Manufacturing of Bricks using WTP Sludge

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Abstract— In this paper different type of benefits, process and main function of Manufacturing of Bricks Using WTP Sludge is discussed. Increased environmental awareness among people exerts high pressure on water production industry for safe disposal of residues generated in water treatment plants. To study if the sludge which has similar properties of that of soil can be used to replace clay in brick manufacturing. This paper reports the use of sludge as new and non-conventional construction materials as an alternative means of sludge disposal. Due to the similar mineralogical composition of clay and water treatment plant sludge, this study focused on the reuse of sludge in clay brick production. The use of sludge as partial substitute for clay in brick manufacturing. In this studied that sludge percentage is varied from zero to fifty percentage by weight. Parameters such as compressive strength and water absorption are studies.

Keywords: Water Treatment Plant Sludge, Sludge Disposal, Compressive Strength, Brick, Clay

I. INTRODUCTION

The sludge disposed during the various water treatment processes can be a major concern for water treatment plants. Most of the water treatment plants, discharge the sludge into the rivers with no treatment. This sludge is causing lot of environmental problems. Indian construction industries are running short of construction materials. In the present investigation, an attempt is made to study the strength characteristics of sludge mixed with other constituents. Recycling the water treatment plant sludge is usually an attempt to reduce its volume, make it harmless and stable, recover useful contents and facilitate its safe disposal without imposing burden to the environment. Brick is one of the most important construction element.

Sludge generated at water treatment plants should be treated and handled in an environmentally sound manneer. The discharging of sludge in water body leads to accumulative rise of aluminium concentrations in water, aquatic oraganisms, and human bodies.

The produced bricks have good properties matching the requirements of the standard specification. Its durability and aesthetic appeal also contributre to its extensive application in both load bearing and non- loading bearing structures.

II. LITERATURE REVIEW

M.Giugliano and A.Paggi in 1985. A laboratory and pilot plant study has shown that tannery sludge can be used in brick manufacture for up to 10% of the dry weight of bricks. Bricks containing sludge are higher in porosity than controls. Bending strength and frost resistance are acceptable at 10% but are decreased below acceptable levels in bricks made with 15% sludge. Increased emission of aromatic and chlorinated hydrocarbon vapours from the sludge in the preheating zone of the furnace could easily be taken care of by recycling exhaust to high temperature zone. Kung-Yuh Chianga, Ping-Huai Choua, Ching-Rou Huaa, Kuang-Li Chiena, Chris Cheesemanb in year 2009. Novel lightweight bricks have been produced by sintering mix of dried water treatment sludge and rice husk. Samples containing up to 20% wt. rice husks have been fired using a heating schedule that allowed effective organic burn-out. Rice husk addition increased the porosity of sintered samples and higher sintering temperatures increased compressive strengths. Materials containing 15% wt. rice husk that were sintered at 1100oC produced low bulk density and relatively high strength materials that were compliant with relevant Taiwan standards for use as lightweight bricks.

III. OBJECTIVES

- To examine the effect of dry sludge in brick properties.
- Economical design and light weight product.
- Proportion effect.
- Properties of WTP sludge.
- Conservation of natural resources.
- To give better environment to the town.
- To check strength in brick.

IV. RESEARCH AND METHODOLOGY

The very essential material of building is Brick. Strength of brick element depends upon its utilized. It also known as small unit of building material which is basically made up of fired clay and secured with mortar, a bonding material comprising cement, sand and water. Bricks retains heat.

General properties of bricks:

1) Color
2) Texture
3) Size and shape
4) Soundness
5) Hardness
6) Strength
7) Thermal conductivity and fire resistance

A. Color:

color of the burnt brick depends on the chemical composition of the natural clay and the minerals present in the clay.

B. Texture:

Texture is an arrangement of the particles of raw material in the brick that is found in the finished brick.

C. Size & Shape:

Bricks should be of standard size (19cmx 9cmx9cm) in this randomly collected bricks are staked along its length, width and height.

D. Soundness:

In these two bricks are held by both hands and struck with one another.

E. Hardness:

A good brick should be sufficiently hard which can be tested by a finger nail.

