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Manufacturing of Bricks with Solid Waste

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ABSTRACT : There has been a massive increase in solid waste creation as a result of urbanisation. In addition to polluting the environment, dumping and landfilling solid waste may also have an adverse effect on human health since it can cause ground water contamination via leaching. Using solid waste to recycle valuable materials and reduce trash volume, other pollutants, and disposal costs has grown increasingly viable in recent years. Bricks are a ubiquitous building and construction material all throughout the world. Since clay and ordinary Portland cement (OPC) concrete are the most common building materials used to make traditional bricks, their production has a significant environmental impact. Several nations throughout the world have already exhausted their natural resources for the production of conventional bricks. Efforts have been made to produce bricks from waste materials in order to protect the environment and promote sustainable growth. This document provides an overview of studies on the use of waste materials to make bricks. Bricks may be made from a broad range of waste materials using a number of techniques. Depending on the technique used to create bricks from waste materials, the study may be broken down into three broad categories: burning and cementing. Despite extensive research, the practical production of bricks built from waste materials is still limited. Bricks made from waste materials, the risk for contamination, the lack of standards and sufficient advice, and the sluggish adoption of waste materials-based bricks by industry and the general public are all plausible reasons for the problem. As a matter of fact, research and development are needed in a variety of fields, including the areas of technical, economic/environmental and public education.

KEYWORDS: Component, formatting, style, styling, insert.

I. INTRODUCTION

For example, hollow, solid blocks and concrete bricks are all made from natural resources that are already present in the environment. As a consequence of the extensive investigation, the ecosystem is fragmented, and natural resources are depleted. It's not only carbon monoxide and other toxic compounds that are released into the open air during the production process, but also sulphur and nitrogen oxides, as well as suspended particles. These emissions have adverse effect on humans and well-being, since they have a harmful effect on the nature and disrupt the normal use of air quality, natural water resources, vast soils, and many plant, animal, and aquatic life species. As a consequence, the existing air quality may deteriorate as a result of shifting quantities in the environment. We have seen a rise in the importance of sustainability and environmental protection in our society in recent years. Sustainable, eco-friendly, low-cost and compact construction materials have been emphasised in civil works because of the growing need for environmentally-friendly, low-cost, eco-friendly, lightweight and compact building materials.

In current year's numerous sorts of secondary products, created from diverse origin such as hospitals, factories, domestic, public places, commercial etc. gathered in extremely significant amounts. As a result, the majority of the waste product is detrimental to the environment. As a result, these items cause a pollution explosion. Because of this, we must discover a method to turn all of the dangerous trash into a beneficial product that can be utilised without causing damage to the environment. To address the issue of environmental deterioration and the frequent dumping of significant amounts of solid waste. The novel idea in which solid waste is used in making bricks is explained and tested for heat resistance and other attributes of solidity in the current study. This presentation is based on the concept of "turning waste into value" in the building industry by employing a various types of waste materials in the casting process for making bricks.

1.1. Background and motivation

Brick has been used by humans from thousands of years to create structures. Bricks are among the earliest known construction materials, dating as far back as 7000 BC. Ancient settlements were found in southern Turkey surrounding the city of Jericho. The first bricks were made up of mud and bricks were dried in the sun to harden in locations with warm weather.



Ancient Egyptian bricks were constructed of clay and mud. In 3,500 BC, the creation of burned brick was the most significant development. Bricks could now be manufactured without exposure to the sun's heat, which led to their widespread adoption in colder regions. Cement, lime, sand, clay, and other ingredients have been used to make bricks for a very long time. So many different kinds of brick exist, from first-class to fourth-class, from fly-ash brick to cement brick to sand lime brick and everything in between.

In past years brick is made by many types of waste materials like paper sludge, coconut shell powder, industrial waste, plastic waste, paint waste etc. bricks are also classified on different types of their properties. Bricks have different types of properties like some have great strength so some have less water absorption. In past years bricks used to heat in kilns after drying but today bricks are used to dry in sun-light or in shades also. As we know waste increasing day by day so we are taking paint waste to make bricks. As in literature review these waste help in saving environment as well, they give so many properties to brick from which made by waste can use in construction and developing the country.

1.2. Reflection

The management of hazardous and toxic solid waste is concerned with enacting policies and procedures that minimize their negative effects on the environment. Industry pays the charge for the management of toxic paint to third parties who get organization licenses if they are unable to control themselves or cannot incorporate them into their own goods. By binding industrial waste into bricks, waste which is in solid form is utilized as a basic raw material or as a raw material combination for crystallization. [1][2]. It is possible to make Eco bricks with up to 10% recycled content by using waste paint as a combination, according to Citra and colleagues [3]. For the production of bricks, the Indonesian National Standard requires a compressive strength of at least 2.5 percent to be met by a combination including paint waste. Sludge paint waste has a notable impact on the compressing strength, and at 10% the compressive strength falls short of what is required for brick-making. Another group of scientists has experimented with using industrial waste as a combination for brick production. [4] [5]. No concrete bricks have yet been made from resin waste, which has been studied for use in the manufacture of concrete [6]. As a construction material, leftover paint may be used as a combination of concrete blocks that do not need a high degree of compression strength and can instead be cover with cement and sand. A concrete block wall offers better weather and rainfall resistance than an eco-brick wall would. This inquiry focuses on the bricks permeability and compressive strength made using ordinary sludge paint waste.

