International Journal for Research in Engineering Application & Management (IJREAM)
ISSN : 2454-9150 Vol-04, Issue-10, Jan 2019

Sound Barrier inside & outside house

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ABSTRACT - Sound Pollution is one of gift of modern living, industrialization and urbanization. Long exposure to sound pollution do contribute to many health disease. With reference to it, attempt is made in this paper to find the sound barrier by analysis the Sound Absorption Coefficient . Experiment was performed in UG lab by using wooden tube, speaker, sound detector. SAC of various sample of different materials of cloth, curtains, window sheets which are commonly used inside the house as well as by using leaves of different road street plants were determine and analyse .Conclusion was convince with hypothesis that cardboard sheet in window will be helping more in blocking sound inside the house whereas trees with big trunk has to be planted on side road.

Keywords: SAC ,Sound barrier, Sound detector ,Sound Pollution, Speaker, Urbanization

I. INTRODUCTION

In daily life, each one of us do use sound in many ways like loud music, Television, people talking on their phone, traffic and even pets barking in middle of night. Some sound is pleasant to hear whereas some sound are irritating to our ears. Those sounds are labelled as Environmental Noise. Environmental noise is sound pollution which is propagation of noise with harmful impact on activity of human or animal life. Some sources of it are machines, loud music in residential area, transport system. Noise is unwanted, unpleasant, disagreeable sound that causes discomfort to all living beings. Industrialization, Poor urban planning like congested houses, large families sharing small space, social events, transportation, construction activities, Household chores like TV, Mobile, Mixer grinder, pressure cooker, washing machine are some of contributors to affects the quality of life in form of sound pollution.

Sound Intensity is defined as sound power per unit area. Sound Intensity is measured in dB. Normal conservation 80 dB, noisy office, busy traffic 70dB,Heavy truck - 90dB,Jet airplane at 30m 140 dB, Bursting of eardrum 160 DB. Human ear can hear minimum 1dB to 90dB[1]. Continuous hammering of 85 dB sound will have major damage to human ear. Some of the Hazardous impact of noise pollution are hearing problems, cardiovascular issues, trouble communicating, sleep disturbance, annoyance, effects on children cognition& learning[2],lead to psychological changes in BP, sleep, disorder and other stress disorders [3].There exists many solutions to reduce sound pollution. On individual level, each one of us can contribute in its control by reducing noise in our homes by lowering volumes of radio, music system, TV .

Sound waves striking any surface are either reflected, transmitted or absorbed. Its amount of energy going for reflection, transmission, absorption depends on acoustic properties of surface. Sound absorption is product of sound absorption coefficient and surface area of material. Its unit is Sabin. Sound absorption is also defined as property possessed by materials and objects of converting sound energy to heat either by propagation in medium or when sound strikes the boundary between two media.

Sound absorption coefficient is fraction of sound energy absorbed by material.It is denoted by α. Its formula is

$\alpha = 1- \frac{I_R}{I_I}$ [4]. where I_R is Intensity of reflected sound, I_I is intensity of incident sound, α is Sound Absorbing Coefficient. Sound absorbing coefficient varies between 0 to 1.To describe the sound absorbing quality of surface and to quantify the proportion of incident sound energy that does not return to room in form of reflection. Higher its value more is its absorption less reflection. Perfect absorption (no reflection) SAC is 1 and for zero absorption

(Total reflection) is 0. Its value varies with frequency and angle of incidence[5].

