VALORIZATION OF SOME WASTE TO OBTAIN SOUND-ABSOPTION COMPOSITE MATERIALS, TARGETING THE REDUCTION OF THE NOISE POLLUTION

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Abstract

The noise is a complex of sounds without a periodical character that affect the biological and psychological health of humans and other organism from nature. Noise pollution represents the human or animal exposure to sounds at disturbing, stressful or harmful levels. This paper aims to introduce new systems for absorption and attenuation of noise from industry or from urban and extra-urban transport based on composite materials made from recycled solid waste. Compared to conventional materials this new type of composites incorporates various wastes that can harm the environment.

The absorption coefficient is used to express the capacity of a material to absorb the sound waves – to transform the kinetic energy of the sound waves into thermal energy. It is expressed in percents and represents the proportion between the total sum of energy that is transmitted and absorbed by the material and the total incidence energy of sound waves.

This paper presents several types of composites produced using waste matrix binder. Absorbing capacity of sound for the new composites varies depending on the proportion of waste used. Also, are presented correlations between the grading of the reinforcing material that is used, the density and porosity of the resulted composite and the absorption sound waves coefficient for composite material samples which are reinforced with different wastes.

Keywords: noise, sound waves, absorption coefficient, composite material, wastes.

INTRODUCTION

In the last century, the global development of the entropic activity and also the activity in the urban areas lead to considerable degradation of the quality of air, due to pollution. The phonic pollution represents the total sounds produced by humans, animals, equipments and machineries, which disrupt the quotidian activities.

Noise is a well known danger for health, disrupting the sleep and other activities, and affects the cognitive and emotional responses. Noise is generally defined as an unwanted sound or set of sounds. [1-3]

The paper aims to introduce new systems in order to absorb and mitigate noise from industry or extra-urban and urban, based composite material made from recycled solid waste.

Compared with conventional materials, it is attempting to obtain new composite that includes different types of waste that can harm the environment. A composite material is made when two or more materials, by combination, lead to a product with superior properties. [4]

Composites are materials made by the association of at least two components whose properties complement each other, resulting in a material with properties superior to either component alone. Solid wastes recovery in various types of composite materials has many environmental impacts and represents an economic advantage. Every type of solid waste results from processes which requires significant quantities of resources, primarily fossil fuels, both as a raw material and as a source of energy for the manufacturing process. Therefore, their recovery in such special composite with high durability involves significant economic and ecological effects.[4]

The sound absorption capacity for the new composite will vary depending on the proportion and nature of the waste used in a single polymer matrix. The resulting phonic insulating materials are compared with the traditional ones to see if they fulfill the requirements of European legislation. Acoustic absorption defines the behavior of the surfaces from enclosed areas in relation with the incident sound waves. The acoustic absorption aims that a part of the aerial sound energy which meet a space separator surface is not reflected but apparently absorbed. The sound absorption is characterized by "*sound absorption coefficient*, α" defined by the subunit ratio between "absorbed" energy (apparent) and incident energy, expressed on standard frequencies or trough absorption classes [5-7].

2. EXPERIMENTAL PROCEDURE

Samples were made from different types of composite materials made of various compounds based on oxide waste, waste that can affect the quality of their storage environment. Among the many environmental problems that threaten our planet, a major problem is, without a doubt, the waste. They are the result of human activity and is a current problem due to the continuous increase both the quantity and patterns (which by the natural decay and infestation presents a danger to the environment and human health) and large quantities of materials raw recyclable materials and energy that can be recovered and put into use.

Thus runoff is an issue of particular importance because the continued recovery in the diversification of their content and contribute to uncontrolled environmental degradation. The objectives of waste management in Romania based prioritization established at European level, namely:

- prevention,
- smaller quantities,
- material and energy recovery.
- disposal by incineration and storage [8,9].

In Table 1 composite sample made :

Table 1. Composite samples

No.	Binder matrix	Proportion (%)	Reinforcement Agent	Proportion (%)
1	Fly ash	60	slag steelworks	40
2		60	sterilized waste garbage	40
3		60	slag outbreak thermal power plant	40
4		60	ash from burning seed shells	40

Also used to obtain composite materials waste are considered cementitious materials, mineral or active hydraulic binding properties latent phase consisting of crystalline and glassy phases silicate and aluminosilicates. The hydration process of cement products has to be activated in order to provide an appropriate kinetics, as well as a corresponding basicity for the system almost ready for strengthening [10]. Therefore, activation of matrix binder that each sample was added to 2% $CaO + CaCl_2$.