1.3 Paint solid waste

After the paint has been applied to a building, factory, or other structure, the paint solid waste or paint leftovers are what is left behind. It is common for paint production operations to produce a substantial amount of trash. In the event that this paint waste is dumped in an uncontrolled manner, it has the potential to degrade soil fertility and generate leachate that contaminates groundwater. So, paint waste may be reused rather than disposed of in landfills. Maharani It has been discovered that industrial paint waste may be recycled back into a valuable product by management in Faridabad, Haryana. Bricks, mortar, and concrete retaining wall units may all be made from paint solid waste if it is properly disposed of. The expenses of treatment and disposal may also be avoided if garbage is reused. Reusing solid waste from the paint industry saves money, as well as providing environmental advantages, such as reduced waste disposal expenses. Total waste quantities are also decreasing as a result of these changes.

II. LITERATURE REVIEW

As emerging nations create more and more garbage, the quantity of waste produced each year will reach 2.2 billion tonnes by 2025 if the trend continues. Continuous methane gas emissions, a harmful greenhouse gas, are a result of solid waste generation's influence on the environment (GHS). As a result, it is advised that alternate strategies be used to better manage these wastes. Eco-friendly garbage recycling has shown to be one of the most effective ways to minimise waste. Limestone dust particles, sludge, wood sawdust, fly ash, and rubber have all been used in trials to include waste materials in the construction of bricks. For bricks, we employ a wide range of waste materials in diverse combinations to generate a wide variety of bricks. Bricks are subjected to a variety of tests to determine their various qualities. Water absorption and compression tests are the most popular.

Kongnole et al. [7], developed a method for control the increasing demand of natural resource in construction of buildings and road etc, availability of conventional building material is not easy and it's also got costly, On the other hand plastic is extremely increased and disposing of waste is a big problem, so the plastic is taken for making of bricks, by this the increasing of plastic waste does not hard the environment and the natural resource like clay is saved from



depletion. In this, gather the waste plastic and remove from other waste, and after separation the plastic waste is dried if it's wet and removed all the moisture, then with the help of crusher crush it and after crushing heated on furnace and when the plastic turn in liquid then stone dust added in liquid plastic and mix properly after mixing done completely, the mixture is poured in moulds and left to dry. After drying it take out for performing various test on it, after testing is done on brick and it gives the result that it has good strength and minimum water absorption. They are useful where fly ash bricks and 3rd class bricks are used.

B. Dhanalaxmi et al. [8], focusing on major toxic waste which is Paint remnants, it is very hazardous if disposed randomly on surface and it cause degradation in soil fertility and generate leachate by which ground water gets contaminated. Maharani paint industry management which located in Faridabad has developed a process in which we can recycled the paint sludge and turn into a useful product. Paint remnants, cement, robo sand, fly ash, water is taken for make eco-friendly brick. The operations involved is batching, mixing, moulding and drying. In batching, ingredient is accurate and precise measurement for making cement, then solid paint waste, fly ash, cement and robo sand ae mixed to form a constant colour and then add water, after mixing the moulding part is started and the mixture is poured in a mould of size 19*9*9cm, oil is applied into the mould inner surface and placed mortar in mould and after 5 minutes mould is detached and brick comes out, then brick dry in sunrays. In this robo sand is replaced in samples by some quantity of paints waste. After this compression test done on the sample of bricks and bricks compared to conventional bricks. The outcome is as per result these bricks have less compressive strength then conventional bricks but they are light in weight and come in 2nd class brick.

Abhishek et al. [9], presented research in which replacement of small quantity of clay with solid waste in manufacturing of bricks. India is largest producer of coconut but the disposal of its hard shell is a critical problem, if it burnt then it emits carbon dioxide which is very harmful for environment. Datar and Shinde had done an experimental study in which the ability of coconut shell powder used as aggregate material for making bricks, they mix Portland cement, coconut shell powder and river sand in different proportions and make bricks then dry them, for every new sample they increase 5% coconut shell powder and decrease same amount of soil means decrease 5% and then after 2 days dry bricks burn in kiln, after that they do all the test and the result is when use 5% coconut shell powder it gives high compressive strength but adding more than 5% decrease the strength of brick and low water absorption is also less only in sample with 5% coconut shell powder and thus coconut shell powder has capability to use as aggregate in construction of bricks[10].

Lianyang Zhang et al. [11], discovered a way to turn waste materials into bricks by igniting them. To manufacture bricks, this approach substitutes some or all of the clay with waste materials and continues the standard procedure of kiln firing the materials. Bricks produced from 80% fly ash and 15% clay, ranging from 77% to 100%. Class F fly ash was studied by Lingling for its potential to substitute clay at high ratios. Fly ash boost bricks compressive strength, after which it is tested to ensure that it has a low water absorption level.

Dina M Sadek et al. [12], focused on the solid waste amount cause from various mining, industrial, agriculture cause vital difficulty from their discarding and take up a large area of lands. This is a waste product from the pulverize and extraction of rocks to make crushed stone. It is often in 4.75mm-sized small particles. It is possible to make hollow blocks and lightweight concrete prefabricated pieces out of quarry refuse, which is widely utilised in highway surface finishing. Quarry waste might be utilised as a replacement for aggregate in building materials, which would alleviate environmental concerns caused by the massive depletion of natural resources. For quarrying activities, rock pieces make up almost 40 percent of the trash. Marble dust waste may be used as an additive or sand in self-compacting concrete and asphaltic concrete. Crushed ceramic is a by-product of the ceramic industry's crushing of earthenware, which is susceptible to cracking during the sintering process and accounts for around 30% of total ceramic industry output. The ceramic sector is unable to discover a waste disposal system that works for them. It offers a number of advantages, such as being long-lasting, hard, and resistant to wear and tear. Cement, crushed stone and quarry sand with a formal size of 10 mm are utilised as coarse and fine aggregate. In order to make the brick, it was necessary to combine various amounts of cement, quarry sand, and ceramic waste and pour it into a mould. The bricks were then demoulded, and after 24 hours, they were exposed to the air. After that, they were cured for 28 days by water sprinkling twice daily. Bricks dried in this quarry have a better compressive strength and waste of marble may replace of coarse material up to 75%, according to compression and water absorption tests.

