MANTECH Publications

Journal of Ceramics and Concrete Technology
Volume 5 Issue 2
ISSN: 2457-0826 (Online)

An Experimental Study on Domestic, Industrial Sludge Integrates into Clay Brick for Using in Building Brick Fabrication

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Abstract

Infrastructure development is the backbone of developing countries; constructions of a building is a replica of human household belief. Bricks have occupied 40% of the construction of the building, manufacturing of bricks made more demand for infrastructure. This paper reveals good quality, strength, and cheapest bricks manufacturers. All methods helpful depends on the geographical area, 30% sludge mix bricks shows a reduction of its power and increase in water absorption. The use of sludge in the brick can save industrial disposal, land pollution, cost and produce a greener brick for construction. From this research, environmental effects from wastes and disposal problems of waste can be controlled and reduced. A better measure by an innovative construction material is formed through this project. Sludge in the brick can save industrial disposal, land pollution, cost and produce a greener brick for construction.

Keywords*: - Domestic sludge, industrial sludge, Compressive strength, water absorption, efflorescence.*

INTRODUCTION

The environment around us is polluted because the pollutants which we have made are damaging the nature around us. Pollution disturbs the balance in our ecosystem, affects our normal lifestyle, and increases global warming. Due to the development of technology, there has been

a growth of human potentials. We waste out bounties of our nature without a thought that our actions cause serious problems. We have to Borden our knowledge of nature to deal with these pollution problems and to get out of it. Here we are going to discuss how to use the waste into a useful product. The industry (leather, body lotions, etc) produces products that are useful for mankind and also leaves a byproduct sludge this is dumped into canals or else dumped on land. Not only industrial waste the waste which is coming from a household that is domestic waste it is also dumped on land causing pollution. This sludge is further thrown into the lakes, ponds, or rivers or else on the land. If the waste is thrown on the land it causes landfill and if in water it causes pollution of water, in this project we have made use of this sludge to make something useful.

Before going into the topic former we have to know what sludge is and what is its composition and properties. Sludge is slurry that is made up of the waste which is produced in the industries and, from water treatment, wastewater treatment, and sanitation structures. For instance, it can be produced as a settled suspension obtained from conventional drinking water treatment, as sewage sludge from wastewater remedy tactics or as fecal sludge from pit latrines and septic tanks. The term is also once in a while used as a usual period for solids separated from suspension in a liquid; this 'soupy' fabric usually contains giant portions of 'interstitial' water (among the strong particles). Sludge can consist of a variety of debris, consisting of animal manure. Industrial wastewater remedy flowers produce solids which can be additionally referred to as sludge. This can be generated from biological or bodily-chemical tactics. In the activated sludge process for wastewater remedy, the phrases "waste activated sludge" and "return activated sludge" are used. In meal processing and beverage-making industries, sludge could have excessive protein content material and different nutrients that can be used for useful functions consisting of animal feed, thereby warding off the disposal at a landfill. The sludge is slurry that comes from many sources that are from domestic water (drainages), industries that may be leather or something else. When the water goes into the sewage pipes than the sediment deposition takes place at the bottom in the sewage and this process is

separately done in the wastewater treatment plant.

When sparkling sewage enters a primary settling tank, approximately 50% of the suspended strong depend will settle out in an hour and a half. This collection of solids is called uncooked sludge or number one solids and is stated to be "fresh" before anaerobic procedures grow to be active. The sludge becomes putrescent in a quick time once anaerobic bacteria take over, and have to be eliminated from the sedimentation tank earlier than this takes place.

This is finished in one in every method. Most typically the clean sludge is constantly extracted from the lowest of a hopper shaped and passed to split sludge digestion tanks. In a few treatment plant life, an off-tank is used wherein sludge settles through a slot to the lower tale or digestion chamber in which it is decomposed by using an anaerobic microorganism, ensuing in liquefaction and decreased volume of the sludge.

