International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 04 | April - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

MANUFACTURING OF CLAY BRICKS BY USING Water Treatment Plant SLUDGE

Pathan Abid Rajjak[1], Pathan Jamal Hakimkhan[2], Pathan Mushtak Hakimkhan[3],

Shaikh Azhar Anwar[4] , Prof. Kadam P.S[5]

Student, Department of Civil Engineering1,2,3,4
Professor, Department of Civil Engineering[5]
Adsul's Technical Campus, Maharastra, India

Abstract - Water treatment plant (WTP) sludge disposal is a major environmental concern that requires creative methods for management. In order to reduce the environmental impact of sludge disposal and improve the sustainability of the brick-making process, this study investigates the viability of using WTP sludge as an additional material in the production of clay bricks. The study looks into WTP sludge's physiochemical characteristics and prospective use as a raw material for brick manufacturing. The study investigates the impact of adding different amounts of WTP sludge to clay brick formulations on important factors such compressive strength, water absorption, and durability using experimental analysis. The findings show that adding WTP sludge can improve the characteristics of clay bricks; the best combinations outperform traditional bricks in terms of performance. Furthermore, by lowering the cost of raw materials and limiting waste disposal costs, the use of WTP sludge offers possible financial advantages. Environmental evaluations show that using WTP sludge in brick production has several sustainable benefits, such as lower energy use, carbon emissions, and a reliance on virgin resources. Furthermore, the use of sludge in bricks supports the circular economy and waste diversion initiatives. All things considered, this study shows that using WTP sludge in the manufacturing of clay bricks is a feasible and ecologically friendly strategy. Through the utilization of waste materials for applications with added value, this study provides valuable insights into tackling resource scarcity and environmental issues in the building sector.

Key Words: Clay bricks, WTP sludge, Waste utilization, Industrial ecology, Waste-to-resource conversion.

1. INTRODUCTION *(Size 11, Times New roman)*

One of the fundamental components of construction is brick. It has been in use since before 3000 BC. Clay was once utilized as the primary raw material to make bricks, and it is being used in the present day. Because of its advantageous qualities, it is utilized in the brick-making process (Hegazy 2012).

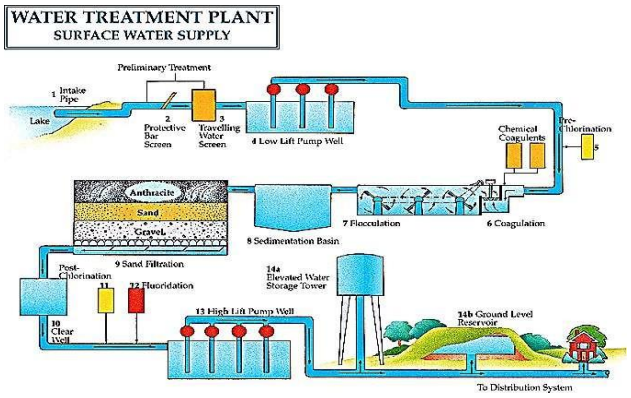
One of the most crucial building materials for constructing masonry walls in India is burnt clay brick. After China, the Indian brick industry is the world's second-largest manufacturer of brick (Gumaste 2004). If the raw materials have high-quality ingredients, high-quality brick can be produced. Different clays are available in different parts of our country, and the physical, chemical, and engineering qualities of bricks formed from these clays vary. India's northern and southern bricks are superior to those made in the country's center. The majority of Maharashtra has black cotton soil, which is unsuitable for making bricks because of the mineral montmorinollite's tendency to inflate and shrink. Sludge, a waste product of water treatment, is typically produced in large quantities and dumped into the closest watercourse. Even while disposing of the sludge is a cost-effective way, it is not environmentally friendly. Sludge that is dumped into streams contaminates the water downstream, making it unfit for human consumption. Aluminum concentrations in water and human bodies gradually rise as a result of disposing of water treatment sludge. Alzheimer's disease has been connected to this practice. Additionally, the chemical makeup of clay and water treatment sludge are similar (Monteriro 2006).