Mohammed Yaseen et al. [13] reduce the amount of garbage that is created by human activity, a new approach was devised and focused on solid waste. It may be broken down into several categories. Nonbiodegradable and biodegradable trash; recyclable trash; inert trash; hazardous trash; and biomedical trash. It is becoming more necessary to employ inorganic solid waste in brick making due to the rising demand for building materials and their rising costs.



Cement, fly ash, plastic, bottom ash, glass, and quarry dust may all be used to make bricks. Crushed waste glass from glass companies is further sieved from 4.75 mm in sieves. Selected LDPE and HDPE plastic trash was shredded and passed a 4.75mm IS filter for recycling purposes. In this mix, the materials used for making aggregate are glass, quarry dust, plastic, and, bottom ash with ration 10, 40, 10, 40 percent each, and by adding fly ash to the aggregate with varying percentages to get the value from those mixes through mass analysis while keeping the cement to aggregate ratio 1:6 constant. By putting it into a mould and allowing it to dry, bricks are formed from the mixture. Water adsorption test, falling test and efflorescence test after drying. Because its water absorption level is less than 20% and it did not break in the falling test or develop precipitate efflorescence on its surface, the results are in favour of eco-friendly bricks. By substituting fly ash for some of the cement in varying ratios, the compression strength of the concrete was enhanced.

P.Amsayazhi et al. [14] focused on tanneries, Tanneries are a major source of pollution and hazardous waste, notably in the form of polluted organic matter and toxic solid waste from the processing of hides. South East Asia's tanning business is one of the region's oldest, biggest, and fastest-growing. Many tannery operations may be found in the city of Chennai, which processes around 55% of the world's leather. Chrome tanning is used by more than 70% of tanneries, whereas vegetable tanning is used by 30%. Industrial Effluent Treatment Company of Pallavaram Tanners (PTIETC). There was also water and tannery muck. Sample ratios were collected from four different bricks, with part of the original brick added in. In addition to 7.04X7.04X7.04 cm cubes for the compressive strength test, three samples were casted and test is done on them, with average values chosen from each of the three results. In addition to the water absorption test, the tests were undertaken for seven and 14 days. Good strength, environmentally friendly bricks, and less than 15 percent water absorption in 24 hours are the main results. The best of both worlds: Reduce the amount of cement you use by 20%.

Raju Sarkar et al. [15] invented the use of paper mill waste in manufacturing of brick. Paper mill waste may be used to make brick instead of being disposed of in a landfill, which is less efficient. Wastes include lime mud, sludge and grits from the waste water treatment. Lime mud, fly ash and paper mill waste, are some of materials that are used. Soil was used to cast the brick samples, which measure 190 mm by 90 mm by 90 mm. Lime mud, fly ash, and soil are used to make these modular bricks. There were no air bubbles in the mould, and it was permitted to cure for two days before being removed. After 28 days, all bricks are checked to ensure they are safe to use. Result Brick compressive strength rises as the quantity of lime mud in the mud increases.

Hariharan.S et al. [16], presented a technique for dumping glass trash, since there is no suitable way for dumping glass garbage. Bricks may be made from glass powder, commonly known as fused silica glass powder. It is crushed into a fine powder from the discarded glass bottles. As much clay as possible was used to replace the waste glass powder in the ratios of 25% to 30% to 45% to 50%. After making a mixture and pouring it into moulds of bricks, the bricks are put into a kiln and then tested. Result When a brick is made by replacing 25 to 45 percent of the waste glass powder with new brick, it has a greater compressive strength and lower water absorption than a typical brick.

K.C.P Faria et al. [17], developed a method for manufacturing of bricks using sugarcane bagasse. The bagasse ash is a waste which is non-biodegradable product of waste. The crystalline silica composition of bagasse ash from sugarcane plants may be explained. So, instead of using natural clay to make bricks, sugarcane bagasse ash was used to recycle the waste. All of the samples were created at 21 MPa by uniaxial pressing, then drying at 110°C after that finally burning at 1000°C. According to SEM data, the sugarcane bagasse waste has the potential by which they can used in clay bricks as an inorganic stuffing, improving chances of recycle in a safe and feasible way. The utilisation of bagasse ash recycled into bricks shows environment advantages, conservation of basic materials and waste reduction.

Taner Kavas,[18], examined the viability of using the fine boron waste (FW) and the clay waste (CW) to produce RM bricks. At 1000°C, the bricks were dried and then burned. This waste boron was shown to be an effective fluxing agent for RM bricks in both the mineralogical and mechanical testing.

J.A. Cusido et al. [19], composed a method for more thermal, lighter and acoustic insulating clay brick, in compared with common clay-bricks Traditional normal clay bricks are less insulated and heavier than the newer bricks. The bricks are made by 80% clay with 15% sewage sludge and 5 percent forest waste. After drying at 100°C, bricks were burned at 1000°C to harden them. A study found that emissions of greenhouse gases were 20 times greater than in traditional ceramic burning, despite the fact that they are still permitted by the EPA.