Secondary treatment procedure also generates a sludge largely composed of microorganisms and protozoa and this is removed via an agreement in secondary settlement tanks. Both sludge streams are normally mixed and are processed via anaerobic and cardio treatment techniques at both excessive temperatures and ambient temperatures. After digesting for a wholesale period, the closing stages result is referred to as "digested" sludge and may be disposed of with the aid of aeration and then landfilling.

"Biosolids" is a term often used at the side of the reuse of sewage solids after sewage sludge treatment. Biosolids can be defined as organic wastewater solids that may be reused after stabilization procedures such as anaerobic digestion and composting. Opponents of sewage sludge reuse reject this period as a public member of the family term. This sewage sludge has many properties in common with the clay, moreover that this sewage sludge is made up of sewage solids these solids are heavier than the water so they settle at the bottom of the drainage and if it is in treatment plant it settles at the bottom of sedimentation tank. From this sediment sludge if there is anything useful that is biosolids than it is removed and this sludge at the sedimentation tank is thrown away. It is not used in any case according to the municipal corporation so if it is from drainage than it is thrown on the sides of

the road or streets and if it is from treatment plant than it is thrown in the dump.

In this project, we have divided the sludge into two types of' domestic sludge and industrial sludge. Domestic sludge is the sludge that comes from the households that are from the kitchen, washroom, and bathing, etc. Industrial sludge is the sludge that comes from the canals of the industrial area.

RESULTS OF LITERATURE REVIEW

(Jan plskorz, dornald, Westerberg, 1986) Have made a study on "Flash pyrolysis of sewage sludge" was pyrolyzed in a bench-scale fluidized bed reactor at residence times of less than 1 s over the temperature range 400-700 degrees centigrade. At an optimum temperature of 450 degrees celsius a 52s liquid is a yield and that too at a time of 0.55-s this is a shorter reaction time which has given high yields. A large unit test is also conducted which has a feed rate of 2 kg/h, their liquid tar product has an H/C atomic ratio of about 1.77. They also made a study on how the char and dashing on liquid yields

Joo Hwa day (1987) the author published a paper on Bricks manufactured from sludge in this paper the author states that the sludge from the wastewater treatment plants creates problems of disposal. Generally, dewatered sludge is disposed of by spreading on the land or landfilling. For highly urbanized cities, sludge disposal by landfilling might not be appropriate due to land limitations. 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. In this paper the results of the utilization of dried sludge and sludge ash as brick making materials. The maximum percentage of dried sludge and sludge ash that can be mixed with clay for brick making is 50% and it got the strength of 69.4 N/mm2, and for 40% dried sludge brick got compressive strength of 37.9 N/mm2 and if no sludge is added that is for 0% it got the strength of 87.2n/mm2 and author also made a comparison graph of compressive strength.

Kuan yeow show (1993) "Manufacture of cement from sewage sludge" is the project on which the author has published a paper in which he has explained that sludge is an inevitable byproduct of municipal sewage treatment. Its abundance results from rapid

industrial growth and increased treatment requirements create problems of disposal. The disposal problems could be drastically reduced if sludge were to be recycled for environmental uses, and how we can use the dried sludge in cement making as follows he used the sewage sludge together with limestone and clay as raw materials for making cementitious building material. A ground mixture of the raw materials was incinerated to produce cement. The effects of mixture compositions, incineration temperatures, and incineration durations on the properties of cement were invested from the results, an optimum condition of mixture composition of the raw materials, incineration temperature, and duration, and curing condition upon the highest possible strength development of the cement was determined. The author studied and showed that sewage sludge could be used to produce cement satisfying the strength requirements in the ASTM (American society of testing and materials) standard for masonry cement.

