Research Article

Study of Indoor Temperature of House in Abakaliki, Nigeria.

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Abstract

This paper presents the study of inner and outer temperature of a thatched house in Abakaliki. The thatched house was erected at Nkaliki-Unuha in Abakaliki and was made up of mud block wood, grass raffia and rope. The temperature was taken using simple mercury-in-glass thermometers with degree of accuracy of ±0.01 degree Celsius was used during the months of March April and May 2008. The analysis of the data collected was done using SPSS.

Keyword: Inner and outer temperature, Mercury-in-glass thermometers, Average environmental temperature, regression, thatched house, mud block.

INTRODUCTION:

The climate in which one builds forms a part of the ‘system’. The impart of the occupants which is also part of the “system” must be understood as they have very significant influence on how the building functions [Garrett, 2005]. A good indoor temperature (climate) is necessary for reason of good health as the world organization stated that the definition of good health: “A state of complete well-being and not merely the absence of disease [W H O 2000,Clement-Croome 1997] The degree of warmth or cold inside a room naturally is dependent on the environmental weather condition of an area, building design and building materials used, in building a house [Ryebcynski 1987]. Though some opinion stipulates that building design is the most probable step in achieving an acceptable indoor climate [Wall, 2005], (Meyer, 2002) others still strongly uphold that building materials play major rule. [Cole, 2000]. This is because adverse emissions to the indoor environment is minimized using building materials that have low primary emission levels and avoiding materials that may give rise to significant secondary emissions [Bakke and Lindvall 1999] Thatch has some natural properties that are advantageous to its performance and is natural weather resistant. It also ensures also good temperature maintained.

Here in Nigeria, buildings are usually built with cement blocks, wood and corrugated iron or aluminum roofing sheet. In recent times research has proved that the uses of local materials mold bricks and thatches have found to be efficient in achieving good indoor temperature. There is now a renewed interest in thatched houses for preserving historic building, sustainability of building materials (Sedemaky, 2003).

In this paper however we want to study the indoor temperature of mud block building roofed with thatches in Abakaliki Ebonyi State Nigeria.

METHODOLOGY

The building was erected at Nkaliki Unuha in Abakaliki using mud blocks, wood and raffia (grass) rope. The internal and external dimensions of building are:

The inner and outer temperature was taken simultaneously using mercury in glass thermometers and was conducted when the average environmental temperature is between 30°C and 27°C in the area. That is within the month of March, April and May.

The thermometers were suspended by a means of thread fixed to a frame inside and the other one outside. Readings were taken from 8.00am to 5.00pm at the interval of every thirty minute for six times in a week for the three specified month in 2008. The collected data were analyzed using S P S S with which the cubic regressions for both the inside and outside temperature were plotted.
RESULT AND DISCUSSION

The graphs of the work are presented in figure 1 to 12. These graphs show the variations of the inner temperature \( T_i(t) \), outer temperature \( T_o(t) \) against time in an attempt to reduce the bulk nature of the graphs, we randomly chose three groups of reading for each month respectively. In this case Fig 1 to Fig 4 depict that of March, Fig 5 to Fig 8 present that of April while that of Fig 4 to Fig 12 show that of May. For the month of March as shown in fig 1 to 4, Fig 1 and Fig 3, it is observed that the outer temperature \( T_o(t) \) is higher than the inner temperature \( T_i(t) \) in the early hour top to afternoon period. Latter in the day, the outer temperature \( T_o(t) \) fall slightly below the inner temperature \( T_i(t) \). In Fig 2 Fig 4, the trend appears to be the same, but even in the late hour of the days \( T_i(t) \) remained during the month of April the graphs portend the same characteristics apart from Fig 8 where the variation in \( T_i(t) \) remained vary slight.

For the month of May whose data is presented in Fig 9 to Fig 12, The variation of \( T_o(t) \) seemed constant during the early hours of the day until in the late hour when \( T_i(t) \) rises slightly greater than \( T_o(t) \). The late hour in Fig 10 presented \( T_o(t) \) greater than \( T_i(t) \) unlike Fig 11 and Fig 12.

![Graph of inner and outer temperatures of thatched house against time](image-url)

Fig. 1: Variations of inner \( T_i(t) \) and outer \( T_o(t) \) temperatures of thatched house against time \( t \) (March, Day 2)
Fig. 2: Variations of inner $T_{it}(t)$ and outer $T_{o}(t)$ temperatures of thatched house against time ($t$) (March, Day 2)

Fig. 3: Plot of instrument function $K(t)$ of thatched house against time ($t$) (March, Day 3)
Fig. 4: Variations of inner $T_i(t)$ and outer $T_o(t)$ temperatures of thatched house against time ($t$ (March, Day 4))

Fig. 5: Variations of inner $T_i(t)$ and outer $T_o(t)$ temperatures of thatched house against time ($t$ (April, Day 1))
Fig 6: Plot of instrument function $K(t)$ of thatched house against time ($t$) (March, Day 6)

Fig 7: Variations of inner $T_i(t)$ and outer $T_o(t)$ temperatures of thatched house against time ($t$) (April, Day 3)
Fig. 8: Variations of inner $T_{ic}(t)$ and outer $T_o(t)$ temperatures of thatched house against time ($t$) (April, Day 2)

Fig. 9: Variations of inner $T_{ic}(t)$ and outer $T_o(t)$ temperatures of thatched house against time ($t$) (April, Day 4)
Fig. 10: Variations of inner $T_{i}(t)$ and outer $T_{o}(t)$ temperatures of thatched house against time ($t$) (May, Day 1)

Fig. 11: Variations of inner $T_{i}(t)$ and outer $T_{o}(t)$ temperatures of thatched house against time ($t$) (May, Day 2)
CONCLUSION.

It is clear here that the inner and outer temperatures vary slightly and intersect at some points which is an indication that these variations coincide at some specific time of the day. It is seen that for some days $T_o(t)$ is lower than $T_i(t)$ at late hours of the day which may be attributed to penetration of radiation into the house which is eventually entrapped in the house or combined effect of heat exchange due to radiation and heat convention.

REFERENCES


Fig. 12: Variations of inner $T_i(t)$ and outer $T_o(t)$ temperatures of thatched house against time $(t)$ (May, Day 6)

Key:

$\cdots \cdots \cdots T_i(t)$

$\cdots \cdots \cdots T_o(t)$
Sedemsky, M 2003 Low-Tech building creze hits Hawai; Indigenous thatched – proof Hale once out favour, now seen as status symbol on the islands. Washington post; 166.