7th International Conference on Recent Innovations in Science, Engineering and Management
The Institutions of Engineers, Delhi State Center (India) RISEM - 16
16th September 2016, www.conferenceworld.in ISBN : 978-93-86171-07-8

USE OF AGRICULTURALWASTE MATERIALS FOR INDUSTRIAL NOISE REDUCTION

Mr. Rupesh R. Kadam[1], Dr. D. N. Mudgal[2]

[1]*PG Student, Department of Civil Engineering, AMGOI, Vathar, Maharashtra, (India)*

[2] *Executive Director, AMGOI Vathar,Maharashtra, (India)*

ABSTRACT

Noise is 'Unwanted sound' emitted from the vibrating body.awareness of which to human being is by the physical sensation of hearing. Noise pollution is an environmental problem all over the world, which has very harmful effects on health and life of the workers in industrial sector. Workers are exposed to continuous noise throughout the workday, may leads to some injurious like hearing loss , weakness in nerves, pain in internal tissues, heart disease, and higher blood pressure. Therefore it is very important to find out economical and effective method to reduce industrial noise. This research work was conducted to investigate the use of Agricultural waste as natural sound reduction material to give solution for industrial noise problem.Prepared specimens having size of 25mm (thickness)×75mm (diameter) were made by using material viz; holy basil(Tulsi) ,Coconut coir with cement andadhesive(Wood grip). Cement, Wood grip, Tulsi and Banana mixed at proportion of 0.5:0.5:0.5:0.5 and 1:1:0.5:0.5. with addition of water. An experimental set up including Function generator, speaker, noise level meter is used to investigate Noise Reduction coefficient of prepared specimens. Noise reduction capacity of Agricultural waste material was calculated by Noise Reduction Coefficient(NRC).

***Keywords**: Coconut Coir, Holy Basil, Impedance Tube, Noise Reduction Coefficient.*

I. INTRODUCTION

Noise free workplace is always expected by every industrial worker. Noise occurs inconvenience, annoyance which affect on quality of life of workers. From various field visits and questionaries' it is seen that long exposer of 85db noise might be dangerous for blood pressure. Presently, in the industrial construction the problem of undesirable and potentially hazardous noise has become much more complex and serious; the demands for a better environment and quality life styles are increased. However owners and architects are not paying much of the attention to control the noise pollution. Most of the developed countries use practical techniques to minimize the nuisance such as barrier walls, duct silencers, acoustical wall panel, sound proof curtains, sound enclosures for industrial machinery and other similar noise control treatments that are installed near the source to effectively reduce the sound level. However, India has not yet yielded much into this issue as noise reduction methods are costly. Therefore, it is necessary to find out cost effective solution to control industrial noise.

In previous study N.S. Shinde investigated Noise reduction properties of Tulsi with cement [1]. He have found that Noise reduction coefficient (NRC) of specimen of larger particles is greater than that of specimen of smaller particles and Noise reduction coefficient is increases with increase in specimen thickness.

In current study Tulsi (Holy basil) and Coconut coir tested for their noise reduction properties.Tulsi was selected due to their higher availability. OcimumTenuiflorum or Holy Basil is scientific name of Tulsi. It is used in preparation of medicine. Low density, spun fibers with large pores these are acoustic properties of Tulsi stem fibers. Texture of Coconut coir consists of fibers. Due to this property Coconut coir stem can be used in manufacturing of sound Reduction material.

1.1 Objectives

Objectives of this research study are

i)To study and use of Tulsi and Coconut coir with cement and adhesive(wood grip) as Sound absorption material.

ii) To investigate material combination and its effectiveness for sound reduction property.

II. RESEARCH METHODOLOGY

Research Methodology includes specimen preparation, Development of Experimental set up and laboratory testing.