2. Research Methodology

2.1 Problem Statement

Brick prices are rising as a result of rising demand for bricks. Since clay is a necessary raw element for making bricks, producing bricks also contributes to the top layer of fertile clay being depleted.

These problems of rise in cost and depletion of fertile top soil layer can be tackled by substituting the primary components of common bricks with waste material. Water treatment plant produce large quantity of sludge. Sludge disposal can be major concern for water treatment plant. Sludge disposal increases environmental problem and harmful for living beings. WTP sludge and clay have closed mineralogical composition. So it can be used in brick manufacturing. So by replacing primary components of clay brick with WTP sludge we can solve problem of sludge disposal and reduce construction cost.



2.2. SOURCE FOR PRODUCTION OF CLAY BRICKS USING WTP SLUDGE

1. Clay Deposits
2. Water Treatment Plants (WTPs)
3. Construction and Demolition Sites
4. Industrial By-products
5. Agricultural Lands

3. Composition of Brick Earth

A good brick earth should consist of a blend of sand and pure clay, so that it may be made with water and dried without bending, shrinking, or breaking. A tiny amount of finely divided lime should be present to aid in melting the sand particles and cementing the brick particles together. Ingredients for a high-quality brick earth include:

1. Silica:
It can be found in clay in both free and mixed forms. in unrestricted form. It is incorporated in a mechanically mixed form with clay. It shares a chemical makeup with alumina. The silica content of a good brick soil should range from 50% to 60%. This ingredient keeps uncooked bricks from shrinking, splitting, and warping. It gives the bricks a consistent shape as a result.

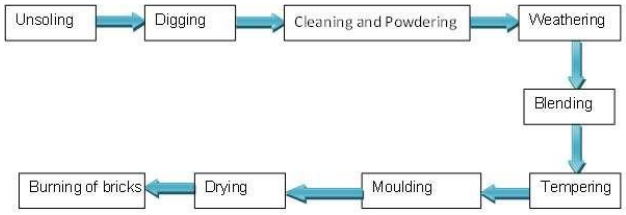
2. Alumina:
It is the chief constituent of every kind of clay. A good brick earth should contain about 20% lo 30% of alumina. This constituent imparts plasticity lo the earth so that it can be moulded, alumina is present in excess. with inadequate quantity oi sand. The raw bricks shrink and warp on drying and burning and become too hard when burnt.

3. Lime:
A small quantity of lime not exceeding 5% is desirable in good brick earth. It should be present in a very finely powered state because even small particles of the size of a pin head cause flaking on the bricks. The lime prevents shrinkage of raw bricks. The sand alone is infusible. But it slightly fuses at kiln temperature in presence if lime. Such fused sand works as a hard cementing material for brick particles. The lumps of lime are convened into quick lime after burning and this quick lime slakes and expands in presence uf moisture. Such an action results in splitting of bricks into pieces.

4. Oxide of iron:
A small quantity of oxide of iron to the extent of about 5 to 6 percent is desirable in good brick earth. It imparts red colour to the bricks. The excess of oxide of iron makes the bricks dark blue or blackish. If, on the other hand, the quantity of iron oxide is comparatively less, the bricks will be yellowish in color.

5. Magnesia:
A small quantity of magnesia in brick earth imparts yellow tint to the bricks and decreases shrinkage. But excess of magnesia leads to decay of bricks

3.1 Manufacturing of Bricks



1. Preparation of brick earth :

The material that is used to make building bricks needs to be cleaned to remove any debris such as gravel, lime, and plant stuff. require certain amounts of additions, such as fly ash, rice husk ash, and sandy loam. The basic ground surface should be covered in stone dust, etc. based on volume. The soil mass is then manually removed, pulled, watered, and left in place for weathering and further processing.

The carefully established processes that go into getting dirt ready for brick production are as follows:

1. Unsoling:
The procedure is scraping the top layer of soil, which is below ISO to 250 mm in depth, in order to reject and discard it since the top soil may include various pollutants, such as waste items. All bushes, plants, and other debris are also removed from the top soil.