C. Martnez Garcia et al. [20], Using sludge to make bricks was suggested by Sludge is a waste product that is generated by wastewater treatment facilities on a yearly basis. To save money and tackle an environmental issue simultaneously, it is possible to substitute clay for sludge in ceramics. Sludge waste was added to body clay at rate of 1, 2.5, 5, 7.5, 10, and 15%. These parameters include compressive strength, the bulk density, water absorption and linear shrinkage of the material. They found bricks that included 5 percent sludge had mechanical qualities that were 3 percent better than those that had less than 5 percent.

M. Dondi et al. [21]. investigated the utilization of glass panel and funnel of tv and glass of pc. Both a television and a personal computer After drying at 100 degrees Fahrenheit, the glass debris and clay mixture was subsequently torched at a temperature of 900 degrees. According to the findings of the experiment, adding 2 percent of glass waste to the clay body had no noticeable influence on the technical performance of burned bricks. The mechanical characteristics and efflorescence may be harmed if more than 5% of the waste is added. The results of the leaching test showed that there was no major pollution of the environment.

Kae Long Lin [22] invented a method to produced bricks by fly ash slag from municipal solid waste incinerator. As a result, the practically total annihilation of all organic components, the amount of solid waste municipal is reduced by 90 percent, and the reactivity of this material is greatly reduced. The mass-burning incinerator in Taiwan's north provided the study's fly ash, which was collected from the cyclone and employed in this investigation. A local municipal solid waste incinerator with a daily processing capacity of 1350 metric tons looked into using MSWI (municipal solid waste incineration fly ash slag) on burned clay bricks. The outcome of the leachates test was in line with the established limits. Mechanical qualities were in line with Chinese National Standard (CNS) standards for second-class brick buildings. Increases in municipal solid waste incinerator were shown to reduce water absorption while boosting the sintered bricks' compressive strength.

Eliche-Quesada et al. [23], focused on different industrial wastes like coffee ground residue, bagasse, sludge from brewing, municipal sewage, and olive mill solid waste were combined to clay for manufacture bricks. These wastes were dried at 90 °C for 24 hours to remove water. A sieve with a mesh size of 150 um was used to ensure that the waste and clay were pulverized to a fine powder of consistent size. Sludge SUW (85%), SBI (5%), bagasse (2.5%) and coffee grounds (3%) make up the clay body. OMW (65%) makes up the rest of the clay. Researchers discovered that when sintering temperature rose, compressive strength rose as well. It was found that adding coffee grounds and olive mill solid waste to clay bricks improved their compressive strength while also improving their thermal conductivity by 19 percent. The bricks satisfied the requisite compressing strength and water absorption standards.

Ismail Demir et al. [24], invented a method in which waste was used to produce clay bricks, and the materials were separated into two categories: A that passed through a 4:75-millimeter sieve (coarse) and B that passed through a 600-millimeter sieve (fine) (3ne). The raw-brick clay was mixed with varying amounts of waste (0, 10, 20, and 30 percent by mass) to ensure equivalent test results. Using it to make bricks would help preserve farms and the environment, according to the findings.

Abdul A. Samad et al. [25] developed a method in which they recycled the sludge of sewage as a raw material for making clay brick. In order to meet the required criteria, the mechanical properties and physical properties of the bricks were confirmed to be appropriate. Aside from their fragility and susceptibility to breakage even when handled delicately, sludge-added bricks weren't suggested for use. These sludge bricks were only suitable to use as ceramic bricks owing to the bad surface finishing of ceramic bricks.

Rania et al. [26], developed a method in which granite and marble waste of various sizes may be recycled in the manufacturing of bricks made from concrete, with the total substitute of typical fine and coarse aggregates with slurry powder and marble waste scrapes. Egyptian code requirements for non-load-bearing building materials were met by all of the cement brick samples assessed in this study, according to this research.

Chin-Tson Liaw et al. [27], invented a process in which co-generation ashes and paper sludge were reused for production of bricks, which were then burned at 1,000 degrees Celsius. The rate of water absorption was less than 15% and the compression strength was more from 150 kg/cm² for the construction bricks built from raw materials and co-generation ashes, which met the necessary criteria for construction material and may be utilized as non-load bearing spacing.



Quintilio Piattoni et al. [28] made an earthen brick. By manually compacting coarse sand and straw fibres. They studied the mechanical characteristics by combining experimental and theoretical methods. Because of the paucity of statistically meaningful data, the results were inconsistent.

Cheng-Fang Lin et al. [29], explore the properties of bricks which are water permeable. Bricks made by bottom ash and water treatment sludge and do not adding any unnatural aggregate. Bricks mechanical properties were inspected with suitable grades. The 20% bottom ash mass content under a 1150°C is able to create a brick with compression strength 256 kg/cm², permeability of 0.016 cm/s and water absorption ratio of 2.78%. By this process brick manufactured can used as eco-friendly for walls brick in urban places and water permeable.

Kidsarin Pimraksa et al. [30] created a method in which bricks manufactured by 100% fly ash lignite. Compared to burnt clay brick, first class bricks, and various kinds of fly ash bricks, the bricks created by fly ash in research had better mechanical and notably compression strength.

Badr El-Din Ezzat Hegazy et al. [31], research on the totally substitution of clay bricks by mixing of rice husk ash and silica fume with sludge. Bricks burnt at 1000°C. Bricks contains 25% SF and sludge 50% give higher properties with compared to normal clay bricks.