2.1 Specimen Preparation

Specimens were prepared with circular shape by mixing Tulsi, Coconut coir, Adhesive (wood grip), cement with water at differentmix proportions. Thickness and diameter of specimen kept 25mm and 75mm respectively. Plastic pipe Mould (gauge 1000 pipe ring) used to cast allspecimens as shown in fig.1

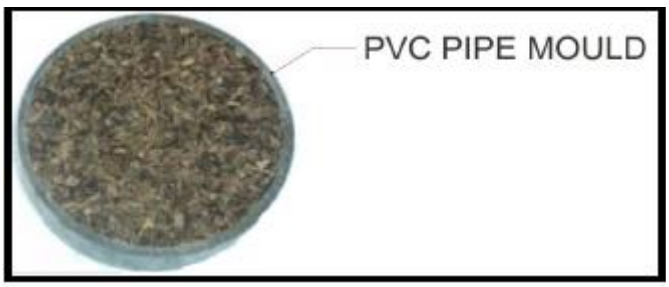

Fig.1 Specimen used for Testing

Circular shaped specimens were prepared by mixing tulsi and coconut coir with cement and wood grip at different mix proportions. Thickness of specimen were kept 25mm and 12.5mm for each mix proportion. Diameter of specimen kept 75mm for each mix proportion. Different mix proportion as 0.5:0.5:0.5:0.5 and 1:1:0.5:0.5 were used for specimen casting.

Particle size were used in two categories given as below

i)0.6 mm > 1.18 mm

ii)1.18 mm > 2.36 mm

Sieve analysis were conducted according to IS: 2720 (part IV) 1985 to obtain fraction of particle size of selected material. Prepared specimens were kept in laboratory 10 days for hardening. Specimens of selected size were cast to find effect of particle size on noise reduction capacity of specimen.

Material combinations and mix proportions used for specimen casting is given in table 1.

Table 1: Material Combinations and Mix Proportions Used for Specimen Preparation

Sr. No	Material combinations with Nomenclature	Mix Proportions (Weight basis)	Particle size Ps(mm)	Specimen Thickness (mm)	
1.	Cement : Wood grip : Tulsi : Coconut coir (C:WG : T : CC)	0.5:0.5:0.5:0.5	0.6 < Ps < 1.18	12.5	25
			1.18 < Ps < 2.36	12.5	25
		1:1:0.5:0.5	0.6 < Ps < 1.18	12.5	25
			1.18 < Ps < 2.36	12.5	25

2.2 Development of Experimental Set-Up

Experimentalset-up developedlike impedance tube system. According to standards of ISO 10534-2 impedance tube system gives accurate measurements of sound absorption coefficient. Experimental set up is developed using equipment's given below

Functional generator model specification Caddo 4061, Stereo speaker, Pyramid 4080 of frequency response 60 to 20,000 hertz with 250 watt power rating to create noise of higher intensity inside the tube.SWR pipe is used as propagation tube. Noise level meter (model SL- 4010) with calibration certificate is used for measuring sound level.

Thus experimental set up consisted Stereo speaker, SWR pipe and Noise level meter.

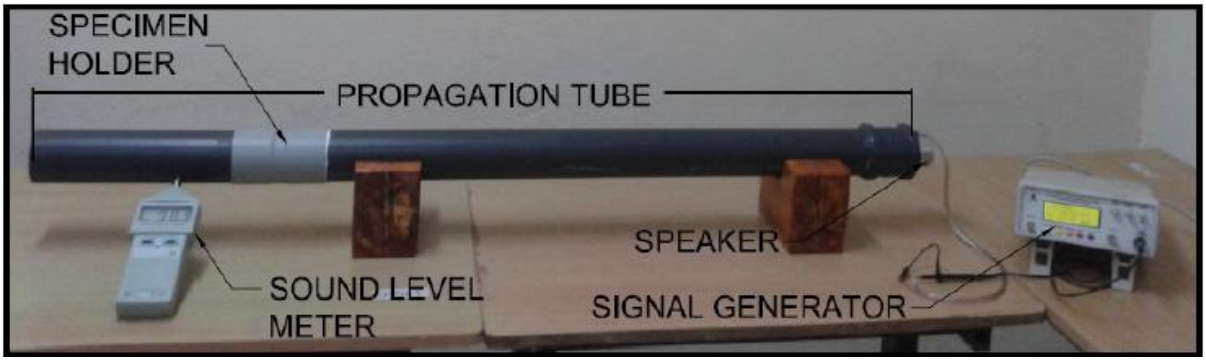

Fig.2 Experimental set Up

2.3 Laboratory Work

Objective of this test is to find out sound absorbed by the specimen and determine noise reduction coefficient (NRC). Noise reductioncoefficient is used to calculate noise reduced by the specimen at each center octave band frequency(63 Hz to 16 KHz)

Reduced Noise intensity (dB)

Noise Reduction Coefficient = _____ ---------- (1)

Incident Noise intensity (dB)

Where,

Incident noise intensity- Noise level measured without placing specimen ('a' dB)

Reduced noise intensity- Noise level measured with placing specimen ('b' dB)

Noise Reduction Coefficient = (a-b) / a ----------(2)

Using frequency generator for each octave band frequency center(25 Hz to 16000 Hz) incident noise intensity (without placing specimen) is measured correctly. Then reduced noise intensity at every respective octave band frequency center is measured by placing each specimen in propagation tube. This procedure repeated twice to verify incident noise intensity and reduced noise intensity.

