Sludge waste production of concrete

Ms brundha ,[1].Ahv sainath [2]. A,Aadhityan [3].M.Arun Kumar [4].M.Manohar
Prathyusha engineering college
Anna university, Chennai

Abstract
The overall objective of this study is to find an alternative solution for the large volume of sludge produced in the wastewater treatment plants . The generated quantities of sludge are expected to be 55.74 tons of solid per day by the year 2025. This large quantity of sludge is related to the scarcely of land area and high population density represented the sludge problem. Many researchers worldwide have been trying to explore new and suitable solutions to solve part of sludge problem. One track of these solutions is to use sewage sludge in construction field. The current study presents the usage of dry sewage sludge in the concrete mixtures and in manufacturing interlock brick samples. According to results findings, no significant strength loss was observed when low organic sludge was used in making concrete cube specimens. The strength loss was increased to 17% when 10% of high organic sludge pellets by cement weight was added to concrete mixture. The results showed that the dry sludge retarded the strength development and has more adverse effect on compressive strength when it has higher organic content and its particles became finer. The addition of dry sludge to interlock brick paste produced a reduction in compressive strength by only 12%. The presence of sludge in interlock samples decreased its density and increased its absorption coefficient. The NEN 7345 leaching test results indicated that the concrete matrix could be fixed more than 73% of total organic material in the worst case. Finally the study concluded that the dry sludge can be used in as an additive toconcrete mixtures and to interlock brick paste as one of the available disposal options for sludge. The study recommended that more researches are needed to evaluate the durability of sludge concrete and the behavior of reinforced sludge concrete.

Introduction

1.1 WASTE

Waste may be defined as an unwanted material generated after the manufacturing process of industrial, or from agricultural, or from house hold activity. It is the discarded material which essential requirement of disposal.

Waste causes many nuisances in the environment. It produces many types of viral or bacterial infection for the human and animal which create bed effect on health

1.2 TYPES OF WASTE

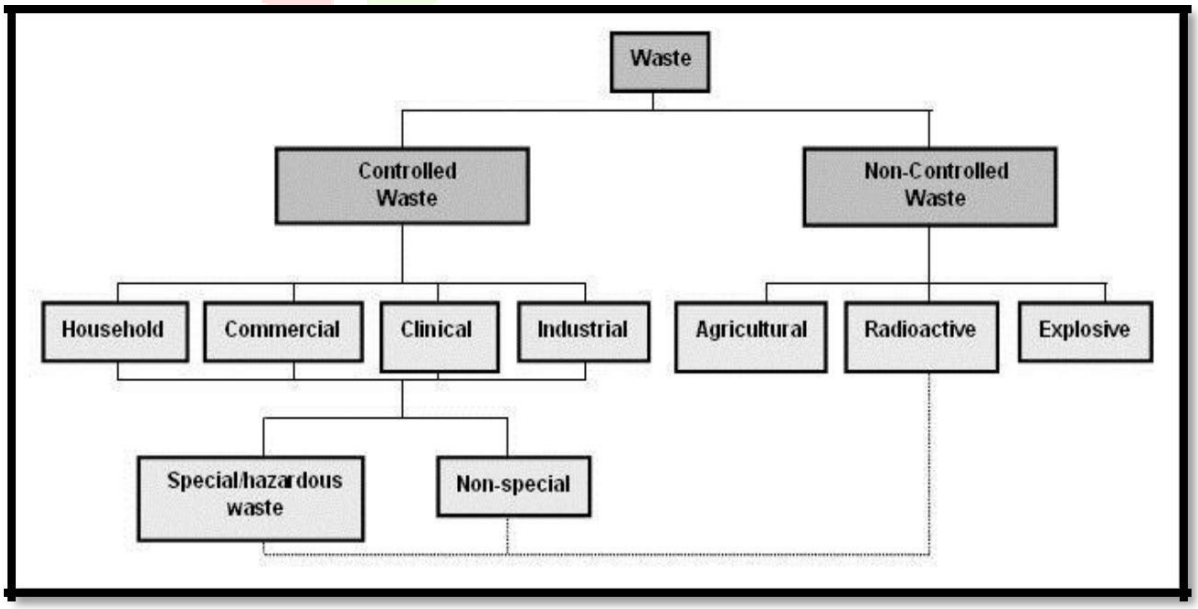

Figure 1.1: Classification of Different Types of Waste

1.3 NEEDS FOR STUDY

- To check the feasibility of sewage sludge as ingredient in brick making.
- Conservation of natural resources like clay.
- To solve the problem of disposal of sewage sludge in urban region.
- To make eco-friendly low cost and durable construction material.

