

Experimental Investigation Carried Out with Lighter to Provide A Fire Retardant- Thatched Roof for Rural Development

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Abstract— Developing rural areas aims at providing people with proper shelter, education, occupation, etc. and the needful among these is good housing because there is a wide range of shortage for rural housing. This study aims at developing a thermally comfortable rural housing (i.e. thatched roof) for rural people. The research also examines the various characteristics of thatch (i.e. dried coconut leaves) and to evaluate a suitable fire resistant material for coating on thatch to resist fire under various conditions, since it's a major drawback is, it is not resistant to fire. Thus, this study delivers a good natural solution both for minimizing the effect of fire by finding a suitable fire resistant material (i.e. a combination of red soil, lime and fly ash) with the best combination for coating on thatch and also, on the whole, prevents the shortage of rural housing, with the aid of naturally and locally available material in order to achieve a sustainable rural housing.

Keywords— *Dried coconut leaves, fire resistant material, rural development, Sustainable rural housing, thatched roof.*

I. INTRODUCTION

Rural development focuses on enhancing the lifestyle of rural people by providing their basic needs. The shelter is one of the most important basic need apart from food and water, is concentrated for its betterment. As per the current scenario in India, the urban population is around 42.7 crores, the rural population is 90.8 crores. This shows that the rural population is twice as much as urban. Thus, there is a wide range of shortage for housing in rural areas estimated to about 4.37 crores compared to 1.2 crores in urban. Therefore, the need for the development of rural housing is of high importance, which can be achieved through sustainable rural development. Sustainable rural development comprises of three main factors: environment, economic and social growth. The rural housing should suit all three factors to become a sustainable one [22]. Energy saving has become an essential need for people all over the world, that will result in protecting the environment and conserve natural resources. Generally, one of the major sources of energy consumption in a building is through energy consumption of heating and cooling [1]. Thatch (i.e. dried coconut leaves) is one of the oldest, cultural and sustainable roofing material ever used in the construction of rural housing.

In India, majority of the coconut producers are from south and Tamilnadu is one of the leading producers of coconut estimated to about 4760.7 million tons. Utilizing thatch (i.e. dried coconut leaves) as a roofing material instead of wasting or depleting the environment aids to achieve an eco-friendly rural housing for the rural living. The main attribute of thatch

is its ability to act as an excellent insulator in all climatic conditions. [7]. The thermal conductivity of dried coconut leaves (i.e., 0.05 W/mK) is lower when compared to other thatching material such as water reed, straw bales, and asbestos which makes it a reliable roofing material [17]. Thatch (i.e. dried coconut leaves) is an economical roofing material because it a locally and naturally available material, so it reduces the transportation charges to a greater extent. The material cost is also reduced since it is a secondary product which is utilized properly without depleting the environment. Thus, the overall cost is greatly reduced when compared to other roofing material like asbestos and clay tiles [22]. Even though thatch, has many advantages, its main drawback is its resistance towards the fire which can be resolved by coating a suitable fire resistant material on its surface. The study focuses on identifying a suitable, naturally available and environmentally friendly material that competes with the other civil engineering materials which can be applied on thatch without compromising its thermal properties [24].

A. AIM

- To study about a fire resistant- thatched roof for sustainable rural development.

B. OBJECTIVE

- To analyze the characteristics of thatch
- To identify and study a naturally available fire resistant material for coating on the thatch
- To carry out an experimental study using lighter on ordinary and coated thatch for analyzing its resistance towards the fire.

II. MATERIALS AND METHODS

General analysis for using thatch (i.e. dried coconut leaves) as a roofing material is been clearly illustrated through the literature. Here the raw materials used are red soil, lime & fly ash. Red soil which comprises of silica and clay is a better fire resistant material when compared to sand [14]. Lime is a thermally efficient binding material that suits all the temperatures and produces low heat. Fly ash is also a good binding material that reduces the water content and in turn, increases the strength [2]. Lime and fly ash are used instead of cement because the latter produces more heat and it affects the thermal comfort of thatch. [9]. The basic tests for these raw materials are carried out as similar to basic tests for cement and fine aggregate as per the IS 4031 part11-1988, IS

4031(part1)-1968 IS: 2386, IS: 383-1970, IS: 2386(part3)-1963.