III. RESULTS AND DISCUSSIONS

From calculation of Noise reduction coefficients it is observed that noise reduction coefficient is increased with increase in specimen thickness. Following material combinations found effective for sound reduction.

Table No.2 Effective Noise Reduction Coefficients of Material Combinations

Material Combination	Mix proportion	Particle size (mm)	Specimen thickness (mm)	Octave band frequencies (Hz)								
				63	125	250	500	1000	2000	4000	8000	16000
				Noise reduction coefficient								
C : WG : T : CC	1 : 1 : 0.5 : 0.5	0.6 < Ps < 1.18	12.5	0.15	0.14	0.09	0.03	0.04	0.32	0.33	0.36	0.41
			25	0.24	0.20	0.16	0.13	0.20	0.32	0.39	0.48	0.60

Fig.3 Shows Noise Reduction Coefficients For The Material Combinations Cement : Wood Grip :Tulsi

Coconut coir (1:1: 0.5:0.5) having thickness 12.5 mm and particle size between 0.6mm – 1.18mm. atfrequency range 2 KHz – 8 KHz NRC increased from 0.32 – 0.36. i.e. selected material performs well at moderate frequency range and reduce noise up to 36%. The noise level of 100 dB is effectively brought up to 68 dB and 66 dB at frequency 2 KHz and 8 KHz respectively in industrial area. NRC is increased up to 0.41 at frequency of 16 KHz. Hence material is perform well at higher frequency range.

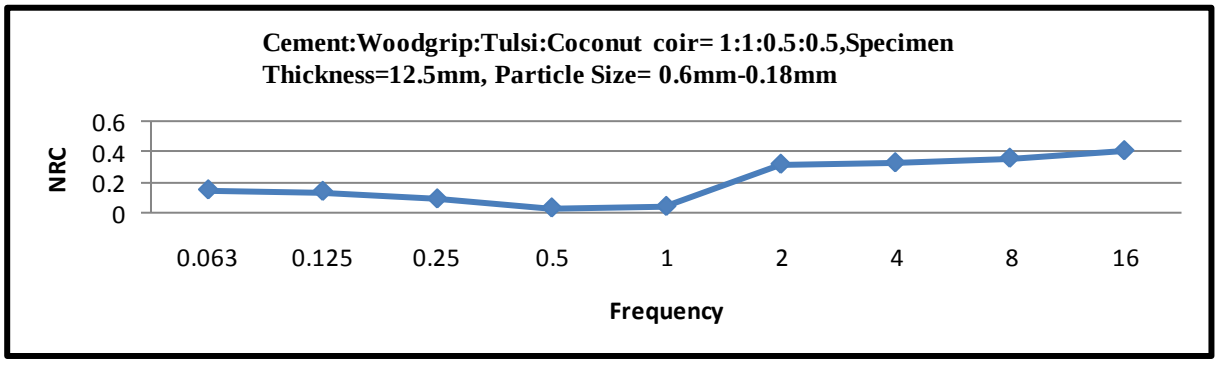

Fig.3 Graph of Cement: Woodgrip:Tulsi:Coconut Coir Showing NRC

Fig.4 shows noise reduction coefficients for material combination Cement : Wood grip : Tulsi : Coconut coir (1:1:0.5:0.5) having specimen thickness 25 mm and particle size 0.6 mm – 1.18 mm.at frequency range 2KHz – 4KHz noise reduction coefficients increased from 0.33 – 0.39. Selected material performs well at moderate frequency. The noise level 100 dB is effectively brought up to 67 dB and 61 dB at respective frequencies in the industrial workplace.NRC increased from 0.48 – 0.60 at frequency range 8 KHz to 16 KHz. Hence material is effective at higher frequencies.