Grain size distribution of the powder was determined that comprise the binder matrix Figure 1, and for materials that are reinforcing agent - Figure 2a-2d.

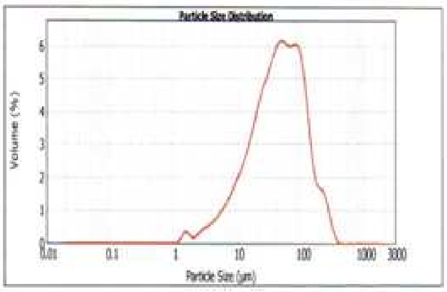

Figure 1. Laser granulometry fly ash

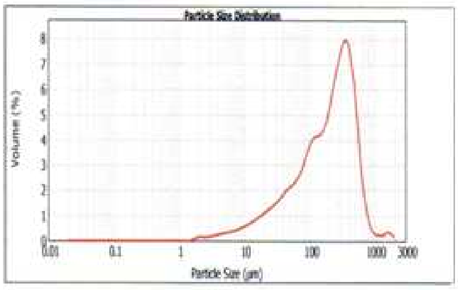

Figure 2a.Laser granulometry slag steelworks

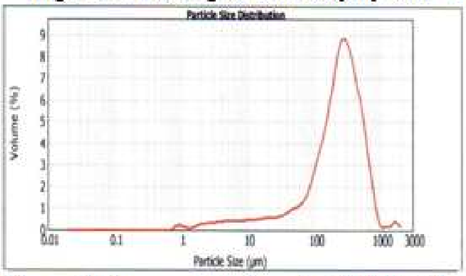

Figure 2b.Laser granulometry sterilized waste garbage

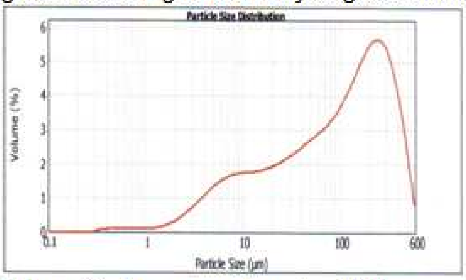

Figure 2c.Laser granulometry slag outbreak thermal power plant

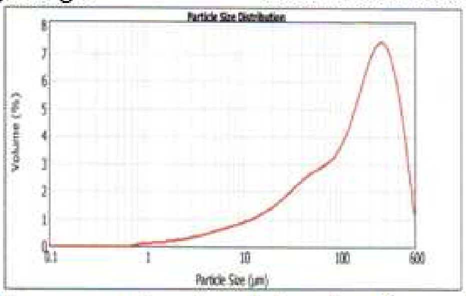

Figure 2d.Laser granulometry ash from burning seed shells

Also determined the apparent bulk density and porosity of the samples analyzed Figures 3a and 3b.

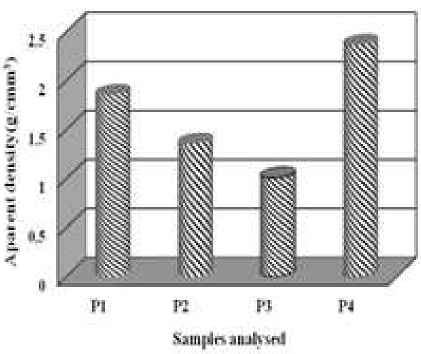

Figure 3a. Apparent density for samples analysed

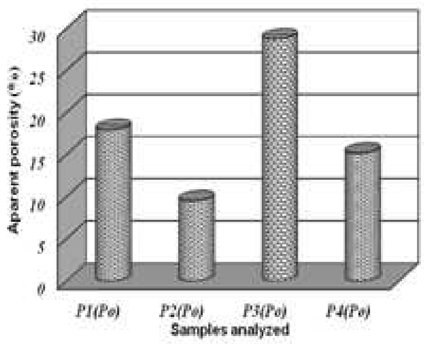

Figure 3b. Apparent porosity for samples analysed

For the determination of the coefficient of absorption of sound waves, tests were carried out on circular samples with a diameter of 63.5 mm and a height of about 20 mm, which were made on the patterns of cylindrical shape. To determine the absorption coefficient is used acoustic interferometer method (Kundt tube), and the method of determination is in accordance with applicable standards [11,12]. The test equipment consists of a tube acoustic interferometer type 4206-A (the tube environment), a system for simultaneous acquisition of signals in five channels with signal generator - multianalizor PULSE Type 3560-B-030, type 4187 two microphones, an amplifier signal acoustic calibrator type 2716 and 4231 DP-0775 adapter for microphones.

