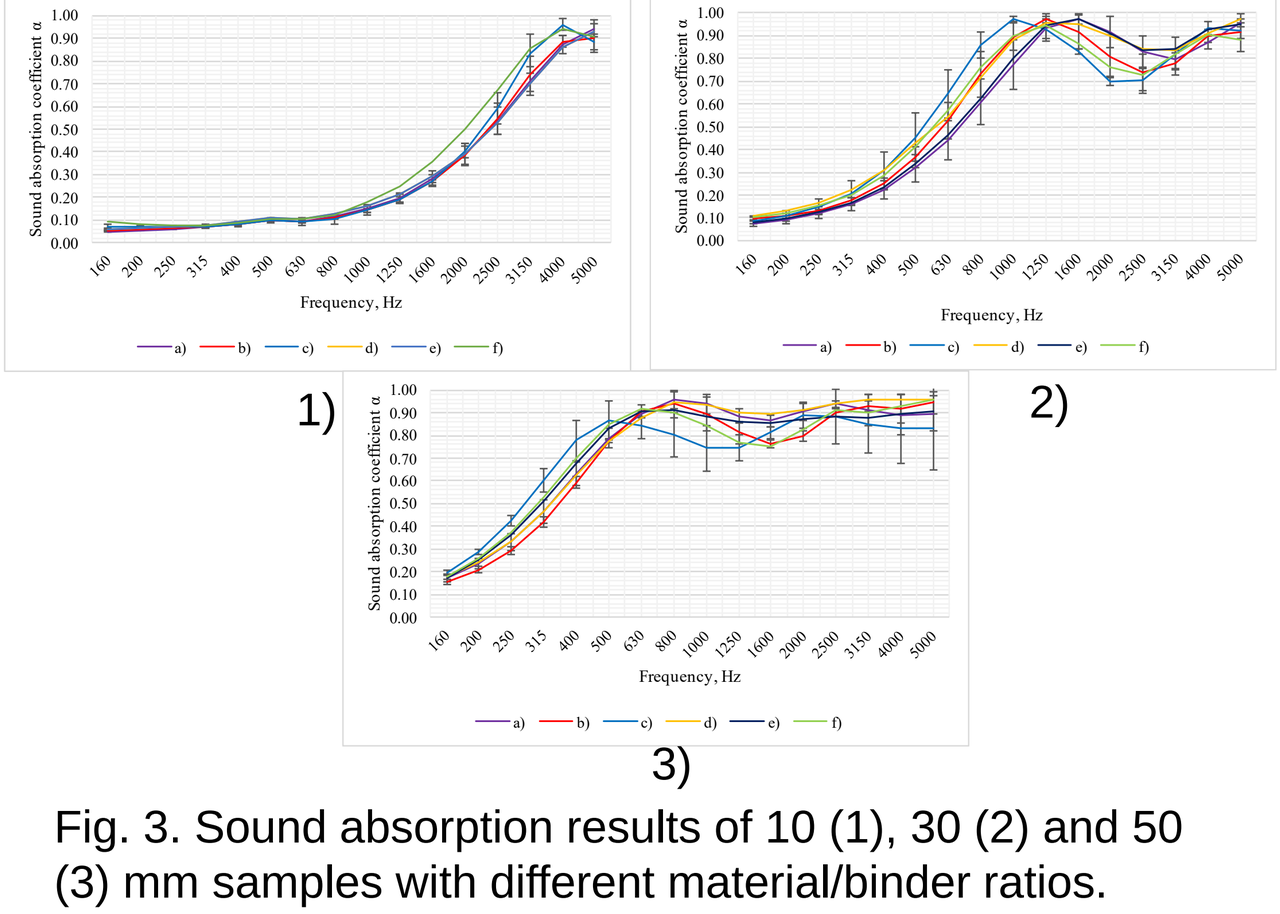


Fig. 2. Impedance tube used in measurements.