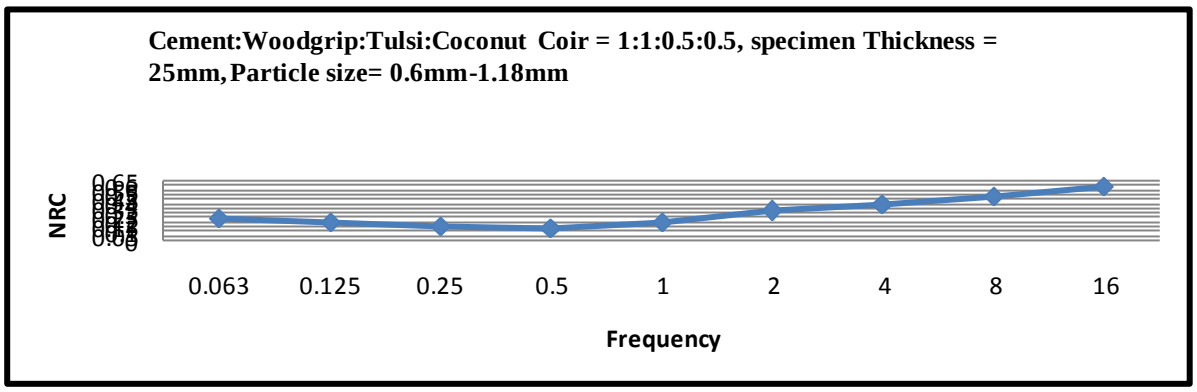

Fig. 4 Graph of Cement:Woodgrip:Tulsi:Coconut coir Showing NRC

IV. CONCLUSION

The noise reduction property of material combinations Cement :Wood grip : Tulsi : Coconut coir having thickness 25 mm and particle size 0.06mm -1.18mm found better than other material combination. NRC obtained from this material combination is better than other material combinations at moderate and higher frequencies.High noise level of 100 dB can be brought up to permissible acceptance limit of ambient noise standards. Selected material is available at low cost hence industrial environmental can be improved by use of this material in industrialconstruction

REFERENCES

[1] N.S.Shinde, M.B.Kumthekar" Natural Materials for Effective Noise Control Measures in Industrial Construction".

[2] LamyaaAbd Al Rehman, Raja Ishak Raja and Roslan Abdul Rehman, "Attenuation of Noise by using Absorption Materials and Barriers: A review", University Technology Malaysia 81310, Skudai, Jokor, Malaysia, *International Journal of Engineering and TechnologyVolume 2 No.7 pp. 1207-1217,July,2012*.

[3] Narendrasingh and S.C.Davar, (Development of Commerce,KurukshetraUniversity,Kurukshetra. 136119, Haryana, india), (2004), "Noise Pollution- Sources, effects and control", *J. Hum. Ecol., 16(3):pp.181-187.*

[4] K.N. HemanthaDedigama, S.M. P.ShyamanPremrathne, G.H.M.J. Subashi De Silva, G.S.Y. De Silva, N.D. Jayasundara, (2012), " Investigation of Natural Material to Reduce Industrial Noise".

[5] Cyril M. Harris,(1966), "Absorption of Sound in air versus Humidity and Temperature", Department of Electrical Engineering, Columbia University,New york 10027,Vol. 40-1, pp. 148-159.

[6] Gabriela Christina Candido de Silva, Maria Alzria deAraujoNunes, Renato Vilela Lopes, Antonio Boson Ameida, (2013),Faculty of University of Brasil, "Design and Construction of a Low Cost Impedance tube for Sound Absorption Coefficient Measurement".*22nd International Congress of MechanicalEngineering, IISN 2176-5480. Pp. 105-115.*

[7] Marcos D. Fernandez, Samuel Quintana , NoeilaChavarria and Jose A. Ballesteros (2009), " Noise Exposure of Workers of the Construction Sector". *Journal of Applied Acoustic, 70 pp. 753-760.*

[8] F.Asdrubali1,S.schiavoni and K. V. Horoshenkov (2012) (University of Perugia, Department of industrial Engineering, Perugia, Italy and school of Engineering , Design and Technology, University of Bradford, "*A*Review of Sustainable materials for Acoustic Applications", Building acoustics, *volume 19,number 4, 2012 pages 283-312.*

[9] Hoda S. Seddq,(Housing & Building Research Center, Acoustic Department, Egypt.),(2009), "Factors Influencing Acoustic Performance of Sound Absorptive Materials,"*Australian Journal of Basis and Applied Science,3(4):pp.4610-4617.*