Eric J. Trauner (1993) "Sludge ash bricks fired to above and below ash vitrifying temperature". In the city of Indianapolis Belmont, an advanced wastewater treatment facility produces 32 dry metric tons per day of ash from incineration of municipal sewage sludge. Available capacity at the existing ash disposal site is limited. To determine the feasibility of an alternate disposal method, a bench-scale study was conducted to determine the physical characteristics of bricks produced at four ratios of clay content to ash content and fired to temperatures above and below the vitrification temperature of the ash. The bricks were assessed for drying weight change and shrinkage, firing weight change and shrinkage, total weight change and shrinkage, total weight change and shrinkage, density before and after firing, compressive strength, water absorption, freeze-thaw resistance, and tendency to leach metals during acid extraction. The use of sewage sludge ash as an admixture in brick appeared to be promising and the authors' work is also planned for a full-scale demonstration run in brick production by using the sewage sludge waste.

R. Tenno and M. Pelkonen (1993), They published a journal on "Activated sludge concentration Dynamics" in which based on settling process characteristics a relationship is made between activated sludge concentration in the aeration tank and settling tank, by using the relationship

they conclude the values which are useful for the study. This study is used in the description of activated sludge concentration and stock dynamics in aeration tank and settling tank and they also determined the limit value for the maximization of activated sludge concentration.

Joo Hwa Tay and Kuan Yeow Show (1994) Innovative civil engineering material from sewage sludge: Biochemist and its use as blended cement material cement are used now a day's very often because it has high strength in less time so author examined the properties of cement-like compressive strength setting time etc. he then after introduced sewage sludge as a replacement for cement, his experiment which was conducted that called as bio cement gives adequate strength for general masonry works. For normal works, it shows high strength so he decided to make laboratory tests to partially replace the general Portland cement with sewage sludge. The results show that the Portland cement can be replaced by up to 30% by weight of ordinary Portland cement without reducing the mortar strength If it is replaced with 10% ordinary Portland cement by weight then it also shows high strength than normal Portland cement.

Deng Fong Lin and Chih Huang Weng (2001) "Use of sewage sludge ash as brick material" In the paper, the author investigated the sludge properties and how much it can be replaced in normal brick making. Dried sewage sludge is tested in the laboratory by using Atterberg limit tests both plastic limit and shrinkage limit decreases with an increase in ash content in the brick mixture. And the author also proposed that firing temperature and ash proportions are the two main key factors in good brick making quality. Therefore increasing the firing temperature and decreasing the ash proportion results in a decrease of water absorption the appropriate percentage of ash proportion mixed in the brick-making was ranged from 20% to 40% by weight with 13% to 15% moisture content. If the percentage of ash is 10% by weight in the brick mix then it showed high compressive strength than normal bricks by firing it at 1000 degrees temperature for 6 hours.

Pinaki Sengupta and Praksh (2002) "Bricks from petroleum effluent treatment plant sludge properties and environmental characteristics" The author explained that sewage sludge which is coming from industries is very hazardous because it contains a high amount of hydrocarbons

and has several metals because petroleum industries generate a large amount of toxic waste into nature. The author has proposed an idea of using sewage sludge in the manufacturing of brick and it shows a very good result. The author has also investigated the various laboratory tests before using the sewage sludge in bricks. The sewage sludge comes from the petroleum industries by using that in brick manufacturing it reduces the usage of water and fuel in the mixture. It also meets the requirements set by the Indian standard specification. And the brick was also subjected to leaching characteristics and protocol leaching tests most of the toxic metals are fixed by the verification process and the leaches' values meet the environmental protection agencies' requirement for recycling of hazardous materials.

Hallvard Odegaard, Bjarne Paulsrud, and Ingemar Karlsson (2002) have published a journal on "Wastewater sludge as a resource: Sludge disposal strategies and corresponding treatment technologies aimed at sustainable handling of wastewater sludge". In this paper, they have discussed the disposal of wastewater sludge, and they had proposed some strategies on disposal too. They mainly discussed on Use of land strategy and the productization strategy. The paper discusses the design and operation experiences either stabilization/disinfection methods in Norway where such treatment has been compulsory since 1995. The productization is determined between the bio soils and production of some products like nutrients, energy, etc ante there marketability is also evaluated in this journal.