The main part of the study falls under the fire resistance tests carried out with lighter on naturally coated thatch and ordinary thatch (i.e. uncoated thatch) which compares the parameters of both the thatch to deliver with a solution that fire can be minimized to a greater extent when thatch is coated with naturally available material. Usually, a coating material is said to be thermally comfortable based on the following characteristics: color, composition, and finish [21].

The parameters that are established helps to identify the best combination of the raw materials that can be coated on thatch and which sustains in all test conditions are as follows: ability of fire ignition (in seconds), vertical flame spread distance (in mm), Ability of fire extinction (in seconds), Smoke startup (in sec), Smoke put off (in sec) [3]. The parameters are briefly explained as follows: ability of fire ignition is the parameters delivers how quickly a thatch (i.e. dried coconut leaves) catch fire, vertical flame spread distance is the distance along the vertical direction on thatch where the fire spreads and it is measured in mm, ability of fire extinction and smoke start-up time as similar because its only when a flame puts-off, the smoke can start up, so it's the time at which a flame is extinguished and smoke is started up, finally the smoke putt-off time is the time or the second at which the entire process of fire resistance test or the smoke comes to an end and it is also measured in seconds.

Usually fire resistance tests is carried out on thatch to examine its resistivity against fire at various test conditions such as before applying waterproofing agent on thatch for various proportions of identified material (i.e.50% red soil, 25% lime& 25% fly ash; 60% red soil, 20% lime& 20% fly ash; 40% red soil, 30% lime& 30% fly ash) and after applying waterproofing agent on thatch for various proportions of identified material (i.e.50% red soil, 25% lime& 25% fly ash; 60% red soil, 20% lime& 20% fly ash; 40% red soil, 30% lime& 30% fly ash) at normal & high wind speed conditions.

The procedure to carry out the study is simpler and definite. Initially different proportions of red soil, lime and fly ash are weighed in grams (say in case of 50% of red soil, 25% of lime, 25% of fly ash - 1000grams of red soil, 500 grams of lime and 500 grams of fly ash) that can be used for coating both sides of a 5.5m x 1.5m thatch with a water content of about 700ml and waterproofing agent of about 50 ml are taken. The combination material is homogeneously mixed at dry condition, then water is added to the dry mix and mixed thoroughly to get a paste-like consistency. After that the mixture is applied gently on to the thatch on both the sides with a brush and dried for 24 hours, then the waterproofing agent is applied on the coated thatch which is dried for about another 1 or 2 hours. Finally, the fire resistance tests are carried out with lighter under various conditions as already mentioned

III. DATA COLLECTION

The data for various tests are collected in a detailed manner. These values help to carry out the further evaluation, analysis and for preparing conclusions. Basic tests are carried out to analyze the standards of the raw materials that is been used as per the IS specifications. And the results of the corresponding tests are drafted in table I below:

Note:

- a) Duration of flame = flame put off time in sec – ignition time in seconds;
- b) Duration of smoke = smoke put off time in sec – smoke startup time in seconds
- c) NWS- normal wind speed, HWS – high wind speed

TABLE I. BASIC TESTS RESULTS OF RED SOIL, LIME & FLY ASH

s.n o	Tests	Red soil	Lime	Fly ash
1	Specific gravity as per IS 4031 part11-1988 & as per IS: 2386(part3)-1963	2.4	2.56	2.212
2	Fineness (%) as per IS 4031(part1)-1968	-	8.8	8
3	Fineness modulus (%) as per IS: 383-1970	2.87	-	-
4	Bulking of FA (%) as per IS: 2386(part3)-1963	28.3	-	-

A. Fire resistance test on normal thatch and coated thatch

Case 1: Test carried out with lighter on normal thatch with a normal wind speed of 4m/s to 7m/s and high wind speed of 7ms.