Malhotra et al. [32] composed a new method to manufacture bricks with granulated blast furnace. Slag-lime sand bricks may be made by pressing the mixture at 50 kg/cm² pressure, according to research. There was evidence that slag uses less energy than traditional burned clay or calcium silicate brick, with compressive strengths ranging from (80-150) kg/cm².

Sivakumar Naganathan et al. [33], Used bottom ash of thermal power plant, combined with cement, fly ash and water used to manufacture bricks. The bricks were made using a flowable mix with a high water-to-cement ratio (1.5-5.5). An ultrasonic pulse velocity of (2.556-2.819) km/s was recorded for compressive strength, with water absorption ranging from 7% to 14%. The novel process for making bricks does not need clay and shale nor does it require high temperature kiln fire, resulting in considerable environmental and ecological advantages over the old way of making brick.

S.P. Raut et al. [34], used different types of waste like the cigarette butts, fly ash- lime-gypsum, cotton shreds, paper trash and limestone powder chucked out of effluent treatment plants, as well as the organic waste and kraft pulp shreds left over from paper processing, were all used to make bricks. These bricks were tested for their water absorption and compression strength. As per the Indian Standard IS1007:1992, the compression strength of bricks made from paper manufacturing leftovers and waste paper pulp exceeded 12 times the minimum specified by the standard.

Chee-Ming Chan [35] analyze the mechanical properties of clay bricks which are made by two natural fibres, pineapple leaves and oil palm fruit and, added with clay. According to BS3921:1985, water absorption, and efflorescence were evaluated in compliance with Malaysian Standards MS 76:1972. Conventional bricks must have a compression strength of 5.2 MPa to achieve the minimum requirement for compressive strength in accordance with BS3921:1985. Due to the deterioration of the non-baked samples, efflorescence was only achievable with baked samples during testing. The presence of fibres in baked specimens increased their strength over that of non-baked specimens.

Paki Turgut et al. [36], compose a low-cost, lightweight, and thermally resistant composite brick may be made using rubber crumbs and concrete. Compressive, bending and splitting strength, freezing resistance, and unit weight all met international standards. Cracker mills are employed in this research to manufacture the shredded rubber from the tire scrap component that does not include steel fibres. It contains particles with a diameter ranging from 4.75 mm to 0.075 mm. The experiments show that replacing scrap rubber with traditional sand aggregate at high levels does not result in an unexpected stiff fracture, shows excessive absorption capacity of energy, drastically decrease measure weight and presents a plain surface when differentiate to currently bricks available and made by concrete in the market. Adding varying amounts of rubber pieces can improve the thermal insulation properties of standard cementitious mixtures.

Hanifi Binici et al. [37], presented an earthquake resistance material with intense compression strength. This was done by testing the compression strength of mud bricks reinforced by fibre made by plastic fibres, lime, cement, basaltic pumice, clay and gypsum. It is permitted to utilize fiber-reinforced mud brick to minimize the weight and material handling expenses of houses in Turkey. Furthermore, it is more resistance to earthquakes than the other kind of mud brick since it has a greater capacity to retain elastic energy.



Alaa A Shakir et al. [38], explore a major heat conductivity resistant brick made of clay and perlite. Binding elements including lime, clay, gypsum, and cement were utilized to make the perlite brick. To dry the samples, they were heated to 200°C and then 950°C in a kiln. Bricks compressive strength decreased, shrinkage was reduced, and heat conductivity resistance was raised as perlite dosage rose. Perlite brick was found to be an excellent insulator according to brick specifications, and the ideal mixture percentage was discovered to be 30% perlite.

2.1. Summary

Paint sludge or paint remnants are paint that has been fully hydrated and maybe some decalcifying substances, termed as both modifiers. If this dense slurry is disposed of indiscriminately on the surface, it will be regarded as a hazardous waste. It may cause soil fertility to deteriorate, as well as the creation of leachate, which can contaminate ground water. As a result, wherever this waste discharges, its harmful to cultivation land, and it may even harm the ecosystem's greenery and wildlife. To provide a solution for the producer of paint sludge that is unsatisfying to the controlled concept of environmental legislation, which prohibits the presence of paint slag 'only within compartments of both the industrial facility where it is produced, Maharani Paint business sector company has grown a procedure throughout which industrial - grade paint waste 'could be subsequently converted to a commodity that is high in value

III. PROPOSED WORK

In proposed work we will study about the current brick which is made by clay and know about the properties of clay brick and also about the test which is done on clay brick. After this we take suitable waste which can be easily mix with brick ingredients to make brick and then we perform various brick test on it.

3.1. Methodology

1. Brief study of current bricks – In this we study about current bricks which is made up clay, sand etc. we study about their characteristics and their use, we also study about the increasing demand of brick in construction sector and which type of brick is highly used.
2. Take or select suitable solid wastes – As we know increasing of waste is a major problem and disposing the waste is also a problem. So, we will use a suitable waste material for making good and effective brick, which also helps in reducing the waste.
3. Follow the procedure for manufacturing of brick – For making a brick we will use a procedure which is cost effective and suitable for making a brick. We will mix all ingredients together and pour in mould for give a shape and then let it dry.
4. Testing of brick – Testing of brick is important because it tells about the characteristic of a brick like strength, durability, water absorption etc. On the basis of their characteristic, they are taken in different construction work.
5. Possible Outcome – Compare both bricks which we made and which is currently used in construction and then we know the brick we made is used in which type of construction.

Brick is used to make with different type of materials and waste with different type of compositions. The main waste which we are using for our brick is paint waste. There is different type of procedure to make brick some are fired in kiln some are air dried in shade.