Chang Gyun Kim, Hyung Sool Lee, and Tai Yoon (2003) have published a paper on "Resource recovery of sludge as a micro media in an activated sludge process". In South Korea, chang and team have experimented to observe the feasibility of the sludge in micro-medium in activated sludge. So they have made two models, one in which clinoptilolite (ZR) is used for 4000 mg/l and it is sustained in an aeration basin for 60 days. The other one in which sludge is used as micro media for activated sludge for 55 days and this is model 2. The organic matter is completely removed at 500 degrees Celsius for 30 min which is optimal drying temperature and here biomass is also increased for model 1. Therefore the increase in nitrification is

also seen in model 1. In model 2 the improved performance is observed in the experiment due to the addition of sludge into the active sludge and also concluded that sludge is reused in the activated sludge process as a micro media.

Huan Lin Luo and Deng Fong Lin (2003) "Evaluation of color changes in sewage sludge ash brick by using image analysis methods" quantifying the surface color changes by digital image analysis to assess the quality of the sewage sludge bricks is investigated relationships among the firing temperatures, percent of incinerated sludge ash added, and changes to red, green and blue of the sludge bricks are studied. indices, deduced from those relationships, while assessing the quality of the sludge brick are evaluated, this research involves testing the specimens of sludge brick under different firing temperatures, under a digital camera to capture images of the tested specimens and uploading them to the personal computers and applying the " image color intensity analyzer" to the images to calculate the intensities of the red, green and blue. Among them, show that red has more intensity, followed by green than blue in RCB color space. Additionally, for HSI color space, hue (H) decreases while saturation increases with rising temperatures before 800 degrees Celsius. Thereafter there is a sudden increase and decrease in H and S at 1000 degrees Celsius, respectively. It is suggested that a firing temperature of 800 degrees Celsius or higher is better in brick making.

Mohammed O Ramadan, Hanan A Fouad And Ahmed M Hassanain "Reuse of water treatment plant sludge in brick manufacturing" The above three authors are from Egypt and they saw the major problem which is occurring in Egypt due to due to the sludge which is coming from the water treatment plant so they have decided to use the sludge. So they made up to do brick manufacturing by using the sludge. Because the sludge is a waste product and the water treatment plant is throwing the waste in the river which is used for drinking purposes so because the aluminum concentrations will rise automatically in the water and also in the body who is drinking water. And it is very uneconomical if we transport the sludge to a distant place and landfilling so the only economical and environmental way is to use the sludge in construction materials so they replaced the clay content to some extent with sludge because the dried sludge from water treatment plant has the

same mineralogy as clay and can be used in brick making without changing its strength so they have replaced the clay with 50, 60, 70, 80 percents with sludge by weight and made bricks and put them in 950, 1000, 1050, 1100 temperatures so total they got 16 bricks type. The maximum amount that can clay be replaced with sludge is 80 and the optimum percentage the sludge replaced with clay is 50 percent and they made the bricks available in the Egyptian market for use and they got success.

Elisabeth, Jan Baeyens, Raf Dewil, and Bart de Heyder (2004) they made a study on "Advanced sludge treatment affects extra=cellular polymeric substances to improve activated sludge dewatering" In this, they explained about the dewatering in the sludge in wastewater treatment plants. However much-Activated sludge treatment (AST) has been developed to dewatering for ultimate disposal in the treatment plant. So they observed two experiments on using different materials for dewatering. The one is the thermal and thermochemical process in which heat is used and the other one is the chemical oxidation process in which hydrogen peroxide is used. To understand these both first we have to know about Extracellular polymeric substances (EPS) it is a thin film-like structure in which microorganisms are embedded and chemical are removed by flocculation. They made a study on EPS and how it is used in enhancing the AST process.