TABLE II. FIRE RESISTANCE TESTS FOR A FIRE LIT UP WITH LIGHTER ON NORMAL THATCHAT NORMAL AND HIGH WIND SPEED

s.no	Description	Average of 3 trails at normal wind speed (NWS)	Average of 3 trails at high wind speed (HWS)
1	Ability of fire ignition (in sec)	6.43	6.5
2	Vertical flame spread distance (in mm)	168	174
3	Ability of fire extinction (in sec)	35.4	35.81
4	Smoke startup (in sec)	35.4	35.81
5	Smoke put off (in sec)	40.7	41.13

From the table II, the average ignition time for NWS is 6.43& for HWS is 6.5; duration of flame for NWS is 28.97& HWS is 29.31, and duration of smoke for NWS is 5.3& HWS is 5.32, and average vertical flame spread for NWS is 168mm& HWS is 174mm.

Case2: Tests carried out with lighter on coated thatch (contains 50% of red soil, 25% of lime and 25% of fly ash) before applying waterproof and also with normal wind speed (NWS) of 4m/s to 7m/s & high wind speed (HWS) of more than 7m/s.

TABLE III. FIRE RESISTANCE TESTS FOR A FIRE LIT UP WITH LIGHTER & AT NORMAL WIND SPEED AND HIGH WIND SPEED ON COATED THATCH (50% OF RED SOIL, 25% OF LIME AND 25% OF FLY ASH) BEFORE WATERPROOF.

s.no	Description	Average of 3 trails at normal wind speed (NWS)	Average of 3 trails at high wind speed (HWS)
1	Ability of fire ignition (in sec)	24.6	20.31
2	Vertical flame spread distance (in mm)	65	67
3	Ability of fire extinction (in sec)	33.7	24.10
4	Smoke startup (in sec)	33.7	24.10
5	Smoke put off (in sec)	43.71	30.9

From the table III, the average ignition time for NWS is 24.6 & HWS is 20.31, duration of flame for NWS is 9.1 & HWS is 3.79, and duration of smoke for NWS is 10.01 & HWS is 6.8, and average vertical flame spread for NWS is 65mm. & HWS is 67mm.

Case3: Tests carried out with lighter on coated thatch (contains 60% of red soil, 20% of lime and 20% of fly ash) before applying waterproof and also with a normal wind speed of 4m/s to 7m/s & high wind speed of more than 7m/s.

TABLE IV. FIRE RESISTANCE TESTS FOR FIRE LIT UP WITH LIGHTER & AT NORMAL WIND SPEED AND HIGH WIND SPEED ON COATED THATCH (60% OF RED SOIL, 20% OF LIME AND 20% OF FLY ASH) BEFORE WATERPROOF.

s.no	Description	Average of 3 trials at normal wind speed (NWS)	Average of 3 trials at high wind speed (HWS)
1	Ability of fire ignition (in sec)	22.81	16.63
2	Vertical flame spread distance (in mm)	62	63
3	Ability of fire extinction (in sec)	36.19	32.27
4	Smoke startup (in sec)	36.19	32.27
5	Smoke put off (in sec)	45.9	38.83

From the table IV, the average ignition time for NWS is 22.81 & HWS is 16.63, duration of flame NWS is 13.38 & HWS is 15.64, and duration of smoke NWS is 9.71 & HWS is 6.56, and average vertical flame spread NWS is 62mm & HWS is 63mm.

Case4: Tests carried out with lighter on coated thatch (contains 40% of red soil, 30% of lime and 30% of fly ash) before applying waterproof and also with a normal wind speed of 4m/s to 7m/s & wind speed of more than 7m/s.