II. LITERATURE

Several Work on sound absorption coefficient , its acoustic properties was done on 17 different wood based material like poplar plywood, exoctic plywood, honeycomb+ veneer and more commonly used in furniture design and manufacture[6,7,8] **on** Magnesia bonded wood panel[9] . It was observed that Honeycomb panels with paper core absorbed better sounds in range between 1Khz and 2K.On similar lines work was done by using Textile curtains[10], Woolen fabrics **[11],** Textile nanofiber[12]**,** Polyster fibre material [13]**,** Jute fibre, polyster fibre[14]

Same pattern of work was performed on different leaves like Tea leaf fibre[15] Plant species using Impedance tube

 DOI : 10.18231/2454-9150.2018.1313

[16], Pineapple leaf fibre [17]. Paper on sound absorption for modular system of vegetable panels was presented by R. Thomazelli. Significant increase in SAC was found when substrate and vegetation were inserted on base plates[18]

III. MATERIAL

Several methods were adopted to determine the sound absorption coefficient in lab[16] and without lab[19]. We have prefer to go with simple method in lab with simple setup which were present in UG Physics laboratory .

Experimental setup consists of

1.Sonometer Rectangular block of dimension 70 cm X 20 cm X 20 cm made of wood
2.Speaker which gives out music of definite frequency which is enabled by Bluetooth, mobile is fixed at one end of rectangular block.
3. Sound detector(Digital sound level meter MECO970P) is fixed at other end to detect intensity of received sound.
4. At middle section of rectangular block slot is made to insert various sample material of dimension 2cm X 20 cm X 20 cm like wood, glass, silk , leaves of different trees.
Incident Intensity was noted initially which was maintain constant throughout the experiment. Reflected Intensity was noted by sound detector at end of experimental setup after keeping each sample separately.

SAC was calculated by using formula.

IV. OBJECTIVES

Though there are many protective laws like I.P.C Public Nuisance 268-295[20],Law of more attention has to be focus on design and planning and improvements to machines can be minimize noise from transportation, construction, mechanical equipment, entertainment and human behavior which is found to be difficult. There are many papers revolves in providing better insight on importance of sound absorption and materials factors in obtaining sound Absorption Coefficient[21].We generally prefer to take measures to control Sound Intensity inside the house by decorating our houses with curtains, covering window by designer sheets, using different fancy cloth covering rather than looking outside the houses. So attempt is made to study on different materials that can control of sound waves are categorized into 3 types – 1)types of curtain,2) types of window covering sheet, 3)type of cloth . Study is also done on road side trees.

V. OBSERVATIONS & CONCLUSIONS

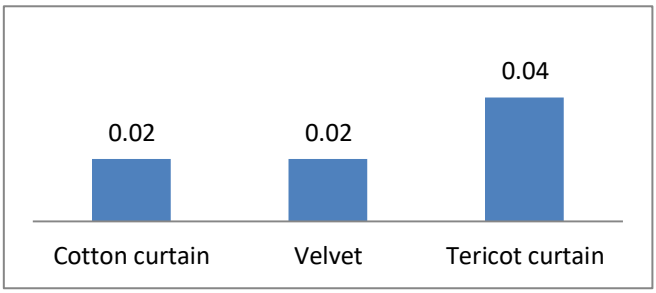

Fig 1: SAC for curtain materials

With reference to mentioned objectives, as seen in fig 1 study is done on considering different material of curtain to be used in house to block sound , Cotton and Velvet cloth has same SAC though porosity is different .It was also found that among curtains tricot curtains absorb sound waves more than rest whereas velvet & cotton curtain 2 % less as tricot cloth has low surface layer density as compared to that of cotton & velvet cloth.

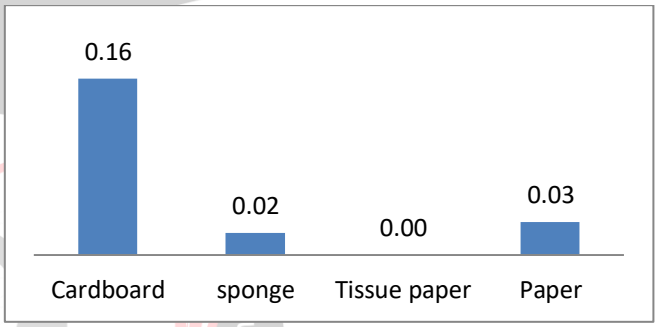

Fig 2: SAC for different window sheets

Refering to fig 2,For types of window covering sheets, Sound absorption Intensity for Cardboard is 0.16, Sponge is 0.02, Tissue paper is 0.0, Paper 0.03. It is found that cardboard sheet absorb more sound intensity whereas tissue paper sheet less. Cardboard absorbs 15 % more than rest material which is more notable and is convinced by material with high porosity allow sound to enter matrix for dissipation. Closed pores block soundwave whereas open pores guarantee continuous channel for sound[22] .