3.2 Methods and Procedure

3.2.1 Materials Used

Unfired bricks are manufactured by using these materials: cement, sand, paint waste, clay, water etc. And equipment's used Trowel, scrapper, brick mold, tamper etc.

A) Cement – Gray-colored powder, cement is a finely powdered substance. Cement manufacture relies heavily on the use of clay and limestone as raw materials. Cement is a common binding agent used all around the globe. It is the most common building material. When exposed to water, cement hardens and stays in a hardened condition. Cement is accessible in the form of a homogeneous dry product. cement comes in various variety but most common cement is ordinary Portland cement (OPC). Every cement has different type of chrematicistics like their strength and composition is different and, on their characteristics, they use according to the requirements. Cement is used to make concrete mix which is made by cement and fine aggregates or gravel aggregate and with sand also. Now cement is also used in making of bricks which give high strength to bricks. I act as an aggregate and improve the workability of concrete mixture.



Figure 1: Cement

B) Sand – Depending on the kind of sand, it may be either natural sand, crushed stone sand or crushed gravel sand. It is a finegrained or it is graded by fine dust. The major source of sand is river banks. River sand contain high silica so it should be checked that I should only contain less than 5% of silica. Sand is also made by crushing of rocks or while cutting the rocks which is called quarry sand. Sand is the mostly used ingredient in manufacturing of bricks. Type of sand use in construction work is as per the requirements of construction.



Figure 2: Sand

C) Paint waste – Paint is a colored substance and it comes in liquid form made by pigments and it that is spread over a surface to decorate or protect it, and when it dries it leave a layer over the surface. Paint is use everywhere like in buildings, street, factory etc. When paint is used most of the time some of the paint is remains and which is hard to dispose because paint is hazardous and toxic waste. If it decompose in open surface then it lead to degrade the fertility of soil and results in generation of leachate by which ground water gets contaminated. So, whenever this paint remnants dispose, they have to regulate the principles of environmental law. Maharani Paint industry management has devised a procedure to recycle industrial paint waste and paint leftovers into a valuable product because of the rising amount of trash and the difficulty of disposing of it. Bricks may now be made using paint.



Figure 3: Waste Paint

D) **Water** – In addition to mixing and curing, it is also utilised for these purposes. These procedures need the use of water that is free of contaminants and suspended particles. This is a critical component, since it combines with cement to produce a fortifying cement.

E) **Equipment's** – The equipment's which are used for making brick – A trowel is used to mix all the ingredients of brick and place the mixture in mold. Scrapper is used to plain the surface of mixture which is in the mold and also remove extra mixture. Using a mould, a brick is shaped and sized to make 19-inch-by-9-inch-by-9-inch blocks of brick. Tamping the brick mixture in the moulds ensures that there are no gaps in the finished product. Sand, cement, standard sludge paint waste, and manufacturing water were the raw materials utilised.



Figure 4: scrapper

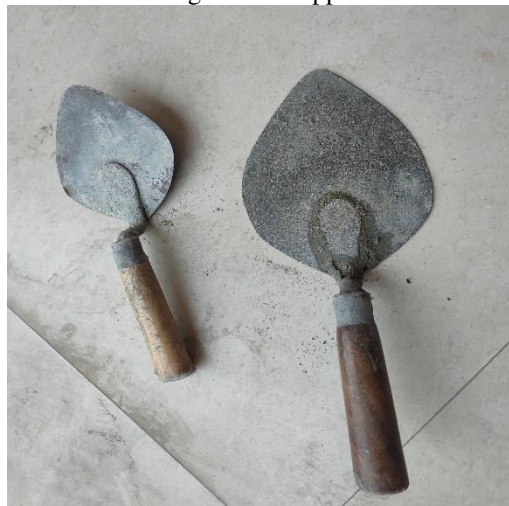


Figure 5: Trowels



Figure 6: Mould for making brick

3.2.2 Composition

Brick size and mixability affect the sand-to-cement ratio, as well as the location where the bricks will be used. Add with sludge paint waste which is depend on how much portion of sand we are removing.



Figure 7: Composition

3.2.3 Procedure

1. Process of making normal Clay bricks

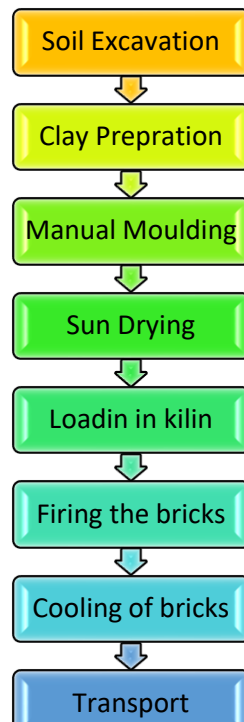


Figure 8: Process of making clay brick



2. Process of making bricks with Paint waste
Bricks are made in three proportions –

Table 1: Compositions of cement, sand and Paint waste.

