

Use of Industrial Sludge as an Ingredient in Brick

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Abstract - Brick is one of the most common masonry units used as building material. Due to large demand placed on the building material industry, civil engineers have been challenged to convert waste to useful building and construction material. The disposal of sludge from industry is a major problem in urban cities as it causes harmful effects on environment. Since the chemical composition of sludge is similar to that of brick clay, this study is focused on the reuse of sludge in clay-brick production. In this study different series of clay and sludge proportioning ratios were studied which included the addition of sludge with ratios 5,10,15,20 and 25 percent of total weight of sludge clay mixture.

considered satisfactory for conventional purposes. Also found at 5% of replacement, the quality of brick is superior to the bricks made from earth alone and can be used for superior work of permanent nature.

Badr El-Din Ezzat Hegazy, Hanan Ahmed Fouad and Ahmed Mohammed Hassanain experimented the incorporation of water sludge, silica fume and rice husk ash in brick making. From the results it was concluded that a mixture consists of 50% of sludge, 25% of SF, and 25% of RHA was the optimum materials proportions to produce brick from water sludge incorporated with SF and RHA.

1. INTRODUCTION

Brick is one of the most important construction material. Various attempts were made to incorporate various waste material in brick production such as natural fibres, foundry sand, processed waste tea, sewage sludge, waste water sludge etc. The increasing popularity of using environmental friendly, low cost building material has brought about investigating the idea of using sludge as ingredient in brick. Sludge generated at sludge treatment plant should be treated and handled in an environmentally sound manner. The old practice of discharging sludge directly into rivers violate the stream standards since it leads to the rise of aluminium concentration in water which affect aquatic organisms consequently humans.

The brick industry is the most indicated technological activity sector to absorb solid waste due to large quantity of raw materials used by the sector as well as by the large volume of final products in construction. The study involves the usage of sludge, a biodegradable material its construction and demolition waste as an essential ingredient.

2. LITERATURE REVIEW

Joo Hwa Tay has done a study on bricks manufactured from sludge. The paper presented the results of the utilization of dried sludge as brick making material. The results showed that the maximum percentages of dried sludge and sludge ash that can be mixed with clay for brick making are 40%. It was also found that bonding of mixture beyond that is poor.

G. Reddy Babul and N. Venkata Ramana have done experiments to study the durability of bricks cast with industrial sludge. This experiment result also showed that the brick can be replaced with sludge up to 40% by weight without loss in strength and other brick characteristics

3. MATERIAL AND METHODOLOGY

3.1 Material

Sludge is a semi-solid slurry and can be produced as sewage sludge from wastewater treatment processes or as a settled suspension obtained from conventional drinking water treatment and numerous other industrial processes.

Different types of sludge waste that can be incorporated in fire clay brick are:

A, Water Treatment Sludge

In a study that was carried out by Taiwan (Chiang et al. 2009). Novel lightweight bricks have been produced by sintering mixes of dried water treatment sludge and rice husk. Samples containing up to 20 wt. % rice husk have been fired using a heating schedule that allowed effective organic burn out. A mixture consists of about 10% of the water treatment sludge was added to about 90% of natural clay to produce the brick.

B. Sewage Sludge

Anyakora Nkolika Victoria represented a paper 'characterisation and performance evaluation of water works sludge as bricks material'. In this paper they are saying that the use of sludge in the well burnt bricks is a long term approach as point of view of the disposal, economy, and environmental sustainability. It was found that proportion of sludge-clay and temperature of firing the bricks are two main factors which affect the quality of the bricks.

C. Textile Mill Sludge

Shrikant S Jahagirdar¹, S. Shrihari², B Manu³ 1 NITK, Surathkal, India investigated the effect of Textile mill sludge addition in burnt clay bricks. The study demonstrates that

textile mill sludge can be used as partial replacement for clays in burnt clay bricks. Textile mill sludge can be used up to 15% without compromising on the compressive strength of 3.5 N/mm² and water absorption of 20% as per the IS code requirements.

- Size, shape and color test
- Soundness test
- Hardness test

D. Other Sludge

Other sludge that are experimentally proven suitable to be used as a partial replacement of brick clay are stone sludge, rubber sludge etc.

The sludge used for the experimental purpose is rubber sludge collected from Latex industry; Binanipuram. The main raw material used in this industry is Latex. Latex is a colloidal suspension of very small polymer particles in water.

3.2 METHODOLOGY AND TESTING

- Collection of materials:-
 - Collection of sludge, brick clay.
- Selection of brick burning site:-
 - Site selection for burning of moulded sundried brick.
- Mix design of brick:-
 - Percentage of sludge, brick clay and water was decided.

Different percentage of sludge	Clay (%)	Water
0%	100%	As per required
5%	95%	
10%	90%	
15%	85%	
20%	80%	
25%	75%	

- Manufacturing of Bricks:-
 - Weigh batching
 - Mixing of material
 - Casting of brick
 - Placing of brick
 - Burning of bricks
- Testing of bricks:-
 - Compressive strength test
 - Water absorption test
 - Efflorescence test

4. RESULTS AND DISCUSSIONS

1. Compressive strength

Sludge (%)	Length (mm)	Breadth (mm)	Maximum load	Compressive strength (N/mm ²)
0	210	100	9.2	4.3
5	210	100	9	4.2
10	210	100	8.9	4.06
15	210	100	8.7	4.06
20	210	100	8.4	3.9
25	210	100	6.3	2.94

2. Water absorption test

Sludge (%)	Weight of dry specimen M1 (kg)	Weight of wet specimen M2 (kg)	% of water absorption (M2-M1)*100/M1
0%	2.10	2.41	14.76%
5%	2.05	2.38	16.09%
10%	2.05	2.40	17.07%
15%	2.00	2.35	17.5%
20%	1.95	2.32	18.9%
25%	1.95	2.35	20.5%

3. Efflorescence test:-

No efflorescence

4. Size, shape and color test

Results are within limits

5. Soundness test

The bricks not broken and a clear ringing sound is produced.

6. Hardness test

Bricks are sufficiently hard.

5. CONCLUSION

The study suggests that the sludge can be effectively used for manufacturing of brick to required shape and size by adopting the proportions of ingredients used in the study particularly 5%, 10% and 15% sludge. Merely dumping and disposal problem of sludge will occupy more space and creates the environmental pollution with in surrounding

region. So in order to prevent all the above issues, sludge can be used for manufacturing of brick as a strong material and cost effective.

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REFERENCES

1. Badr El-Din Ezzat Hegazy, Hanan Ahmed Fouad, Ahmed Mohammed Hassanain, "Incorporation of water sludge, silica fume, and rice husk ash in brick making", *Advances in Environmental Research*, Vol.1, No. 1, 2012, pp 83-96
2. Joo-Hwa Tay, "Bricks Manufactured From sludge", *Journal of Environmental Engineering*, Vol 113, Issue No 2, 1987, pp97-112
3. Gopal Bajaj, Vikas Gore, Kalyan Patre, "Partially Replacement of Clay by S.T.P. Sludge in Brick Manufacturing", *IJIRAE*, Vol 3, Issue No 05, May 2016, pp 41-47
4. Pratik P. Shinde, Aakash S. Borade, Chetan P. Kalje, "Manufacturing of Bricks From Sewage Sludge and Waste Materials", *IJIR*, Vol 3, Issue No 5, 2017