Mauricio Escudey, Juan Forster, Becerra, Magdelena Quinteros, Justo Torres, Nicolas Arancibia, Gerardo Galindo, and Andrew Chang (2006) they made a magnificent study on "Disposal of domestic sludge and sludge ash on volcanic soils". In this authors have conducted leaching experiments to test the ability of Chilean volcanic soils in retaining the mineral constituents and metals in sewage sludge and sludge ash that were incorporated in soils. There are many minerals like Pb, Fe, Cr, Mn, Cd, and Zn (0-2%) and more amount of significant mineral constituents such as Na (7-9%), Ca (7-13%), PO4 (4-10%) and so4 (39-46%) in the sludge as are negligible and soluble in water. The sludge ash is placed on the soil and 12 pore volumes of water are on the sludge for 3 months from which leaching of mineral from drainage is taken place and the authors concluded that volcanic soil is capable of returning minerals and sludge ash is used as nutrients for plant growth.

Rajesh Kanna (2008) made a fabulous study on "Bioremediation of petroleum sludge “The petroleum sludge has various components and the sample first analyzed to find out wither it has water contents, wax contents, asphaltene content, residue and microbes like aspergillus flavus, staphylococcus aureus. Here an attempt is made to treat the storage pit sludge by the bioremediation process under the aerobic condition and the time for this process is also observed.

Arevalo, Moreno, Gomez (2009) have published a paper on "Applicability of the sludge biotic index (SBI) for MBR activated sludge control". In 1994 Mandeni have created Sludge biotic index (SBI) based on the presence of a certain protozoan group. Normally the wastewater treatment plant uses this index but in this study, they have applied this index in a pilot-scale membrane bioreactor with polyvinylidene fluoride with 25 and 35 days retention with a constant hydraulic retention time of 30h. Here the heavy molecules broken down into simple molecules in activated sludge were protozoa is broken down into small molecules. The stable sludge is also obtained here and they saw the noticeable change in microbiota and SBI increase to.

Stefanakis, Akrotas, Melidis, Tsihrintzis (2009) they made a detailed study on "Surplus activated sludge dewatering in pilot-scale sludge drying reed beds". Here they made an experiment on surplus activated sludge (SAS) is presented, where two pilot-scale vertical flow, sludge drying beds(SDRBs), plants use the bottom is filled with cobbles and connected to the atmosphere, and the roots are colonized. The two layers of gravel are layer which makes drainage layer where reeds are planted. The two beds are fed accordingly with one week with 30kg/m2/year and another week with 75kg/m2/year and resting for three weeks. The results hawed that SDRBs can effectively dewater the SAS dorm domestic sludge. The fertilizer for treated SAS, which contains no added chemicals, is comparable to that of traded SAS of other methods.

K.B.Thapa, Hoadley.A.F.A (2009) experimented on "Interaction of polyelectrolyte with digested sewage sludge and lignite in sludge dewatering". Here the interactions between the two cationic polyelectrolytes and lignite (which is low-rank coal) in conditioning the digested sewage sludge and is investigated the flocculated sludge is agglomerated by the lignite by forming a

bond using bridging, because of that bond dewatering of flocculated sludge is improved. The bond between the flocculated sludge and lignite from the sludge high in molecular weight and low in charge density, the agglomerated bond is weaker in low molecular weight and high charge density condition.

Maria P Durante ingunza, Anaxsandra, and Ruens (2011) "Use of sewage sludge as a raw material in the manufacture of soft mud bricks" This article assesses the use of sewage sludge as a raw material in the ceramic industry, specifically in the manufacture of soft mud bricks, to determine the maximum incorporation of sludge that results in technically sound and environmentally friendly bricks. The results obtained confirm that there was no alteration in the odor of the bricks, even at high proportions of sludge; however, high concentrations of sludge had a negative influence on certain properties, such as mechanical strength and absorption. Compressive strength was significantly diminished with the addition of sludge: the bricks with 5% sludge lost on average of 45% of the strength obtained by the control brick; the bricks manufactured with 15 and 20% lost around 70% of the maximum proportion of sludge that could be incorporated into ceramic mass and still meet technical and environmental requirements.

