Experimental Analysis of Interlocking Bricks by Using Sewage Sludge And Fly Ash

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ABSTRACT:

The interlocking bricks are more popularly used in many foreign countries as an alternative to conventional bricks for sustainable housing. It is being always challenge for researchers to make interlocking brick light weight, low cost and improve the performance against aggressive environment. This paper gives the results of an experimental investigation in which the compressive strength, water absorption and density were investigated by using varying percentage of sewage sludge, fly ash , stone dust, cement with three different mix proportions. The experimental results compared with ordinary clay brick for its sufficient strength and their use in sustainable building construction.

Keywords: Sewage sludge, Fly ash, Stone dust, Interlocking brick.

1. INTRODUCTION:

Nowadays the use of river sand are reduced due to exploitation of natural resources in order to overcome this difficulty, an experimental analysis is made on interlocking bricks by using sewage sludge and fly ash. Interlocking bricks are more popularly used in many foreign countries as an alternative to make conventional bricks for sustainable housing. It is being always Challenge for researchers to make interlocking brick light weight, low cost and improve the performance against aggressive environment.

Due to rapid increase in population growth the formation of sewage are also increased. Increase in sewage cause many health and environmental problems, to solve these problems the sewage are treated by treatment plant and also generated sludge should be treated and handled in an environmentally sound manner. The conventional practice of discharging the sludge into a nearby stream which leads to pollution of river on the other hand if it is used as a soil fertilizer causes sewage sickness. Hence sludge disposal is a major hazard to the environment and human health and its treatment cost also high due to this risk sewage sludge has to be used for different purposes.

A number of studies had taken serious steps in manufacturing bricks from several of waste materials. However, the traditional mean of bricks production which has brought hazardous impacts to the context has not yet been changed or replaced by more efficient and sustainable one

2. EXPERIMENTAL MATERIALS:

2.1 Sewage sludge:

Sewage sludge is a product of waste water treatment. Wastewater and storm water enter the sewage system and flow into waste water treatment facilities, where the solid wastes are separated from the liquid wastes through settling. At this point, they are processed and “digested” or “decomposed” by bacteria Sewage sludge refers to the residual, semi solid material that is produced as a by-product during sewage treatment of industrial or municipal wastewater.

Fig 2.1 Sewage Sludge

2.2 Fly ash:

Fly ash is a byproduct from burning pulverized coal in electric power generating plants. Fly ash is collected from the exhaust gases by electrostatic precipitators or bag filters. The fine powder does resemble Portland cement but it is chemically different.

2.3 Stone dust:

Stone dust, also known as stone screenings, is the finest type of crushed stone. When used by itself stone dust forms a hard surface that is water resistant. When used with a larger stone it acts as a binding agent because of its ability to form a strong, non porous surface.

2.4 Cement:

Cement is a binder, a substance used for construction that sets, hardens and adheres to other materials, binding them together.

3. METHODOLOGY:

3.1 COLLECTION OF MATERIALS:

Sewage sludge is a waste material which is obtained from the waste water treatment plant in Ukkadam, Coimbatore. The quantity of materials collected was based on number of bricks to be made. The sludge was collected from the treatment plant after getting permission from the executive engineer at JnAurm section, Corporation office. The total quantity of dried sludge collected was 45 kgs and then the sludge is damped and sieved by using the damper and 300micron sieve. Other materials such as fly ash, cement, stone dust collected from the brick manufacturing site.

Fig 2.2 Sludge

3.2 PREPERATION OF MATERIALS:

The sewage sludge collected from water treatment plant are damped and sieved by using dampers and 300micron sieve. The damping and sieving process of sludge are carried out for 2weeks and the required final product of finely sieved sludge are used for casting interlocking bricks.

Fig 3.1 Damping of sludge

Fig 3.2 sieving of sludge

3.3 PROPORTIONING OF INTERLOCKING BRICKS:

In this experimental investigation three mix proportions were used to identify the optimum mix proportion.

The first sample contains 25% of cement, 25% of fly ash, 40% of stone dust and 10% of sewage sludge. This type of interlocking brick is named as **A_1**.

The second sample contains 25% of cement, 25% of fly ash, 30% of stone dust and 20% of sewage sludge. This type of interlocking brick is named as **A_2**.

The third sample contains 25% of cement, 25% of fly ash, 20% of stone dust and 30% of sewage sludge. This type of interlocking brick is named as **A_3**.

