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Experimental Study of Vibration Isolators Made of Expanded Cork Agglomerate

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Abstract : The goal of the present work is to experimentally evaluate the feasibility of using vibration isolators made of expanded cork agglomerate. Even though this material, also known as insulation cork board (ICB), has mainly been studied for thermal and acoustic insulation purposes, it has strong potential for use in vibration isolation. However, the adequate design of expanded cork blocks vibration isolators will depend on several factors, such as excitation frequency, static load conditions and intrinsic dynamic behavior of the material. In this study, transmissibility tests for different static and dynamic loading conditions were performed in order to characterize the material. Since the material's physical properties can influence the vibro-isolation performance of the blocks (in terms of density and thickness), this study covered four mass density ranges and four block thicknesses. A total of 72 expanded cork agglomerate specimens were tested. The test apparatus comprises a vibration exciter connected to an excitation mass that holds the test specimen. The test specimens under characterization were loaded successively with steel plates in order to obtain results for different masses. An accelerometer was placed at the top of these masses and at the base of the excitation mass. The test was performed for a defined frequency range, and the amplitude registered by the accelerometers was recorded in time domain. For each of the signals (signal 1- vibration of the excitation mass, signal 2- vibration of the loading mass) a fast Fourier transform (FFT) was applied in order to obtain the frequency domain response. For each of the frequency domain signals, the maximum amplitude reached was registered. The ratio between the amplitude (acceleration) of signal 2 and the amplitude of signal 1, allows the calculation of the transmissibility for each frequency. Repeating this procedure allowed us to plot a transmissibility curve for a certain frequency range. A number of transmissibility experiments were performed to assess the influence of changing the mass density and thickness of the expanded cork blocks and the experimental conditions (static load and frequency of excitation). The experimental transmissibility tests performed in this study showed that expanded cork agglomerate blocks are a good option for mitigating vibrations. It was concluded that specimens with lower mass density and larger thickness lead to better performance, with higher vibration isolation and a larger range of isolated frequencies. In conclusion, the study of the performance of expanded cork agglomerate blocks presented herein will allow for a more efficient application of expanded cork vibration isolators. This is particularly relevant since this material is a more sustainable alternative to other commonly used non-environmentally friendly products, such as rubber.

Keywords : expanded cork agglomerate, insulation cork board, transmissibility tests, sustainable materials, vibration isolators
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