Hossien Hazrati, Jalal Shayegan (2011) they made a detailed study on "upgrading activated sludge system and reduction in excess sludge". There are 200 activated sludge plants in Iran and most of them are overloaded and their efficiency becomes low. So they have installed a pilot plant in Tehran in one of the wastewater treatment plants, instead of activated sludge they used bioreactor and up-flow anaerobic bank reactor as pretreatment unit. Municipal wastewater is used as effluent in this and the efficiency of this pilot plant is about 98% and the retention time is about 4h. This can increase the plant capacity up to 5 and excess sludge can be reduced up to a factor 10and the sludge volume reactor was about 12 after granulation occurred.

Jiang Qian, Yeong Woo Yoon, Pil Sang Youn, Ji Hye Kim, Don Sun Choi (2011) They have published a journal paper on the topic of "Drying characteristics of sewage sludge". In the paper, they made a vigorous observation on the drying of sewage sludge so that how it can be used in conductive indirect heating dryer design

making. They have the information about drying characteristics of the sewage sludge from there different treatment plants and were investigated with thermogravimetric analyzer (TGA) in isothermal conditions. The samples consider experiment variables and they got the activation energy of drying was about 17.30 KJ/g mol, they have also proposed rate equation for the drying of sewage sludge.

Alaa.A.Shakir, Sivakumar nagananthan, Kamal Nasharuddin Bin Mustapha (2013) they have reviewed the topic "Development of bricks from waste material: is view paper". In this paper, the authors say that in this competitive modern world the hunger for new products and construction materials has been increased, with the increasing population new challenges have arrived that are converting the waste which is left into a construction material. The product which came from waste should be fulfilling all the specifications of the construction field. The bricks should not have any environmental hazards and reduction in waste and these bricks are reviewed in this paper both physically, mechanically so that it can be used by fellow researchers into the future.

Amanatidou, Georgios Semiotics, Elenti (2014) they have done a detailed study on "Evaluating sedimentation problems in sludge treatment plants operating at complete sludge retention time". The authors have done a clear study about how to reduce the growth of sludge in activated sludge wastewater treatment that is in high strength and biodegradable wastewaters. During the solids growth, the MLSS and MLVSS concentration were at platue and observed growth yield tends to zero. To identify the problems two identical waste aster treatment plants were considered to study this process.

Rohit Kumar, Rajeev Kansal (2015) they have done a fabulous study on "Utilization of waste paper to produce eco-friendly bricks". The author says that the paper which we produce is much smaller than the paper which we waste, the paper which is wasted ends up in landfills or dumpsites than in recycling. As we all know the construction field is the largest consumer of nonrenewable resources so they made the brick out of paper that is by using it as a raw material for brick making. By doing so they have found the bricks compressive strength, water absorption, fire resistance, hardness, etc are determined. As they have used the paper pulp and magazines for the

brick making the weight of the brick is 50% lesser than the traditional clay bricks because the structure weight also decreases.

Miss Shruti Kirti and Dr. M Hussain (2016) "Utilization of waste sludge in brick making"

The Author has explained that the Indian automotive industry has emerged as a sunrise sector in the Indian economy with an annual production of 23.37 million vehicles in 2014-15. Even it is a value-adding industry, it has several environmental impacts causing land and water pollution with toxicity. Effluent sludge waste management becomes a big problem nowadays. Except for engineered landfills, the rest of the methods for dumping leads groundwater combination and thereby other socio-economic impacts. Many studies have been conducted in this area and reported that the pollution levels are high in groundwater and nuisance due to dumping in the treatment plant area premises. There is a growing need to find alternative solutions for sludge management. In the present study, an attempt has been made to utilize the automotive ETP sludge (dry) in making of construction materials, which is produced from Tata Motors, Pune even to analyze the sludge, has been studied for including strength materials like fly ash, lime sand, cement, CaCl2, have been used sludge bricks show better compressive strength when compared with normal fly bricks or building bricks.