2. Digging:
Following the unsoiling and elimination of impure material, such as pebbles, weeds, etc., the brick earth is excavated manually or with the use of power excavators. Just slightly below ground level, the duct soil is dispersed across the leveled terrain. The brick earth's hipped height can range from 0.6 to 1.2 meters.

3. Cleaning and Powdering:
Stones, pebbles, lime, roots, and other vegetation matter are removed from the brick earth. The dug soil lumps are also broken up to convert them to a powder. Clay that is lumpy and hard is ground into a powder by rolling it between stone or cast iron rollers.

4. Weathering:
Weathering is the process of softening or mellowing excavated clay by exposing it to air and adding a small amount of water. following the clods' shattering. After being excavated, the dirt is combined with a little amount of water and placed in heaps to weather for a few weeks to a complete monsoon season. The brick earths become more resilient and flexible as a result of process 01 weathering. The dirt is kept slightly moist throughout the weathering process by periodically misting it with water and flipping the heap over.

5. Tempering or pugging:
After that, the brick earth is properly broken up, irrigated, and well-kneaded by hand, with the help of livestock, or with a machine, until it is a silent, homogenous mass. Tempering, or pugging, is the process of kneading brick clay by adding water to get the necessary plasticity and homogenous bulk. Pug mills

are used for large-scale production tasks (Kulkarni P.D. et al, 1992).

4. Classification of Brunt Clay Bricks

1. Classification of bricks according to IS code IS:1077(1992) classifies the brick into various classes depemding upon their compressive strength. Table 2-1 shows the classification according to IS:1077(1992)

2. Table 3-1 classification of bricks based on compressive strength (IS:1077(1992))

Class	35	30	25	20	17.5	15	12.5	10	7.5	5	3.5
Average comp. strength not less than (N/mm^2)	35	30	25	20	17.5	15	12.5	10	7.5	5	3.5

4.1 ADVANTAGES OF CLAY BRICKS

1 Aesthetic Appeal

2 Thermal & Acoustic Insulation

3 Zero Maintenance Cost

4 Fire Resistance

5 Flexible in Application

4.2 DISADVANTAGES OF CLAY BRICKS

1. If clay bricks are used in the construction business, a significant amount of rich topsoil will be lost. This could pose a serious risk to the ecosystem.

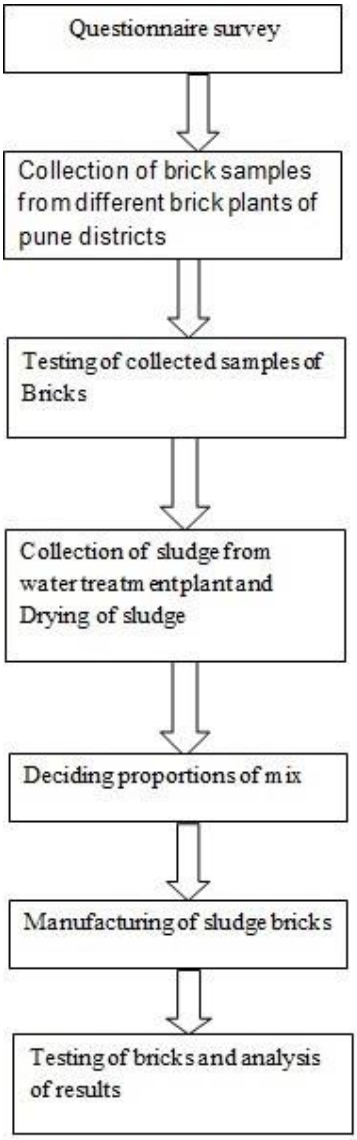
2. A rise in clay brick prices would be the outcome of increased demand. We should choose alternative building materials like flyash bricks and hollow or solid blocks in order to maintain the cost of building materials within a realistic level.

3. Using alternate building materials, such as flyash bricks, could reduce the rate of deforestation. An enormous tract of woodland is cleared each year to make way for the production of bricks.

4. Outdated technology is used in the production of burnt clay bricks, and the industrial site lacks facilities for quality testing. The majority of bricks made with antiquated technology are of lower quality and have a lower compressive strength. They are inappropriate for structures with multiple stories.