S. No	Cement	Sand	Paint waste
Sample 1	50%	30%	20%
Sample 2	50%	25%	25%
Sample 3	50%	20%	30%

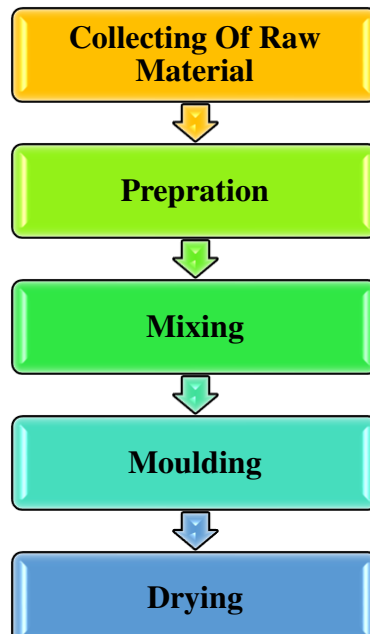


Figure 9: Process for making bricks with paint waste

IV. RESULTS AND DISCUSSIONS

The test performed on casted brick is compared between every composition and shown in figure. Finding out the outcome will come in several ways. The compressive strength of paint waste bricks is lower than that of typical clay bricks.



The effect of adding waste with different proportions on casted brick are –

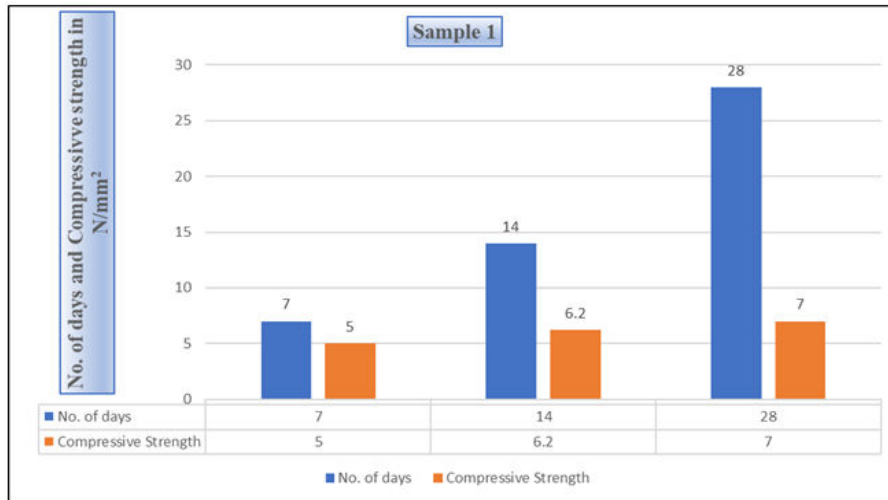


Figure 10: Sample 1 Compressive strength result of casted bricks.

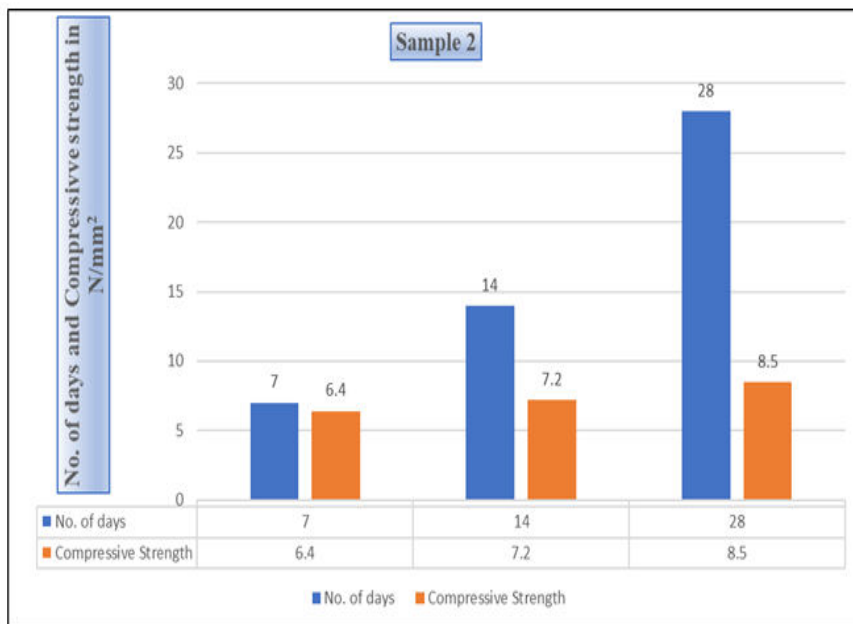


Figure 11: Sample 2 Compressive strength result of casted bricks.

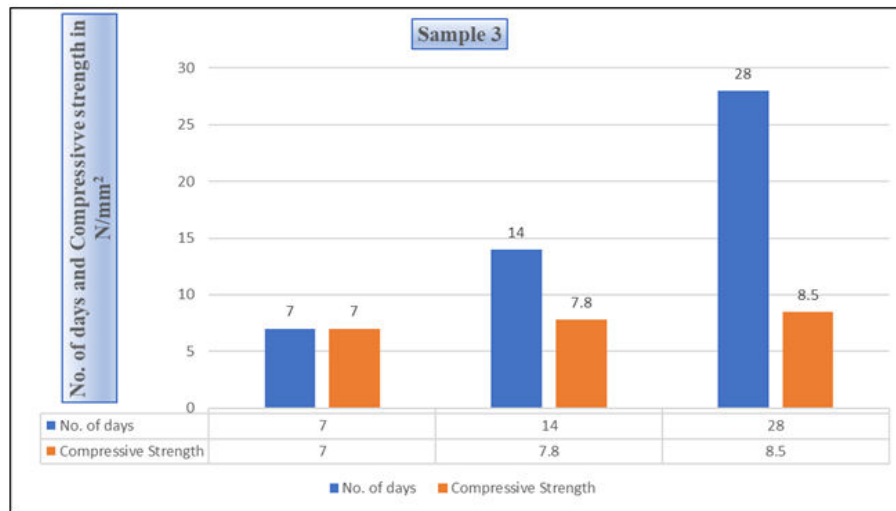


Figure 12: Sample 3 Compressive strength result of casted bricks.