TABLE V. FIRE RESISTANCE TESTS FOR A FIRE LIT UP WITH LIGHTER & AT NORMAL WIND SPEED AND HIGH WIND SPEED ON COATED THATCH (40% OF RED SOIL, 30% OF LIME AND 30% OF FLY ASH) BEFORE WATERPROOF.

s.no	Description	Average of 3 trials at normal wind speed (NWS)	Average of 3 trials at high wind speed (HWS)
1	Ability of fire ignition (in sec)	13.73	15.83
2	Vertical flame spread distance (in mm)	72	74
3	Ability of fire extinction (in sec)	26.94	32.9
4	Smoke startup (in sec)	26.94	32.9
5	Smoke put off (in sec)	37.57	45.16

From the table V, the average ignition time for NWS is 13.73 & HWS is 15.83, duration of flame for NWS is 13.21 & HWS is 17.07, and duration of smoke for NWS is 10.63 & HWS is 12.26, and average vertical flame spread for NWS is 72mm & HWS is 74mm.

Case5: Tests carried out with lighter on coated thatch (contains 50% of red soil, 25% of lime and 25% of fly ash) after applying waterproof and also with normal wind speed (NWS) of 4m/s to 7m/s & high wind speed (HWS) of more than 7m/s.

TABLE VI. FIRE RESISTANCE TESTS FOR A FIRE LIT UP WITH LIGHTER & AT NORMAL WIND SPEED AND HIGH WIND SPEED ON COATED THATCH (50% OF RED SOIL, 25% OF LIME AND 25% OF FLY ASH) AFTER WATERPROOF..

s.no	Description	Average of 3 trials at normal wind speed (NWS)	Average of 3 trials at high wind speed (HWS)
1	Ability of fire ignition (in sec)	65.11	65.51
2	Vertical flame spread distance (in mm)	64	62
3	Ability of fire extinction (in sec)	74.25	77.95
4	Smoke startup (in sec)	74.25	77.95
5	Smoke put off (in sec)	89.41	103.47

From the table VI, the average ignition time for NWS is 65.11 & HWS is 65.51, duration of flame for NWS is 9.14 & HWS is 12.44, and duration of smoke for NWS is 15.16 & HWS is 25.52, and average vertical flame spread for NWS is 64mm. & HWS is 62mm.

Case6: Tests carried out with lighter on coated thatch (contains 60% of red soil, 20% of lime and 20% of fly ash) after applying waterproof and also with a normal wind speed of 4m/s to 7m/s & high wind speed of more than 7m/s.

TABLE VII. FIRE RESISTANCE TESTS FOR A FIRE LIT UP WITH LIGHTER & AT NORMAL WIND SPEED AND HIGH WIND SPEED ON COATED THATCH (60% OF RED SOIL, 20% OF LIME AND 20% OF FLY ASH) AFTER WATERPROOF.

s.no	Description	Average of 3 trials at normal wind speed (NWS)	Average of 3 trials at high wind speed (HWS)
1	Ability of fire ignition (in sec)	26.91	29.01
2	Vertical flame spread distance (in mm)	69	66
3	Ability of fire extinction (in sec)	36.21	34.14
4	Smoke startup (in sec)	36.21	34.14
5	Smoke put off (in sec)	41.90	48.81

From the table VII, the average ignition time for NWS is 26.91 & HWS is 29.01, duration of flame NWS is 9.3 & HWS is 5.13, and duration of smoke NWS is 5.69 & HWS is 14.67, and average vertical flame spread NWS is 69mm & HWS is 66mm.

Case7: Tests carried out with lighter on coated thatch (contains 40% of red soil, 30% of lime and 30% of fly ash) after applying waterproof and also with a normal wind speed of 4m/s to 7m/s & wind speed of more than 7m/s.