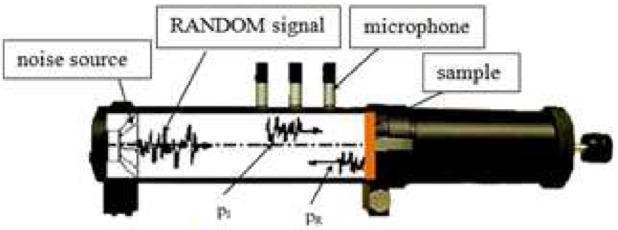

Figure 4. Equipment for determining the absorbing coefficient

RESULTS AND DISCUSSION

According to previous statements were obtained new types of composite materials made of different types of waste oxide which may be affected by their storage environment quality. Size analysis of waste that make up the composite material obtained shows a wide range of particle sizes, which influences the density and porosity of the composite material obtained but also absorbing sound waves. A good absorption material is given by the value of α = 1 or close to 1 and an absorption in the plateau value as a wide range of frequency.

Such materials are classified into classes of sound absorption [13] according to, and are shown in Table 2.

Table 2. Absorbing class According to the absorbing coefficient

Acoustic absorbing class	α
A	0,90; 0,95; 1,00
B	0,80; 0,85
C	0,60; 0,65; 0,70; 0,75
D	0,30; 0,35; 0,40; 0,45; 0,50; 0,55
E	0,15; 0,20; 0,25
Without class	0,00; 0,05; 0,10

Figures 5÷8 present the results of analysis of the absorption coefficient for the composite samples prepared. The frequency at which the measurements are made is 16 ÷ 3150 Hz.

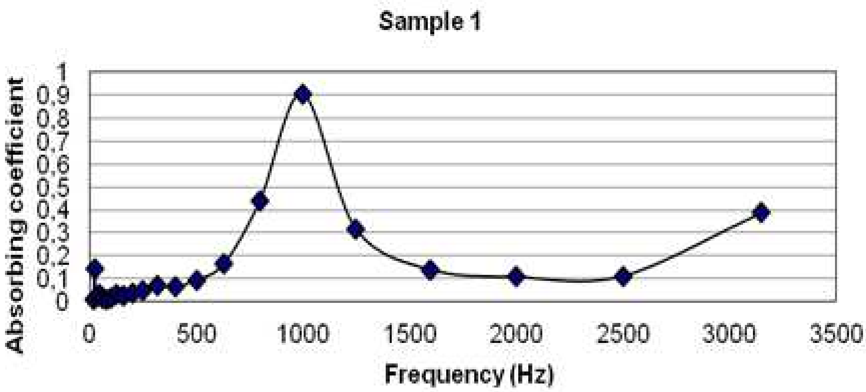

Figure 5. The absorption coefficient for sample 1

For sample 1 is an increase of the coefficient of absorption of sound waves up to 0.9 on a range between 500 ÷ 1500 Hz. It is a good value which makes this material a Class A sound absorption**.**

