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Advances in Applied Science Research, 2012, 3 (2):1008-1011



Comparing Energy in Different Buildings using two Insulators

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ABSTRACT

This paper describes how to measure conductivity of two new insulators. Mat is made up of Agave plans which are now produced in Iran; gunny made up of plant fibers which is producing in Iran both can be used in walls of buildings to reduce energy loss in cold season. In this work the thermal conductivity for mat is to be 0.06949 J/s.m°c and also from temperature gradient curve it was found that the temperature changes uniformly with thickness of the mat and also the thermal conductivity for gunny is to be 0.080 J/s.m°c and also from temperature gradient curve it was found, the temperature changes uniformly with thickness of the gunny. Finally the difference of the energy gain in the brick buildings with & without the mat was estimated to be 1.9656×10^3 kcal in the cold season in Tehran for 150 days. Ultimately it was estimated energy gain in the brick buildings with & without the gunny to be 2.393×10^5 kcal in the cold season in Tehran for 150 days. The measured thermal insulation of mat and gunny proved to be more desirable comparing with other insulators.

INTRODUCTION

Prior to world war II in the 1940s, coal and wood were important. As we begin the new century the challenges we face as building designers increase daily. In criticism of energy due to the increasing oil and energy price, the main consumption of energy is usually used in residential and commercial buildings. Mat is made up of plant fibers which are produced in many countries in the world.

Both sisal and henequen come from the leaves of species of Agave (Agavaceae). Sislana has sharp spines on the ends of its leaves that have been used by native people as needles, Gunny in made up of plant fibers which is produced in India, from which it is spread throughout the Turkey, Iraq, Pakistan, China, and Iran. Europeans began to search for an inexpensive substitute for flax, they tried to used gunny. The species appears to be a native of the Mediterranean region, from which it was spread throughout the Middle East and Far East. Today gunny uses for coarse goods. We have tried to introduce gunny and mat as two of the desirable insulators. The provision of both the fiber and a sewing utensil gave rise to the common name needle and thread plant. Today the fibers are used for sacking, mat, teabags and as reinforcements for materials such as rubber. Fibers are removed from Agave species in the same way. The outer, mature leaves are cut at the rphous mush that is scraped away from the fibers. The fibers are then washed and hung in the sun to dry. They cabase, to the factory, and fed between rollers that squeeze out most of the water and turn the soft tissues into an amon be dyed or used directly since they are naturally a creamy white if properly washed and dried.[1]. This work tries to consider mat and gunny as two new of the desirable insulators.

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2. Instrumentation

In order to find the thermal conductivity for gunny and mat, the insulation chamber of dimensions

 $0.75 \times 0.6 \times 1$ m³ was made in Shahed University, physics department which consists of three thermometers in which the heat flows through the mat and plywood from the warmer inside to cooler outside (both regions are inside the chamber). The area of the insulation is 0.75×0.60 m², thickness of 0.076m and of 0.01m thick plywood Table1

Ma Materials	Dimensions	
	Area	Thickness
Chamber	0.7*0.6m ²	1m (height)
Mat	0.7*0.6m ²	0.076m
Plywood	0.7*0.6m ²	0.01m

Table1.The dimensions of the insulation chamber



Fig1. The insulation chamber and temperature controller



Fig2(a) A brick chamber with the mat.



Fig2(b) A brick chamber with the gunny.

Inside the chamber blacken and outside of it whiten to avoid penetrating heat into the chamber from outside fig.1. A temperature controller used to control temperature. This system has been constructed from the following difference parts: 1) water container, 2) set of pump, heater and fan, 3) digital thermometer, 4) temperature sensor and 5) digital timer this system has been located on the insulation chamber fig.1. Two chambers made up of brick on the veranda of physics Department, both of them with thickness of 10cm, area of walls are 64×62 cm², one of them without the mat and other with matwith thickness of 0.0261cm. Figure 2(a) shows the brick chamber covered with the gunny and the temperature controller.

3. Measurements

Twenty observations have been taken in different days and the average temperature at inside the chamber shown by temperature controller to be 37° C, the interface temperature to be 30.4° C while the temperature at outside surface to be 29.6° C. The thermal conductivity both insulators [2,3] is given by

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$$Q = \frac{KAt\Delta T}{L}$$

Where Q the number of J/s.m°c, Δt is the temperature difference between the ends of the insulations materials and K is the thermal conductivity of mat and guny, L is the thickness of insulation, cross-sectional area is A and t is the time in hours. From the temperature gradient alongeach insulators, the temperature drops per unit length is constant fig.3[4]. In fact we used in our calculations thermal conductivity of plywood to be 0.08 J/s.m.c [5] The energy gain for one cold season in Tehran is given by:



$$Q = \frac{24(hr) \times A(m^2) \times (\deg days)}{R(hr.m^2.°C/J)}$$

Where $R = \frac{1}{K}$, Q is for the number of degree days for 150 days and every day nine hours observations have been taken.

CONCLUSION

Differences between two energies with two brick chambers with mat and gunny for 150 days about 42.74kcal were estimated for one cold season in Tehran. The measured thermal insulation of mat and gunny proved to be more desirable comparing with thermal insulation of wood. From temperature gradient, the temperature falls uniformly along its length from T1 to T2, and the data points are arrayed in linear fashion. So the heat energy per second reaching the cooler end is less than that energy per second which flows from the hot end. On this basis, it is concluded that for reducing the energy consumption such as coal, natural gas, oil and etc, to the lowest level, mat and gunny can be considered as the best choice. They are cheaper as compared to other insulators. They are available everywhere and can be used easily. They have no side effect at all.

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