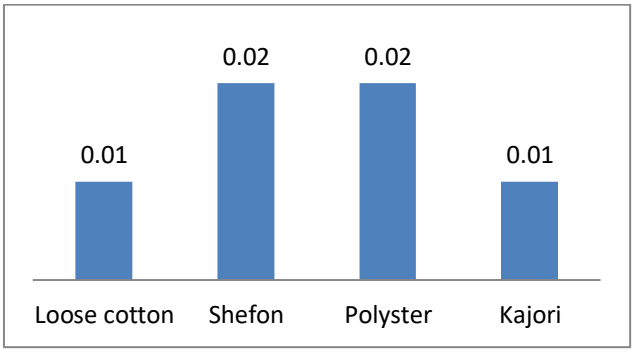

Fig 3: SAC for different cloth material

As observed in fig 3, Among type of cloth, it is seen that SOI for Cotton, Shefon, Polyster & kajori cloth are 0.01, 0.02, 0.02, 0.01 respectively. This indicates that all studied cloth control sound intensity nearly same though porosity of each cloth is different.

 DOI : 10.18231/2454-9150.2018.1313

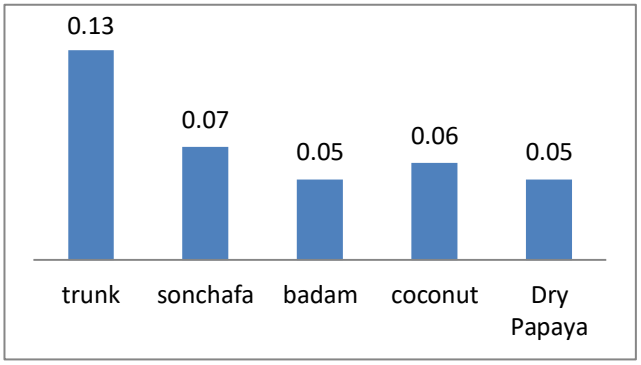

Fig 4: SAC for different leaves

Work was also done regarding sound control outside the house too, to find which part of tree blocks more sound. SAC for trunk, leaves of sonchafa, badam, coconut & dry papaya were 0.13, 0.07, 0.05, 0.06, 0.05. So it was calculated and found that trunk part of tree block most 8 % as compared to its leaves. Study was also done on leaves of different road side plants. It was found that sonchafa absorbs more sound intensity as compared to Coconut, Badam, Papaya leaves as pointed in fig 4.

VI. CONCLUSIONS

Focus was on to find sound barrier inside & outside the house which are commonly used inside the house & commonly seen on street side roads.

Inside the house we prefarrbly use velvet curtains to give fancy and rich look to home. But studies says Tricot material curtains should be more preferably use in house as per above study it lessen up sound intensity within the room and are easy washable .

Generally cloth sheets are used as window sheets like curtains . Studies highlight the point that Cardboard sheet on window are advisable to be use at home as it block sound intensity as well as light intensity too. But to clean & reuse those sheets is doubtful.

More Sonchafa trees should be grown on street roads. These trees will satisfy beautification of street as well as block nearby sound intensity

It is also observed that sound can be more controlled inside the house by using cardsheets as curtains whereas by trunk outside the house.

ACKNOWLEDGMENTS

My sincere thanks to my S.Y.BSc students Mr. Vaibhav R. Patil & Mr. Niraj G. Roge for their help in doing this experimental project in Physics Labaratory. I am also thankful to C.K.Thakur A.C.S College to allow me to use Physics laboratory to perform the experiment.

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