1.4 OBJECTIVES OF STUDIES

- Conservation of natural resources.
- To give better environment to the town.
- Economical design and light weight product.
- Reduce in construction cost.
- To achieve strength in brick and investigation for check feasibility.
- To examine the effect of dry sludge in brick properties.
- Reduce pollution

1.5 METHODOLOGY

- **LITERATURE REVIEW**

Literature pertaining to utilization of dry sludge in brick will be reviewed from published papers in journals, code practice and standard book to find out the research gap.

- **DATA COLLECTION**

Data will be collected pertaining to available methodologies and applications of dry sludge used in the brick.

- **DATA ANALYSIS**

Based on the collected data analysis will be made to find out the most suitable methodology that can be applied for replacement of dry sludge in brick as soil.

It is required to study the compressive strength, water absorption, weight and other aspects as well as economical as parts in detail inform the stakeholders for maximizing its use.

1.6 SCOPE OF STUDIES

The scope of the current work can be summarized as follow:

- The dry sludge samples used in this work was brought from Raiya Sewage Treatment Plant.
- The dry sludge was dried at natural sun light.
- The dry sludge used to produce different type brick.
- The use of dry sludge in several types of concrete mixes was investigated.

Chapter 2
Literature review
2.1 PAPER -1
Title:-"Incorporation of water sludge, silica fume, and rice husk ash in brick making"
By- Badr El-Din Ezzat Hegazy, Hanan Ahmed Fouad and Ahmed Mohammed Hassanain*

Abstract. The water sludge is generated from the treatment of water with alum. Disposing of sludge again to the streams raises the concentrations of aluminium oxides in water, which has been linked to Alzheimer's disease. The use of water treatment plant (WTP) sludge in manufacturing of constructional elements achieves both the economical and environmental benefits. Due to the similar mineralogical composition of clay and WTP sludge, this study investigated the complete substitution of brick clay by sludge incorporated with some of the agricultural and industrial wastes, such as rice husk ash (RHA) and silica fume (SF). Three different series of sludge to SF to RHA proportions by weight were tried, which were (25: 50: 25%), (50: 25: 25%), and (25: 25: 50%), respectively. Each brick series was fired at 900, 1000, 1100, and 1200oC. The physical and mechanical properties of the produced bricks were then determined and evaluated according to Egyptian Standard Specifications (E.S.S.) and compared to control clay-brick. From the obtained results, it was concluded that by operating at the temperature commonly practiced in the brick kiln, 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.The produced bricks properties were obviously superior to the 100% clay control-brick and to those available in the Egyptian market.
Keywords- water treatment sludge; sludge disposal; clay; brick; silica fume; rice husk ash

2.2 PAPER -2
Title – "BRICKS MANUFACTURED FROM SLUDGE"
By- Joo-Hwa Tay1

ABSTRACT: Sludge resulting from wastewater treatment plants creates problems of disposal. Generally, dewatered sludge's are disposed of by spreading on the land or by land filling. However, for highly urbanized cities, sludge disposal by land filling might not be appropriate due to land limitation. Incineration might be an alternative solution. However, a substantial amount of ash will be produced after the burning process and must be disposed of by other means. This paper presents the results of the utilization of dried sludge and sludge ash as brick making materials. The maximum percentages of dried sludge and sludge ash that can be mixed with clay for brick making are 40% and 50% respectively. The compressive strength of the bricks is 87.2 N/mm2 for 0% sludge, decreasing to 37.9 N/mm2 for 40% dried sludge, and 69.4 N/mm2 for 50% sludge ash.

2.3 PAPER-3
Title – "Durability of Bricks Cast With Industrial Sludge"
By - G. Reddy Babu1, N. Venkata Ramana2

Abstract: Recovery of waste constituents from industrial waste is a cost effective solution in control of environmental pollution. Present investigation deals with the feasibility of usage of sludge obtained from sand beneficiation treatment plant in the production of bricks and their durability. The experimental results show that the brick earth can be replaced with treatment plant sludge up to 40% by weight without loss in strength and other brick characteristics considered satisfactory for conventional purposes. Apart from that when reference specimens and test bricks (5% Sludge) were immersed in various concentrations of hydrochloric acid (HCl) solution at different immersed ages

CHAPTER 3

MATERIALS USED

3.1 INTRODUCTION

The properties and the detail of the all kind of material to be used in the concrete mix design are as given bellow.

1) Dry Sludge
2) Soil
3) Fly Ash

3.2 DRY SLUDGE

Now a day, disposal of sewage has become a necessity for societies. The construction of treatment plants has caused problems with huge content of dry sludge. It has been found that each person produce 35 to 85 grams of solid sludge per day. In recent years, waste production has increased dramatically in developing nations such as India.

There are two methods to solve the problem such as disposal of solid waste (dry sludge) including land filling and using dry sludge as fertilizers. But by both these methods some harmful material remains in sludge which causes harm to environment including land, air and water as a whole.

In the sense grit sludge may be generated in a grit channel or chamber. Grit particles are removed because they may damage pumps and other equipment.