5 Methodology

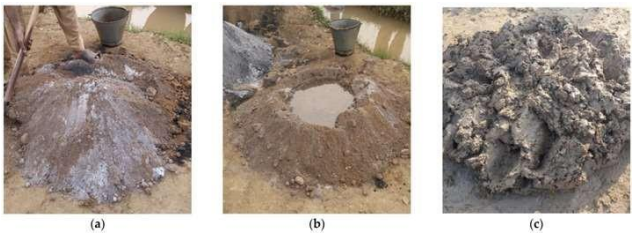
5.1 FLOW CHART OF METHODOLOGY



MANUFACTURING CLAY BRICK WITH SLUDGE

Fig 5.1 mixture of sludge ,clay, coal and sawdust

2 Then water is added in this mixture



3 Then after adding water tempering is done by feet

Fig 5.3 tempering

4 After tempering mixture is kept for weathering for one day

Fig 5.4 mixture for weathering

5 On next day ground molding is done and bricks are kept for drying for 7 days Eight Bricks aremoulded of each proportion

Fig 5.5 moulding and drying of bricks

6 After 7 days bricks are kept for burning for seven days

6. CONCLUSIONS

1. A review of the literature leads to the conclusion that the chemical makeup of sludge and clay is comparable.

2. It has been observed that when sludge is utilized in place of clay bricks, the compressive strength of the bricks diminishes as the quantity of sludge increases.

3. It has been shown that the water absorption of clay bricks increases with the amount of sludge added when sludge is utilized as partial substitute.

4. According to IS 1077:1992, the minimum strength required by this IS code is 3.5 N/mm2, and bricks made with 30% sludge and 70% clay have a good strength of 3.56 N/mm2.

5. Sludge increases beyond thirty percent result in strength values below 3.5 N/mm2.

6. Sludge bricks can be afforded.

7. Sludge bricks are environmentally benign.

8. Bricks made with 70% clay and 30% sludge are appropriate for use in construction.

ACKNOWLEDGEMENT

Presenting my project report on "MANUFACTURING OF CLAY BRICKS BY USING WTP SLUDGE" brings me great pleasure.

I would want to sincerely thank Prof. Kadam P. S for all of his help, support, and encouragement while I was working on my project. I am very grateful for his excellent advice and support during this Project.

My deepest gratitude to Prof. Daule A.D., Head of the Department of Civil Engineering, for his help, advice, and provision of the workspace I needed to complete my task. I also like to express my gratitude to Dr. Patil P.M., the principal of ADSULS Technical Campus, for his inspiration and support during the project.

I also want to express my gratitude to everyone of the Civil Engineering Department's faculty members for their participation, whether direct or indirect.

REFERENCES

1. Research Articles: Seek out scholarly studies that address the application of WTP sludge in brick production. These articles frequently include thorough details regarding the experimental setups, approach, and outcomes of utilizing WTP sludge in clay bricks.

2. Journals on Construction Materials: Papers about sustainable building materials, such as the utilization of waste materials to make clay bricks, are frequently published in journals like Construction and Building Materials and Journal of Materials in Civil Engineering.

3. Conference Proceedings: Papers on creative use of waste materials in building, such as WTP sludge in bricks, are frequently presented at conferences on environmental engineering and civil engineering.

4. Case Studies: Seek out case studies on initiatives that have effectively employed WTP sludge in the production of clay bricks. These case studies could offer helpful perspectives on the advantages and procedure.

5. Government and Industry Reports: These sources may offer recommendations and best practices for the use of WTP sludge in the production of bricks. Data regarding the financial and environmental advantages of employing WTP sludge may also be included in these reports.

6. Technical Papers: Look for studies on the application of WTP sludge in brick making by searching through technical papers from associations like the Institution of Civil Engineers (ICE) or the American Society of Civil Engineers (ASCE)
.
7. Patents: Search patent databases for novel applications of WTP sludge in the production of clay bricks. Patents may provide information on special techniques or materials.