- Compressive strength of Casted bricks – The compressive strength of the casted brick was measured and found to increase when paint waste was added as seen in the bar charts figure. The brick's weight is rising as a result of this. Compressive strength was improved by adding paint waste to the experiment. Adding 30 percent paint waste resulted in the strongest compressive strength. Increased sand-to-cement bonding is achieved by including paint waste into the mortar mix. Environmentally friendly eco-bricks may be made by mixing paint waste with sand and water, as has been shown in prior experiments. Finally, after 28 days, we have 8.74N/mm2 as evidence. The compressive strength of casted brick is less than first class brick. As per result the casted brick comes under 2nd class brick and it can be used in construction work.

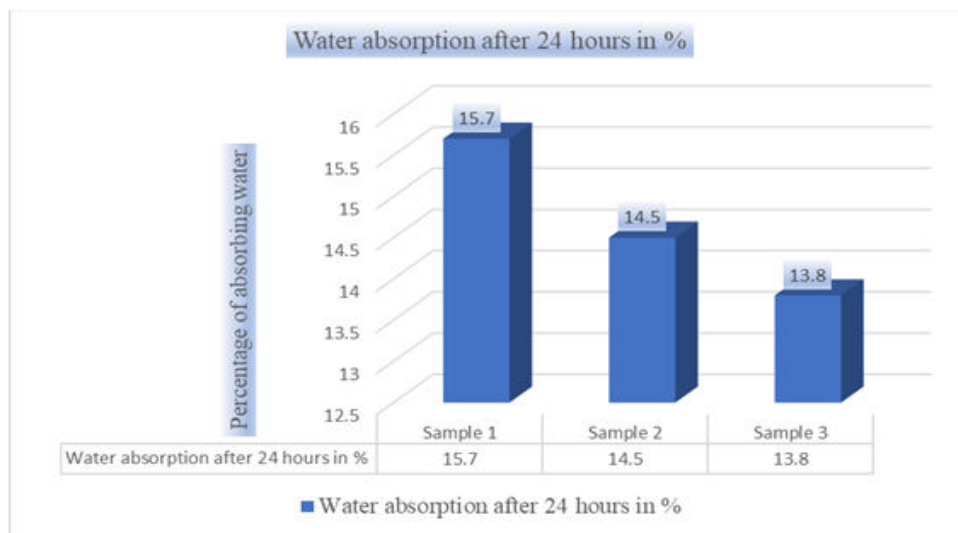


Figure 13: Water absorption after 24 hours of casted bricks with different proportions

- Water absorption Of Casted brick – Addition of paint waste or effect of paint waste content on the water absorption of casted concrete brick is good and favorable because it does not absorb much water and after comparing casted bricks and the final value or percentage of water absorption is 13.8% as shown in bar chart (Figure), Which is less than 20% so brick can be used in construction works.

4.1. Characteristic of normal sludge waste paint

As much as 45 to 70 percent of this waste is made up of a mixture of the primary compound's propenoic acid 2-propenoic acid 2-ethyl xz, 1-1-2-3 propanetryltris xy, and additional components that may be added up to 100 percent.



Paint waste composition has an impact on the compressive strength of bricks when combined with sand and cement in the form of sludge and water.

4.2. Benefit of solidification processes.

To make reusable items, the solidification of solid waste may be used in conjunction with waste conversion into mixed raw materials. Hazardous material components are less prone to seep into the environment because of the binding effect of solidification. According to TCLP testing on the use of paint waste as a mixture for manufacturing eco-bricks, the test value falls below the environmental quality standard. As a building material, brick is often used for walls covered with sand and cement, which attaches hazardous components to the brick and prevents them from being easily leached.

V. CONCLUSION AND FUTURE WORK

Concrete bricks' compressive strength and water permeability are both improved by mixing paint waste into the sand and cement mixture. Casted bricks have a compressive strength of 8.74N/mm² and a water absorption rate of 13.8%. As a result, this cast concrete brick may be put to good use in building projects. Concrete bricks are made stronger by the inclusion of paint waste as a binder. It is possible to manage industrial situations that create solid paint waste by using paint waste as a basic material for mixing bricks. Cement bricks made using paint waste from the paint industry and paint left over by consumers have no detrimental impacts, according to the study's findings, and their mechanical characteristics are even improved. This research looked on substituting waste paint for clay and sand in the production of bricks. For this experiment, the goal was to maximise the usage of waste paint, and to take use of chemical similarities between waste paint and ordinary concrete in order to improve workability. Concrete bricks may benefit from the addition of leftover paint, as it was discovered.

Because of the dangers posed by greenhouse gas (GHG) emissions and the unavoidable depletion of finite, nonrenewable energy sources, the brick industry is always looking for more environmentally friendly ways of manufacture, such as employing alternative fuels and adding recycled material. In recent years, the brick business has seen a significant shift in the manufacture of non-fired bricks. Unfired bricks differ greatly from conventionally fired bricks in terms of both cost and environmental impact. To safeguard the environment, we need to develop bricks in a more sustainable, smart, constitutional, and eco-friendly manner. The paint waste is useful in using brick making and it can be used in construction purpose. In future it can be mixed with other waste also to make more ecofriendly and cost-effective bricks which help in reducing the rapidly increasing of waste and problem of dumping, it also saves the natural resource like clay which is now in shortage and hard to find and to find it need to dig ground more than nominal level.

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