3.3 PROPERTIES OF DRY SLUDGE

3.3.1 PHYSICAL PROPERTIES

Table 3.1: Typical Physical Properties Of Sludge

SR.NO	PROPERITES	RESULTS
1	Specific Gravity	1.34-1.45
2	Bulk Density, kg/m3	687
3	Water Absorption,%	0.6
4	Clay And Sulphate Content,%	0.1-0.5
5	Softening Coefficient	0.96
6	Grain Type Coefficient	1.1
7	Moisture Content, %	0.1-11.5

Source: The open materials science journal-2011

3.3.2 SIEVE ANALYSIS OF DRY SLUDGE

Determination of quantitative size distribution of particles of dry sludge to fine grained fraction.

Procedure

1) Take a suitable quantity of oven dried dry sludge. The mass of dry sludge sample required for each test depends on the maximum size of material.

2) Clean the sieve to be used and record the weight of each sieve and the pan.

3) Arrange the sieves to have the largest mesh size at the top of the stack. Pour carefully the soil sample into the top sieve and place lid over it.

4) Place the sieve stack on the mechanical shaker, screw down the lid, and vibrate the dry sludge sample for 10 minutes.

5) Remove the stack and re-weight each sieve and the bottom pan with the soil sample fraction retained on it.

6) Initial mass of soil sample taken for analysis (kg) = 0.500 kg.

Chapter – 4 Experimental Design

4.1 MIX DESIGN

Table 4.1: Mix Design For CUBE

Different Percentage of sludge	Soil	Sand (Murrum)	Fly Ash	water
10%	52%	26%	12%	40 lit.
20%	45%	23%	12%	42 lit.
30%	38%	20%	12%	44 lit.
40%	31%	17%	12%	42 lit.
50%	24%	14%	12%	45 lit.

4.2 MANUFACTURING PROCESS

4.2.1 WEIGHT BATCHING

The measurement of materials for making is known as batching. There are two method of batching.

- Volume batching
- Weigh batching

Chapter – 5

TESTING AND RESULTS

Table 5.1: Compressive Strength Of Cube

No. Of Cubes	Conventional Cubes (N/mm^2)	10% Sludge Cubes (N/mm^2)	20% Sludge Cubes (N/mm^2)	30% Sludge Cubes (N/mm^2)
1	3.3	2.8	2.6	2.0

2	3.5	3.0	2.5	1.8
3	3.4	3.1	2.8	1.5
4	3.6	3.2	2.6	1.9
5	3.8	3.0	2.7	2.0
6	3.5	2.9	2.4	1.7
7	4.0	3.2	2.6	1.6

5.1.4 CONCLUSION

- Its plastic limit is a zero.
- Dry sludge is available free of cost so, we will reduce cost of brick.
- After doing the practical we judge some properties are match with soil.
- In this project we have incorporated the use of Dry Sludge in brick up to 50% by replacing soil. **(Dry Sludge 10%, 20%, 30%, 40% and 50%)**
- Based on limited experimental investigation concerning the water absorption and compressive strength of brick, the following observations are made regarding the resistance of partially replaced Dry Sludge. The water absorption decreased up to 20% replacement of soil by Dry Sludge. Compressive strength increase when replacement of Dry Sludge percentage increases when compare to traditional Brick. From this project, replacement of soil with this Dry Sludge material provides good compressive strength at **Dry Sludge 20% replacement**.
- Thus, this project shows that replacement of soil with this Dry Sludge material reduce the weight of brick. And it's become light weight product.
- Use of Dry Sludge in brick can save the ferrous and non-ferrous metal industries disposal, land pollution, cost and produce a „greener" brick for construction.
- Environmental effects from wastes and disposal problems of waste can be reduced or controlled through this research.

- **RESEARCH PAPER'S :**

1. "Incorporation of water sludge, silica fume, and rice husk ash in brick making"

By- Badr El-Din Ezzat Hegazy, Hanan Ahmed Fouad and Ahmed Mohammed Hassanain*

2. **"BRICKS MANUFACTURED FROM SLUDGE"**

   By- Joo-Hwa Tay[1]

3. **"Durability of Bricks Cast With Industrial Sludge"**

   By - G. Reddy Babu[1], N. Venkata Ramana[2]

4. **"Utilization of Textile Mill Sludge in Burnt Clay Bricks"**

   By - Shrikant S Jahagirdar1, S. Shrihari2, B Manu3 1 NITK, Surathkal, India

5. **"CHARACTERISATION AND PERFORMANCE EVALUATION OF WATER WORKS SLUDGE AS BRICKS MATERIAL"**

   By- Anyakora Nkolika Victoria

- **I.S. CODES:**

1) IS: 1498 - 1970 (Reaffirmed 2007)

   "Indian Standard CLASSIFICATION AND IDENTIFICATION OF SOILS FOR GENERAL ENGINEERING PURPOSES (First Revision)"