Sound absorption



1)

2)

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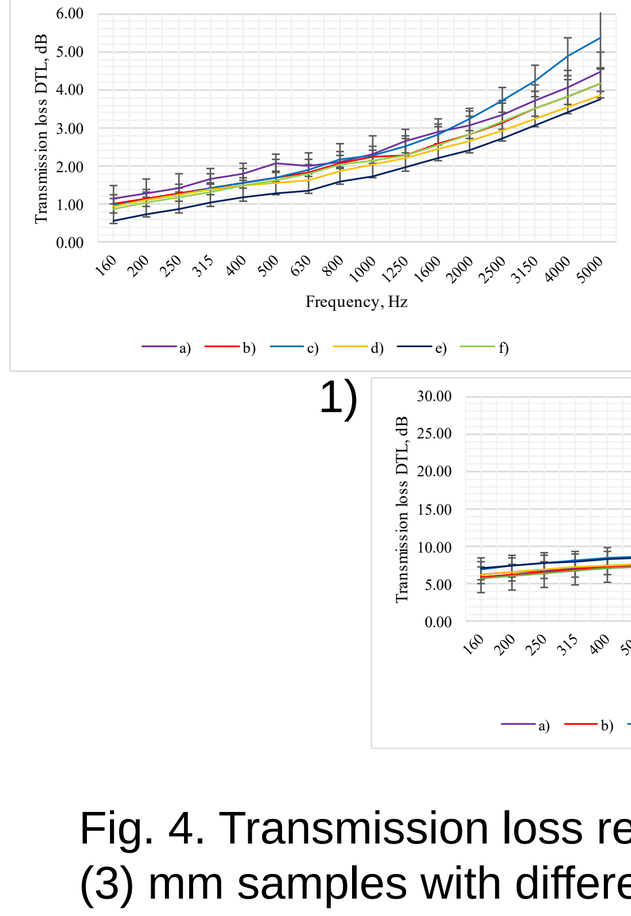
Fig. 3. Sound absorption results of 10 (1), 30 (2) and 50 (3) mm samples with different material/binder ratios.

Sound transmission loss



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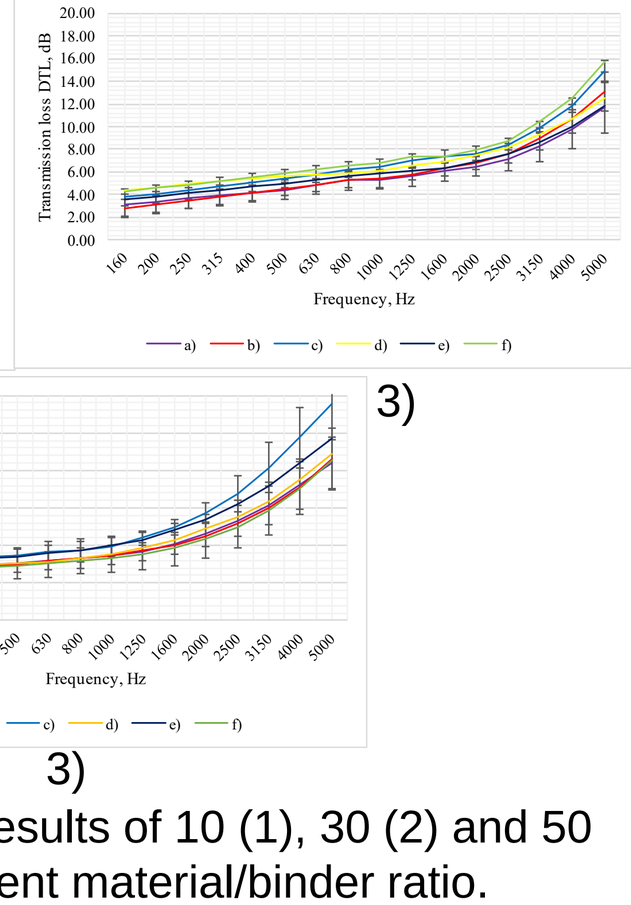

3)

3)

Fig. 4. Transmission loss results of 10 (1), 30 (2) and 50 (3) mm samples with different material/binder ratio.