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CET Code: E-175 (UG)/T-942 (PG)

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**Project Reference number:- 46S\_BE\_1168**

**Title of Project:-**

**Utilization of industrial waste red mud in manufacturing roofing tiles.**

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**Introduction:**

Red mud is an industrial waste generated during the processing of bauxite into alumina using Bayer process. Annual production of red mud worldwide is 150 million tons, India itself generates 9 million tons of red mud annually. Because of high level production of red mud and excessive presence of alkalinity it is posing a significant environmental hazard and storage problem. Waste red mud is dumped into mud lakes in the form of slurry impoundments or stacks, due to which various environmental problems such as soil contamination, ground and surface water pollution is increasing. As a result, significant research and studies are being carried out by researchers. Due to large scale development of industrialization and urbanization has caused greater demand for construction materials this resulted the excessive use of natural resources and depleted it as well. So, the replacement of conventional building materials using byproducts generated by factories and industries to achieve sustainability in environment should be promoted. The red mud as a byproduct from industries can be utilized in civil construction. Roofing tiles have been manufactured using various wastes, but no works have been carried out on manufacturing roofing tiles with the combination of waste red mud. So, we are making use of waste red mud in manufacturing roofing tiles in order to reduce the disposal problem.

## Objectives:

Industrial red mud which is a waste by product obtained from aluminum industry is causing disposal problem as the seepage of alkaline liquor into ground may cause contamination of ground water. Waste red mud storage leads to reduction in availability of usable land and cause soil pollution. In order to overcome many other problems apart from above mentioned issues, the waste red mud can be utilized in construction materials which may reduce the loss of natural red soil and lower overall cost.

In view of literature study, the objectives of this study are set as:

- To determine strength characteristics of roofing tiles with red mud.
- To determine optimum dosage of red mud in present roofing tiles.
- Comparative study in cost estimation of existing roofing tiles with roofing tiles of red mud.

## Methodology:

Raw materials were collected, i.e., clay from Khanapur, red soil from Belagavi, and red mud from HINDALCO industry Belagavi. Firstly, basic tests were carried out to know the index properties of soil samples. The raw materials were dry mixed according to mix proportion (i.e., replacing red soil by red mud by 0%,10%,20%, 30%, 40%, 50%, 60%, and clay 40%. Plastic fibers were added about 0.2% of total weight). Then water is added to dry mix to get required consistency. Mould size of 300x100x30mm was used to shape the samples. The mixture was filled into mould with proper compaction and demoulded. The samples were subjected to air drying for 7 days and then burnt for about 8 hours. After which the samples were subjected to finishing by redox coating for aesthetic purpose. The finished samples were tested to determine the strength characteristics.

## Result :-

1. It is observed that, the compressive strength of roofing tile produced by replacing red soil by red mud goes on increasing up to 50%. After 50% replacement the strength decreases. At 50% replacement the compressive strength is found to be 9.16 MPa and is 120% higher than 0% replacement.

This may be due to the fact that at 50% replacement, the added red mud, being fine in nature fills up all the pores and develop a compact microstructure for the soil, thereby increasing the compressive strength.

Thus, it can be concluded that, the higher compressive strength for the roofing tile may be obtained by replacing 50% of red soil by red mud and it exhibits 120% higher compressive strength as compared to the reference mix.

2. It is observed that, the flexural strength of roofing tile produced by replacing red soil by red mud goes on increasing up to 50%. After 50% replacement the strength decreases. At 50% replacement the flexural strength is found to be 4.44 MPa and is 120% higher than 0% replacement.

This may be due to the fact that at 50% replacement, the added red mud, being fine in nature fills up all the pores and develop a compact microstructure for the soil, thereby increasing the flexural strength.

Thus, it can be concluded that, the higher flexural strength for the roofing tile may be obtained by replacing 50% of red soil by red mud and it exhibits 170.73% higher compressive strength as compared to the reference mix.

3. It is observed that, the water absorption of roofing tile produced by replacing red soil by red mud goes on decreasing as the percentage % replacement increases.

This may be due to the fact that the added red mud, being fine in nature fills up all the pores thereby reducing the water absorption capacity of the mass.

Thus, it can be concluded that, the water absorption of roofing tiles produced by replacing red soil by red mud goes on decreasing as the percentage % replacement increases.

4. Red mud being a waste product of aluminum industry and being fine in nature, it can be added as a replacement material for red soil. Since the red mud is used in production of roofing tiles certainly the cost of the product becomes less. Also, since the industrial waste is used, it will bring down the pressure of dumping in the nature. Thus, overall utilization of red mud in production of roofing tiles becomes cost effective.

## **Conclusion**

Following conclusions may be drawn based on the experimental results.

1. The higher compressive strength for the roofing tile may be obtained by replacing 50% of red soil by red mud and it exhibits 120% higher compressive strength as compared to the reference mix.
2. The higher flexural strength for the roofing tile may be obtained by replacing 50% of red soil by red mud and it exhibits 170.73% higher compressive strength as compared to the reference mix.
3. The water absorption of roofing tiles produced by replacing red soil by red mud goes on decreasing as the percentage % replacement increases.

## **Scope of Project:-**

Following works can be taken up in future.

1. Impact resistance of roofing tiles produced by replacing red soil by red mud.
2. Effect of freezing and thawing on the roofing tiles produced by replacing red soil by red mud.
3. Effect of rainfall impact on the roofing tiles produced by replacing red soil by red mud.
4. Effect of alternate wetting and drying on the roofing tiles produced by replacing the red soil by red mud.