TABLE VIII. FIRE RESISTANCE TESTS FOR A FIRE LIT UP WITH LIGHTER & AT NORMAL WIND SPEED AND HIGH WIND SPEED ON COATED THATCH (40% OF RED SOIL, 30% OF LIME AND 30% OF FLY ASH) AFTER WATERPROOF.

s.no	Description	Average of 3 trials at normal wind speed (NWS)	Average of 3 trials at high wind speed (HWS)
1	Ability of fire ignition (in sec)	12.90	15.28
2	Vertical flame spread distance (in mm)	74	73

s.no	Description	Average of 3 trials at normal wind speed (NWS)	Average of 3 trials at high wind speed (HWS)
3	Ability of fire extinction (in sec)	22.9	22.52
4	Smoke startup (in sec)	22.9	22.52
5	Smoke put off (in sec)	37.63	36.88

From the table VIII, the average ignition time for NWS is 12.90& HWS is 15.28, duration of flame for NWS is 10 & HWS is 7.24, and duration of smoke for NWS is 14.73& HWS is 14.36, and average vertical flame spread for NWS is 74mm& HWS is 73mm.

IV. RESULTS AND DISCUSSIONS

A. Analysis of fire resistance tests carried out with lighter on normal thatch

A brief analysis is carried out on normal thatch lit up with lighter for both normal and high wind speed conditions and corresponding parameters are noted as in figure 1 to compare it with the coated thatch.

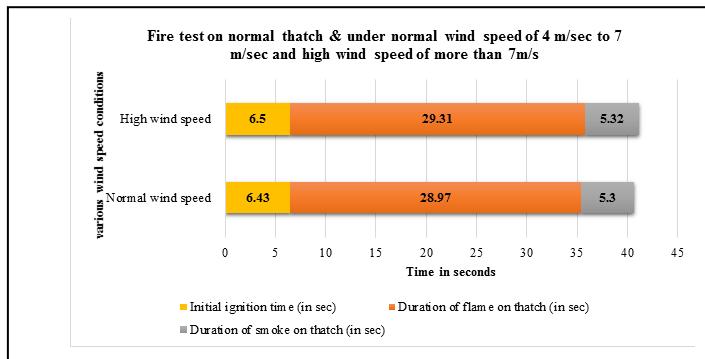


Fig. 1. Fire test on normal thatch & under normal wind speed of 4 m/sec to 7 m/sec and high wind speed of more than 7 m/sec

In case of a normal or conventional thatch, the ability of ignition is less, and the period of flame and smoke that sustains on thatch is more, which is a major drawback of the conventional thatch. This lead to the identification of a fire retardant material for applying on thatch to increase its ignition time and reduce its period of flame and smoke.

B. Analysis of fire resistance tests carried out with lighter on coated thatch

A detailed analysis is carried out on coated thatch lit off with lighter under various test conditions and its parameters are compared with normal thatch to analyze its fire resistivity.

1) Analysis of fire tests on coated thatch in terms of its ability of ignition, the period of flame & smoke.

Ability of ignition, the period of flame & smoke are analyzed for three proportions and the suitable combination is identified with the help of the analysis that is been carried out for various conditions. It analyses how rapidly a coated thatch catches fire and also how long flame and smoke sustains on the thatch.

Case 1: Fire tests using lighter at normal wind speed and before applying the waterproofing agent.

The figure 2 indicates the results of fire test using lighter, before applying waterproofing agent and under normal wind speed of 4 m/sec to 7 m/sec which are represented by the ignition time, duration of flame and smoke on thatch and also the combined duration of flame and smoke on thatch in seconds for various proportions of red soil, lime and fly ash is been examined from the figure.

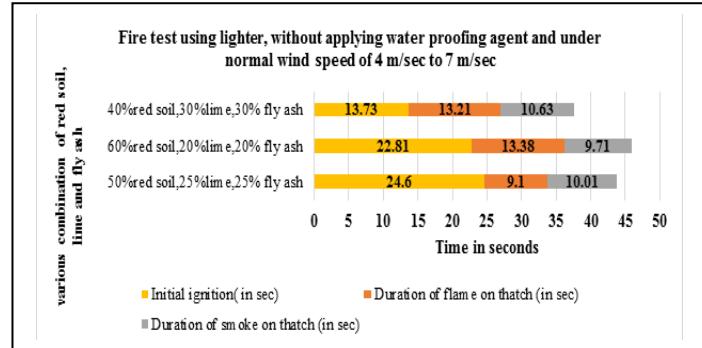


Fig. 2. Fire test using lighter, without applying waterproofing agent and under normal wind speed of 4 m/sec to 7 m/sec

The figure 2 infers that, by considering all the three proportions say 50% of red soil, 25% of lime, 25% of fly ash; 60% of red soil, 20% lime, 20% of fly ash; 40% of red soil, 30% of lime, 30% of fly ash, the ignition time for 50% of red soil, 25% of lime, 25% of fly ash was found to be the highest (i.e. higher the ignition time better the outcome). Whereas the combined duration of flame and smoke on thatch was better with 50% of red soil, 25% of lime, 25% of fly ash (i.e. lesser the duration better the outcome). Thus, 50% of red soil, 25% of lime, 25% of fly ash proportion seems to be the one which is better than other proportions.

Case 2: Fire tests using lighter at high wind speed and before applying the waterproofing agent.

The figure 3 indicates the results of fire test using lighter, without applying waterproofing agent and under high wind speed of more than 7 m/sec which are represented by the ignition time, duration of flame and smoke on thatch and also the combined duration of flame and smoke on thatch in seconds for various proportions of red soil, lime and fly ash is been examined from the figure.

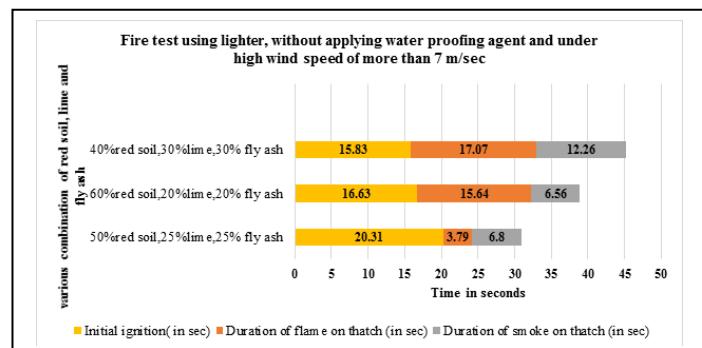


Fig. 3. Fire test using lighter, without applying waterproofing agent and under high wind speed of more than 7 m/sec

The figure 3 infers that, by considering all the three proportions say 50% of red soil, 25% of lime, 25% of fly ash;

60% of red soil, 20% lime, 20% of fly ash; 40% of red soil, 30% of lime, 30% of fly ash, the ignition time for 50% of red soil, 25% of lime, 25% of fly ash was found to be the highest (i.e. higher the ignition time better the outcome). And the combined duration of flame and smoke on thatch was also better with 50% of red soil, 25% of lime, 25% of fly ash (i.e. lesser the duration better the outcome). Thus, 50% of red soil, 25% of lime, 25% of fly ash proportion seems to be the one which is better than other proportions.

Case 3: Fire tests using lighter at normal wind speed and after applying waterproofing agent.

The figure 4 indicates the results of fire test using lighter, after applying waterproofing agent and under normal wind speed of 4 m/sec to 7 m/sec which are represented by the ignition time, duration of flame and smoke on thatch and also the combined duration of flame and smoke on thatch in seconds for various proportions of red soil, lime and fly ash is been examined from the figure.

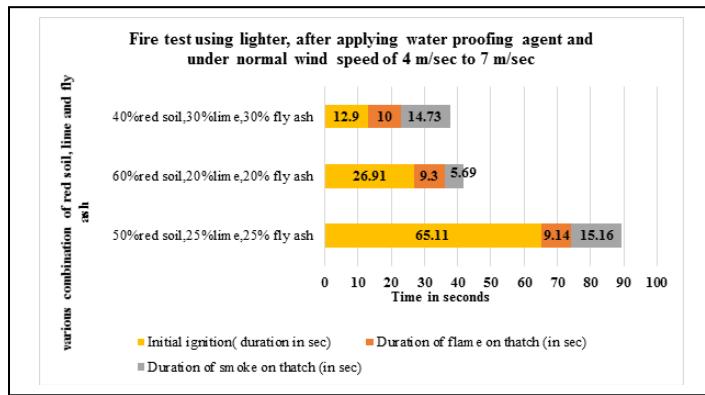


Fig. 4. Fire test using lighter, after applying waterproofing agent and under normal wind speed of 4 m/sec to 7 m/sec

The figure 4 infers that, by considering all the three proportions say 50% of red soil, 25% of lime, 25% of fly ash; 60% of red soil, 20% lime, 20% of fly ash; 40% of red soil, 30% of lime, 30% of fly ash, the ignition time for 50% of red soil, 25% of lime, 25% of fly ash was found to be the highest (i.e. higher the ignition time better the outcome). Whereas the combined duration of flame and smoke on thatch was better with 60% of red soil, 20% of lime, 20% of fly ash (i.e. lesser the duration better the outcome). Put together, considering the difference in time taken between ignition times of the above two proportions is around 38.2 sec and the difference between the combined duration of flame and smoke for respective proportions is about 9.31 sec. Thus, by taking into account the parameter which has a maximum difference, 50% of red soil, 25% of lime, 25% of fly ash proportion seems to be the one which is better than other proportions.

Case 4: Fire tests using lighter at high wind speed and after applying waterproofing agent.

The figure 5 indicates the results of fire test using lighter, after applying waterproofing agent and under high wind speed of more than 7 m/sec which are represented by the ignition time, duration of flame and smoke on thatch and also the combined duration of flame and smoke on thatch in seconds for various proportions of red soil, lime and fly ash is been examined from the figure.

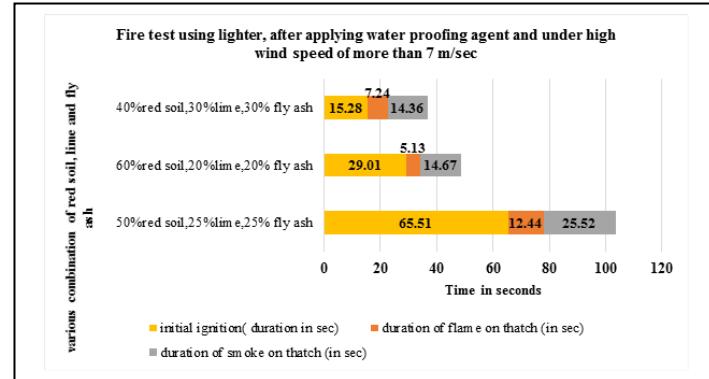


Fig. 5. Fire test using lighter, after applying waterproofing agent and under high wind speed of more than 7 m/sec

The figure 5 infers that, by considering all the three proportions say 50% of red soil, 25% of lime, 25% of fly ash; 60% of red soil, 20% lime, 20% of fly ash; 40% of red soil, 30% of lime, 30% of fly ash, the ignition time for 50% of red soil, 25% of lime, 25% of fly ash was found to be the highest (i.e. higher the ignition time better the outcome). Whereas the combined duration of flame and smoke on thatch was better with 60% of red soil, 20% of lime, 20% of fly ash (i.e. lesser the duration better the outcome). Put together, considering the difference in time taken between ignition times of the above two proportions is around 36.5 sec and the difference between the combined duration of flame and smoke for respective proportions is about 18.16 sec. Thus, by taking into account the parameter which has a maximum difference, 50% of red soil, 25% of lime, 25% of fly ash proportion seems to be the one which is better than other proportions.

2) Analysis of fire tests on coated thatch in terms of its vertical flame spread distance in mm.

To carry out the analysis, the coated thatch is marked for every 75mm distance with a marker and the fire is lit with crackers and its vertical flame spread is been examined visually to check whether they fall under the standards.

Case 1: Vertical flame spread tests carried out with lighter for three proportions before waterproof coating and also under normal and high wind speed.