F. Strength:

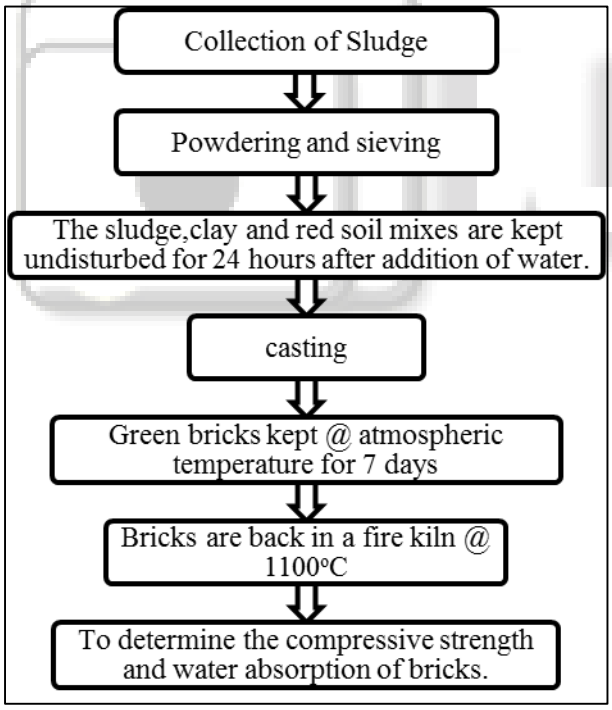
Crushing strength of brick should be as high as possible, IS code does not permit any brick of strength less than 3.5 N/mm2 for building construction.

G. Thermal Conductivity and Fire Resistances:

A good brick should have adequate fire resistance. Ordinary brick can resist temperature up to 1200^0C.

Sludge is the residual and semi-solid material left behind from industrial waste water or sewage treatment processes. It can also refer to the settled suspension obtained from conventional drinking water treatment and numerous other industrial processes. The term is also sometimes used as generic term for solids separated from suspension in liquids this material usually contains significant quantities of "interstitial" water.

V. SCHEDULING



VI. TYPES OF TESTING

- Water Absorption test
- Compressive strength
- Brick Weight loss on ignition
- Hardness test
- Shape and size
- Colour test
- Soundness test
- Structure of brick
- Presence of soluble salts

Bricks before Ignition

Bricks after Ignition

VII. RESULTS

A. Water Absorption Test:

Water absorption of ordinary clay bricks was 10.00% while of bricks with sludge percentage 10%, 20%, 30%, 40%, 50% was 17.00%, 17.44%, 17.94%, 18.51%, 20.16% respectively.

B. Compressive Strength Test:

Compressive Strength of ordinary bricks was 2.74N/mm^2 while of bricks with sludge percentage 10%, 20%, 30%, 40%, 50% was 1.95, 1.75, 1.56, 1.17, 0.78 (in N/mm2).

C. Brick Weight Loss on Ignition:

Brick weight loss on ignition of ordinary clay bricks was 18.00% while of bricks with sludge percentage 10%, 20%, 30%, 40%, 50% was 19.00%, 20.00%, 23.00%, 23.8%, 24.6% respectively.

D. Hardness Test:

When bricks scratched with a nail, NO scratches or very least scratches were seen.

E. Soundness Test:

When 2 bricks were struck against each other, a clear bell ringing sound was produced.

The bricks up to proportions of 30% remained intact in this process. However those above 40% did get some cracks in them after striking. Also cracked up into small pieces.

F. Color Test:

As the percentage of sludge in brick increased, color of bricks was seen varying brown to faint brown.

G. Efflorescence Test:

After placing the green bricks in water for 24 hours no traces of efflorescence were found.

VIII. CONCLUSION

The use of sludge in brick manufacturing is an option to use the unnecessary sludge that is produced from the water treatment plants in the cities.

Special care had to be taken whilst the handling of the bricks which had sludge content greater than 40% as these were more susceptible to breaking after they were dried.

The weight of the bricks obtained were lighter in weight and they got even lighter with increasing percentage of sludge content. Weight of ordinary clay brick was 2.259 kg while of bricks with sludge percentage 10%, 20%, 30%, 40%, 50% was 2.120, 2.806, 2.046, 2.020 and 1.964 (in kg) respectively.

The bricks that were obtained from this experiment bear slightly lesser values in compressive strength and water absorption than the conventional bricks. For e.g. compressive strength of ordinary clay brick was found out to be 2.74 N/mm2 and for those of 10%, 20%, 30%, 40%, %50, was found out to be 1.95N/mm^2, 1.75N/mm^2, 1.56N/mm^2, 1.17N/mm^2 and o.75N/mm^2 respectively.

The bricks of lesser sludge percentage i.e. 10% to 30% did have the form like that of a conventional brick but did not manage to complete with them in terms of strength. The bricks with sludge percentage 40%-50% had deformed compared to other bricks. To conclude we could like to present that the use of sludge in the brick making is not yet completely the most suited way of using the sludge as desired results were not obtained.

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