Umme Sarmeen Akhtar, Mohammad Moniruz Zaman, Md Sagirul Islam, Farah Nigar and Md Kamal Hossain (2017), have published a paper on "Effect of different types of glasses as a fluxing agent on the sintering temperature of bricks". In Bangladesh, the bricks are sintered at 950 to 1050 digress Celsius temperature. That bricks have compressive strength upto 2600 to 3000 psi. As the sintering temperature is high to lower that glass powder is added that is soda-lime, because of the soda-lime the sintering temperature decreased to 650 degrees Celsius. The compressive strength also increased due to the soda lime which is higher than normal conventional bricks too, and not only strength water absorption of the brick and other features also increased in here. The longevity of the bricks has increased due to the glass powder.

Tanveer Ahmed Sheik, Mr. Masoom Reza (2017) have done a detailed study on

"Production of eco-friendly bricks from copper mine tailings through geopolymerization in India". In this paper, the author has explained how we can use the copper mine tailing in the brick making by using polymerization technology. The brick-making procedure includes the mixing of copper tailing with alkali solution and pressing it in the mould with desired pressure and curing is done with slightly high-temperature water. Here firing of bricks is no needed; the brick should be an insufficient condition so it won't need any high temperature or kiln. The forming pressure is 0 to 35 mpa and the curing temperature is 60 to 120 degrees Celsius. This is an eco-friendly brick.

Akash, Athira, Sankar, Shifa and Nidhin (2018) "Use of industrial sludge as an ingredient in brick" The author has explained bricks are one of the most common masonry units used as a building material. Due to the large demand placed on the building material industry, Civil engineers have been challenged to convert waste to useful buildings and construction material. The disposal of sludge from industry is a major problem in urban cities as it causes harmful effects on the environment. Since the chemical composition of sludge is similar to that of brick clay production. In this study different series of clay and sludge proportioning ratios were studied which included the addition of sludge with ratio 5, 10, 15, 20, 25 percent of the total weight of sludge clay mixture

Saiur Rehman (2018) has published a journal paper on "Low-cost paper brick for the financially marginalized section on urban poor". In this changing world the cost of everything increasing drastically in the construction field, this change has a drastic effect on urban rich-poor division. Because the poor can't afford high-cost materials, in the construction of dwelling poor brick is the major and one of the components. The cost of the brick can change the cost of the whole structure so the author has made a replacement for the brick material by using paper granular, cement, etc. By using the paper granules the cost is decreased and the usage is eco friendly and a major part f construction is done by using the bricks.

Gaurav Goel, Ajay, Anupam (2018) Have explained "Parameter optimization for producing fired bricks using organic solids". In this explanation, the authors have given elaborated details of how waste solids can be used in brick-making. The

waste solids are replaced by some parts of the in the term of ratio. The different types of soil are used in different types of solid waste in different ratios that are 20%, 30%, 40%, 50%, etc and they are heated and tested. The compression is made and noted.

Azmil, Khalid, J M irwan, PN mazenan, Z Zahir and S shahidan (2018) have made a detailed study on "Performance of composite sand cement brick containing recycle concrete aggregate and waste polyethylene terephthalate with different mix design ratio". In the making of these concrete bricks, the aggregates are replaced with recycled aggregates to test their mechanical and physical properties these aggregates are replaced in 25%, 50%, and 75% ratios. As the ratio of recycled aggregates increases the water absorption increases and strength decreases but in proper proportion to the sand and cement weight the strength increases and water absorption decreases. