

Enhanced Sludge Brick

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Abstract: - The tradition of treating sewage in India is not very popular and the practice which is in use is direct discharge in various natural water bodies. Where ever the sewage is treated the main problem occur is dumping of sludge, as it dumped in an open environment which leads to pollution in environment. On other hand, brick is one of the important element in civil engineering and construction industry, so using sludge as primary brick manufacturing material will make the brick more economical as well as load of sludge for dumping will automatically get reduce. The work of using sludge as a brick manufacturing material is in progress all around the globe and India is also making a remarkable progress in this direction. We are trying to use sludge in various proportions with fly ash and with clay after performing all tests we will analyze the feasibility of sludge as brick manufacturing material.

Keywords: - Sludge, Sewage, STP- Sewage Treatment Plant, Sludge disposal, Clay, Brick

I. INTRODUCTION

Nagpur city generates approximately 525 MLD of sewage, Maharashtra 8,143 MLD Sewage (maximum in India 13%) and entire country generates-61,948 MLD Sewage(Source-Ministry of Environment, Forests and Climate Change (MoEFCC)) if taking only Nagpur city in account, the treating capacity of Sewage treatment plant Bhandewadi (Nagpur) is 200 MLD the plant is being further expanding to increase its capacity by 100 MLD in near future, though the total capacity will became 300 MLD but also then the 200 MLD sewage will remain untreated which means it will contribute to pollute the natural body by being get discharge into them. Focusing on other side of coin we know that the construction industry play very vital role in development of a city, state or country and India is one of the developing country which indicate towards a large scale construction at present and in near future, after concrete and steel, brick is the next big requirement for construction. Economical brick will lead to economical construction and sludge brick can achieve that in very significant manner. The sludge brick with some enhancement can contribute to the construction industry and environment. As the use of sludge will get regularized the waste sludge will be given more value and the trend of treating sewage will increase automatically.

II. INTERNATIONAL & NATIONAL STATUS

An original patent covering the incorporation of raw sewage sludge into clay bricks dates back to 1889. Since 1975, the use of water treatment sludge in various industrial and commercial, manufacturing

processes has been reported in UK, USA, & Taiwan. 5 million tons of annual leftover bio solids production in Australia, New Zealand, the EU, the USA and Canada are used for making Sludge bricks. Port Elizabeth brickworks in South Africa has been making Sludge Bricks since 1979.

The researches and the progressive work around the globe took a swift after 2010, the scholars of Norwegian University of Science and Technology (NTNU), Trondheim, Norway published their research on 2014, The National R&D Institute for Textile & Leather, Bucharest, Romania on 2018, University Tun Hussein Onn Malaysia, Malaysia on 2018 and Khulais University of Jeddah, KSA (Kingdom of Saudi Arabia) & National Research Centre, Dokki, Cairo, Egypt on 2018 except brick manufacturing the use of sludge in various industrial and commercial, manufacturing processes has been reported in UK, USA, Taiwan. Turning towards India, there are several research work has been done and many are in progress. V.V.P. Engineering college, Rajkot on 2014, Walchand College of engineering, Sangli, on 2015, School of Civil Engineering, SASTRA Deemed University, Thanjavur on 2017, Dr. D. Y. Patil School of Engineering & Technology, Lohegaon, Pune on 2017, D. Y. Patil College of Engineering, Akurdi, Pune, India on 2018 and Dr. Vithal Rao Vikhe Patil College of Engineering, Ahmednagar on 2019.

III. MATERIAL & METHODOLOGY

A) MATERIALS

a) Sludge- Sludge is a by-product of sewage, it's one of final products of wastewater treatment at sewage treatment plants. The Sewage treatment plants (STPs) accumulate and separate solid from water. The solid is known as sludge. The chemical composition of sludge extracted Nagpur city sewage is shown below.

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	S
57.84%	7.65%	4.96%	23.92%	5.20%	0.16%

Table 1

b) Fly Ash- Fly ash is a byproduct from burning coal which is inert chemically. The fly ash used as a mass in brick manufacturing and this is also one of the waste byproduct which is available in very large amount. The chemical composition of fly ash from Koradi Thermal power plant is shown below.

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	S
63.64%	20.39%	0.56%	12.69%	2.44%	0.07%

Table 2

c) Gypsum- Gypsum is a mineral which found in layers that were formed under salt water millions of years ago. When water evaporated, it left the mineral behind. Gypsum is composed of calcium sulphate (CaSO₄) and water (H₂O). Its chemical name is calcium sulphate dehydrate (CaSO₄.2H₂O). Gypsum generally accelerate the time of setting.

d) Soil- We have taken the liberty of using any soil which is suitable for making red brick and it can be

used along with the sludge. Sandy and loamy **soils** are considered good soils for making bricks. The range of various constituents which is suitable for making red brick are

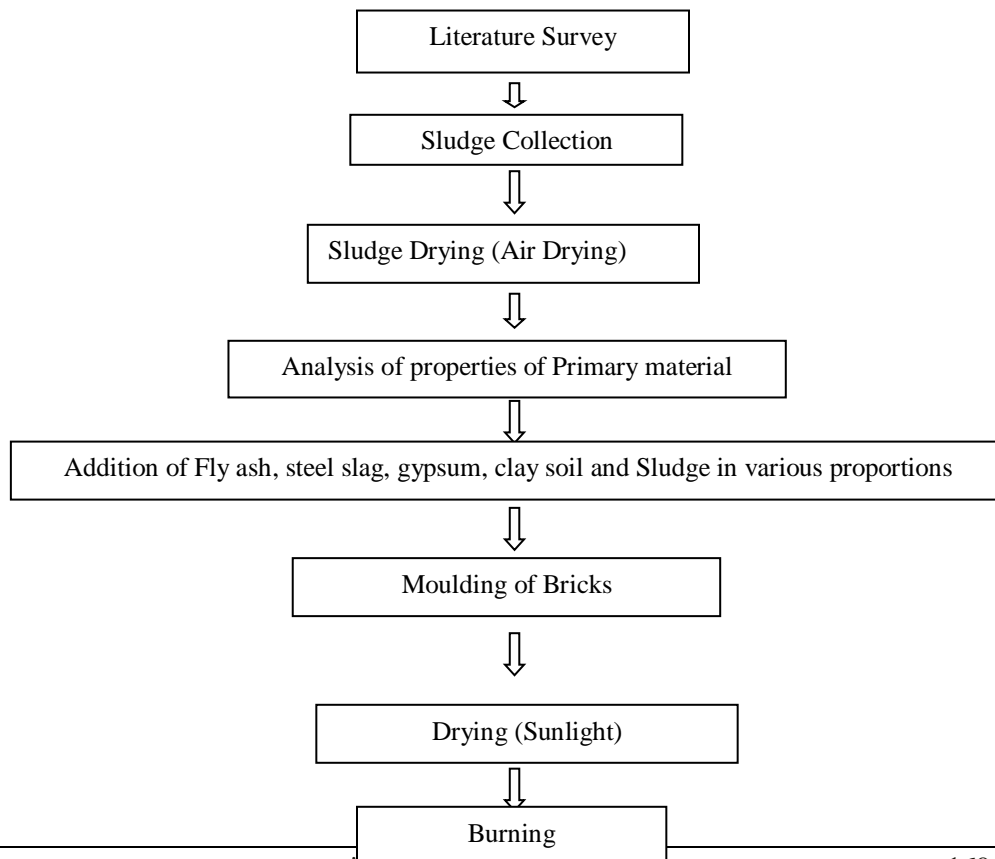
SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO
50% - 60%	20%-30%	≤ 7%	2- 5%	less than 1%

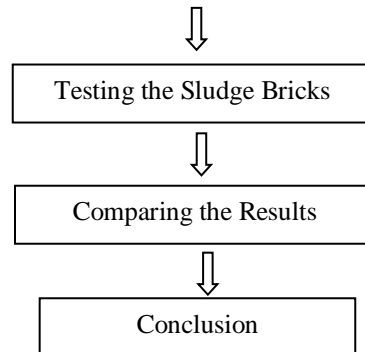
Table 3

e) **Steel Slag-** Steel slag is by-product of steel making and it's produced during the separation of the molten steel from impurities in steel-making furnaces. Steel slag contains some toxic ingredients such as nickel, cadmium, chromium and strontium. These compounds could be harmful for environment as well as human health. The primary constituents of steel slag are limestone (CaO) and silica (SiO₂) in very small percentage.

B) METHODOLOGY

Casting and burning has been done in a manner such as conventional red bricks are manufactured in plant so that adoption of sludge as a primary constituent of brick can become more promising and the feasibility of brick can be determined when its being manufactured in plant with regular plant practice. The following flow chart will give more distinct idea about the methodology.





IV. EXPECTED RESULT

With each step of work and analysis we get to know that the per brick cost is comparatively very less than the conventional red brick and fly ash brick. The compressive strength is expected to be nearby the strength of red brick so that the range of application will increase along with these the sludge waste from the environment will get reduced and also the consumption of sludge will increase in an effective manner which will be beneficial to environment and construction industry as well.

V.CONCLUSION

The brick from sludge will help us to achieve various environmentally and construction oriented objectives such as the trend of treating sewage will increase because the plant can earn from the end product after treatment of sewage which is considered as a waste at the same time sludge mass can be directly eliminated from the environment and load of dumping sludge will become negligible.

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