3.4 MIX PROPORTION IN PERCENTAGE:

Mix proportion for A1, A2 and A3 type of interlocking brick are given in percentage form.

3.5 CASTING OF BRICKS:

After the collection and proportion of materials casting process is carried out. The materials are proportioned by the weight batching. The interlocking bricks are casted in a manufacturing industry. Mixing of materials is done in the machine. Then the raw materials are transported to the interlocking brick casting machine by the use of conveyors.

Fig 3.3 belt conveyor

Fig 3.4 Casting of interlocking brick

3.6 CURING OF INTERLOCKING BRICK:

After casting the bricks are allowed to dry for 24 hours in direct sunlight. Then the bricks are

Type of Inter locking brick	Cement in %	Fl y as h in %	Ston e dust in %	Sewag e sludge in %
A_1	25	25	40	10
A_2	25	25	30	20
A_3	25	25	20	30

cured for 21 days. For 14 days the bricks are cured by spraying water for 2times a day. After 14 days the bricks are cured by immersing it into the curing tank for 5minutes each bricks up to 21days. Simultaneously the drying process is also carried out by placing the bricks in room temperature. The bricks cured for 7th day, 14th day and 21st day are taken for testing the compressive strength.

4 TESTING AND RESULTS:

4.1 WEIGHT OF INTERLOCKING BRICK:

Weight of different proportions of interlocking bricks is measured with the help of weighing balance. Weight may be varied based on the different proportions of sewage sludge.

Fig 3.5 Weight of interlocking brick

4.2 WATER ABSORPTION TEST:

Water absorption of bricks is not related directly to the porosity owing to the nature of pores themselves. Some of Pores may be through pores which permit air to escape in absorption tests and allow free passage of water in absorption tests, but other are completely seated and inaccessible to water under ordinary conditions. For this reason it is seldom possible to fill more than about three quarters of pores by simple immersion in cold water. For measuring total absorption the boiling method is adapted. More is the water absorption capacity weaker is the brick and vice versa.

Fig 3.6 Water absorption test

Type of interlocking brick	Dry weight in gm	Wet weight in gm	Water absorption in %
A_1	6836	7492	9.596
A_2	8052	9022	12.046
A_3	8510	9280	9.048

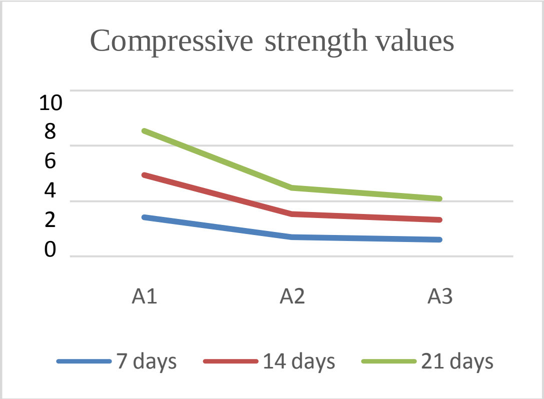
4.3 COMPRESSIVE STRENGTH TEST:

This is the main test conducted to test the sustainability of the brick for construction work. This test is executed with the help of compression testing machine. It is compressed till its breaks. Then the compression strength of the brick is recorded from the meter of the compression testing machine.

S.No	10% Sludge in gm (A_1)	20% Sludge in gm (A_2)	30% Sludge in gm (A_3)
1	7424	8184	8510
2	6836	8050	9550
3	7980	8174	8814

Fig 3.7 CTM Testing

Brick Type	Mix Proportion (%)	7 days curing in N/mm^2	14 days curing in N/mm^2	21 days curing in N/mm^2
A_1	10	7.14	7.65	7.91
A_2	20	3.57	4.08	4.84
A_3	30	3.06	3.57	3.82



5.CONCLUSION:

This study suggests that the sludge can be effectively used for manufacturing of brick to required shape and size by adopting the proportion of A_1 brick. Dumping and disposal problem of sludge will occupy the more space and creates the environmental pollution with in surrounding region. So in order to prevent all the above issues,sludge can be prove economical and strength is achieved. Also the water absorption for this brick is in the range of 9 to 12% that means its follow the condition requirement of first class brick and provides good compressive strength in the range of 4 to 8 N/mm^2.

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