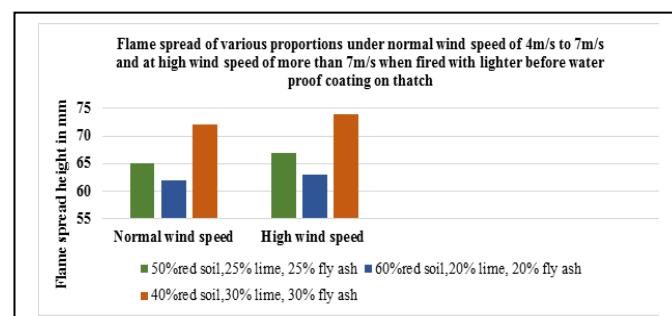


Fig. 6. Flame spread of various proportions under normal wind speed of 4m/s to 7m/s and at a high wind speed of more than 7m/s when fired with lighter before waterproof coating on the thatch

From the above figure 6, it is inferred that for all the three proportions say 50%red soil, 25% lime & 25% fly ash;

60%red soil, 20% lime & 20% fly ash; 40%red soil, 30% lime & 30% fly ash when the fire is being ignited with lighter before waterproof coating, the flame spread for both normal wind speed of 4m/s to 7m/s and for high wind speed of more than 7m/s is below 165mm and it falls under class 1 (as per BS 476:PART7:1997 standards). Thus, all the three proportions follow the standards and it's evident that all the proportions are suitable in case of considering the vertical flame spread in a thatch. So, the best-suited proportion can be concluded with the help of the other three aspects namely ignition time, duration of flame & duration of smoke.

Case 2: Vertical flame spread tests carried out with lighter for three proportions after waterproof coating and also under normal and high wind speed.

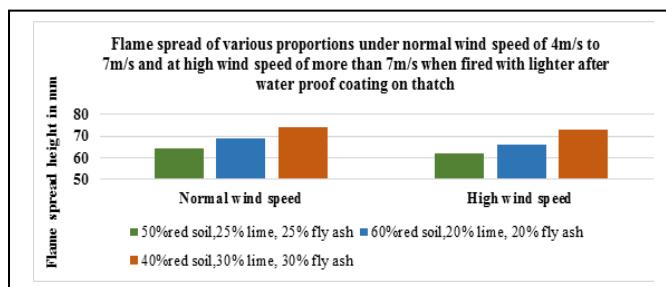


Fig. 7. Flame spread of various proportions under normal wind speed of 4m/s to 7m/s and at a high wind speed of more than 7m/s when fired with lighter after waterproof coating on a thatch

From the above figure 7, it is inferred that for all the three proportions say 50%red soil, 25% lime & 25% fly ash; 60%red soil, 20% lime & 20% fly ash; 40%red soil, 30% lime & 30% fly ash when the fire is being ignited with lighter after waterproof coating, the flame spread for both normal wind speed of 4m/s to 7m/s and for high wind speed of more than 7m/s is below 165mm and it falls under class 1 (as per BS 476: PART7:1997 standards). Thus, all the three proportions follow the standards and it's evident that all the proportions are suitable in case of considering the vertical flame spread in a thatch. So, the best-suited proportion can be concluded with the help of the other three aspects namely ignition time, duration of flame & duration of smoke.

V. CONCLUSION

The study concludes the importance of thatch as a sustainable roofing material if properly treated with a suitable and eco-friendly fire retardant material (I.e. red soil, lime and fly ash). On comparing the parameters of normal and naturally coated thatch, using 50% of red soil, 25% of lime & 25 % of fly ash proportion inferred to be the best proportion that can resist fire when lit up with lighter under various test conditions. Eventually, the study creates awareness on a locally available material such as thatch and extends its utilization for rural housing. Further, the study can stretch its arm towards enhancing the performance of naturally coated thatch, by comparing the durations (ability of ignition time & period of flame and smoke on thatch) of naturally coated thatch with chemically coated thatch.

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