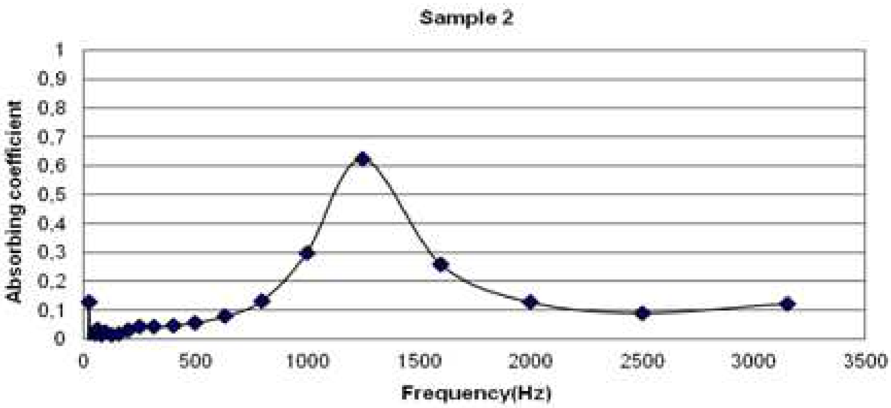

Figure 6. The absorption coefficient for sample 2

For sample 2 the absorption coefficient has a value lower value of 0.62 showing a frequency range between 500 ÷ 2500 Hz. Thus this composite material in class C sound absorption**.**

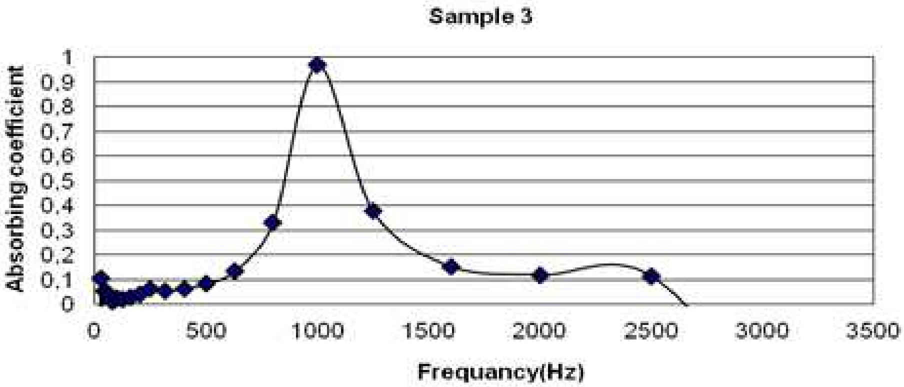

Figure 7. The absorption coefficient for sample 3

The absorption coefficient for sample 3 reaches the maximum value close to 1 with a value of 0.98 on a freq range of between 400 ÷ 2600 Hz Thus, you like of this type of material falls into grade A sound absorption.

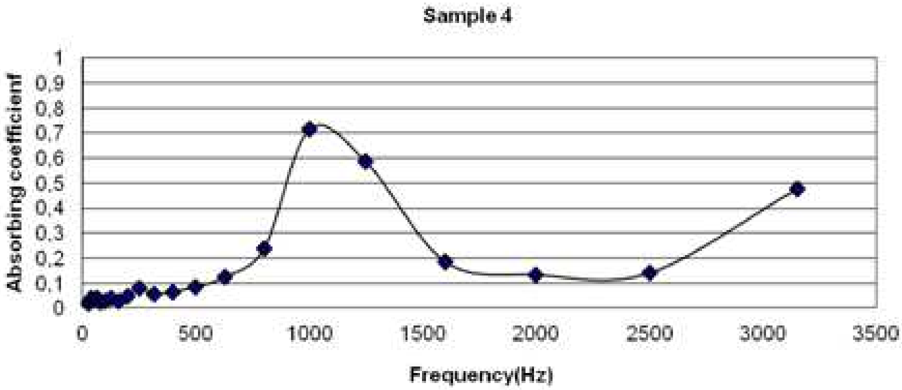

Figure 8. The absorption coefficient for sample 4

Sample 4 shows an absorption coefficient of 0.73 over a range of frequencies between 400 ÷ 2000 Hz. Is an increase in absorption at higher frequencies of sound waves in 2500 ÷ 3200 Hz.

CONCLUSIONS

- Particle size binder matrix material representing and reinforcing materials exhibit a wide range of particles that affect both density and porosity but also absorbing sound waves.• highest porosity sample 3 shows a sample followed by 1, 4, 2
- Sample 3 shows the best material absorption coefficient is a Class A sound absorption

- According to Table 2, sample 1 is a material classified as Class A sound absorption but with an absorbance lower than sample 3.• samples 2 and 4 shows lower absorption due to reduced porosity.
- Materials that make up the composite particle size, porosity and apparent density influences the absorption coefficient of the waves sonore.3
- Composites were obtained us through the use of inorganic waste by storing them can affect environmental quality. These composites can be used to manufacture absorbing panels to reduce noise pollution.

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