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Performance of Brick using Demolition and Other Waste Materials

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ABSTRACT- *The disposal of sewage wastes comprises as one of the major worldwide environmental problems as these wastes render the environment unfriendly. The growing demand for waste utilization has made solid wastes like sludge and demolition waste an essential composition of this study. The possibility of reduction of the production costs provides a strong logic for use of this waste. This study involves the usage of sludge, construction and demolition waste as an essential ingredient. The sludge was checked for its physical characterization such as bulk density, compressive strength and chemical properties such as water absorption percentage, presence of toxic metals such as Pb, Zn, Cu and Fe for the commercial purpose. The study was performed by using different ratios as 3:2:2:3, 3:2:3:2, 2:3:2:3 of fly ash, cement, sludge and demolition waste respectively for making brick samples. The test results showed a common trait that with the increase in content of sludge, the strength decreased. A maximum compressive strength of 15.88 MPa was achieved for the ratio 2:3:3:2 and a minimum of 11.67 MPa was achieved for 2:1:5:2, respectively.*

1. INTRODUCTION - Construction and demolition wastes are mostly found whenever any construction or demolition activity takes place such as construction of bridges, flyovers, roads etc. it comprises mostly of inert and non- biodegradable material such as sand, gravel, concrete, metal, plastics, glass, etc. Demolition wastes are heavy, bulky and have high density and take up loads of land and space. So what if try recycling of these wastes**.**

Importance of Construction & Demolition Waste

The construction industry is a major contributor to excessive natural resource consumption, depletion and degradation; waste generation and accumulation; and environmental impact and degradation. The total of waste generated by the construction and demolition activity is sub-stantial.

1. Construction and Demolition Wastes

Construction sabotage or non use Materials Construction waste varies world spread depending on the structure materials being used and construction methods employed. In Canadian and the America for instance, family homes are usually built with a wooden frame while clay bricks are used in much of Europe (Merino & Arevedo, 2011). A US study estimated that residential construction waste consisted primarily of wood (42%), followed by gypsum wallboard (27%), brick (6%), roofing (2%) and metals (2%) (United States Environmental Protection Agency, 2003). A further 12.5% was made up of remaing materials such as plastics. Construction waste is usually 15 to 25 times less than demolition waste and consists primarily of cut off and trimmings.

2. Importance of sludge

On account of its high organic content and good wettability, sludge makes for an ideal additive to the clay-shale mix of bricks. So the various importance of sludge are **[**

- In many ways sludge is the ideal additive to the clay-shale mix of bricks. How can that be? Because it is an organic material with the added advantage of being wet. Organic

2. LITERATURE REVIEW - The very well purpose of this literature is designing of a well composed commercially used in highrise construction (construction brick). Disposal of sewage again to the water bodies raises the amount of aluminium oxides in water, which has been linked to Alzheimer's disease.

Studying the use of sludge (Chi-huang Weng et al, 2003) (Joo Hwa Tay, 1987) and (Badr El-Din Ezzat Hegazy et al, 2012) the use of sewage treatment plant (STP) sludge in manufacturing of constructional elements achieves both the economic and environmental benefits. Due to the similar mineralogical composition of clay and STP sludge, this study investigated the complete substitution of normal clay by sludge. From the obtained results, it was concluded that by operating at the sludge content commonly, a no. of ratios was obtained and then the properties were tested. The developed bricks properties were obviously superior to the 100% clay control- brick in terms of strength and bulk density, but lacked good water absorption.

The brick made was according to the IS: 1077 – 1992 and IS: 2212 – 1991 norms. The properties like Compressive strength and Bulk density were studied and taken from there ferences mentioned by (Mahapatria, 2012)

3. EXPERIMENTAL PROCEDURE

Sample Preparation

The first step of the study was to prepare a mixture or sample and then the properties were checked. The process was as follows. A particular ratio was of the elements are taken for example a ratio of 3:2:3:2 was taken for fly ash, cement, and sludge & demolition waste. The sludge was then dried at atmospheric temperature for 2 days. Now the demolition waste was crushed using hammer and then sieved through a sieve size of 1.75 mm. The sand was sundried and also sieved through the same. The mixture was then added in thoroughly and placed in the mould compactly and was left to dry in atmospheric condition. The sample when dry enough was taken out of the mould by the help of oil and grease. The sample was now cured for 7 days, with continuous supply of water. This method was repeated with different other ratio of varied sludge content, fly ash, cement, sludge & demolition waste. The weight mentioned is the weight of the brick that was found after it was taken out of mould. The weight of the samples ranged from 2.5-3kg and the samples were casted in a mould of size 23cm ×9.5cmx7.5cm. Individually all the components varied from 400-1200 gm in range in terms of weight. The weight of the mold was also found out to be 1.196 kg.

4. RESULTS AND DISCUSSION

4.1 Physical Properties Test

4.1.1 Compressive Strength Test

The strength test was then carried out on these bricks and the Crushing Strength of the bricks was duly noted as below.

This test is the most important test for assuring the engineering quality of a building material.

The study showed that with the increase in %age of sludge content the strength decreased. This is because the strength of a material greatly depends on the sludge content and the temperature it's being applied to. It is also seen that with the increase in amount of cement the strength increases. This is mainly due to the properties of the cement.

Sludge (%)	Sample I	Strength (MPa) of Sample I	Sample II	Strength (MPa) of Sample 1I	Sample III	Strength (MPa) of Sample 1II	Sample IV	Strength (MPa) of Sample 1V
30%	3:2:3:2	13.23	2:3:3:2	15.88	2:2:3:3	14.48	3:2:3:2	13.7
40%	1:3:4:2	12.45	2:3:4:1	15.57	3:2:4:1	14.01	3:1:4:2	14.79
50%	2:1:5:2	11.67	2:2:5:1	14.07	1.5:1.5:5:2	13.23	1:2:5:2	13.54

The compressive strength varied from 10 MPa to 16MPa. So from the various ratio experimented we see that the best possible ratio for building a brick came out to be 2:3:4:1 and 2:3:3:2**Table 2: Results of the Compressive Strength**

4.2 Chemical Property Test

Table: pH content for various Sludge

Sludge (%)	Sample 1	pH	Sample 2	pH	Sample 3	pH	Sample 4	pH
30%	3:2:3:2	8.18	2:3:3:2	7.6	2:2:3:3	7.23	3:2:3:2	7.78
40%	1:3:4:2	12.45	2:3:4:1	15.57	3:2:4:1	14.01	3:1:4:2	14.79
50%	2:1:5:2	10.18	2:2:5:1	7.89	1.5:1.5:5:2	8.3	1:2:5:2	8.74

5. CONCLUSIONS

The experimental results carried out during the present work would lead to the following conclusions.

- The samples with Sludge content of 30-40% was found to be vitrified.
- A ratio of 2:3:3:2 containing fly ash, cement, and sludge and Sabotage or recycle waste, respectively was found to be the better suitable ratio in manufacturing brick made of sludge and demolition waste along with fly ash and also has a potential to be used as instead of normal bricks.

- While some of the properties of the designed brick with the ratio of 2:3:3:2 was found to be absolutely fine, some weren't. Such as compressive strength of the brick was 15.88

MPa, whereas the normal brick strength lies in the range of 7.5-10 MPa. **[3]** The bulk density of it was found to be 2.62 g/cm3, whereas a normal brick ha a density of 1.8-2 g/cm3.**[4]** The properties like pH was found to be 6.7 which wasn't appropriate enough as normal bricks have pH a of 8.5-10.5**[4]**.

The samples and their properties were also checked according to the IS: 1077 – 1992 and IS: 2212 – 1991, the Code of practice for brick work

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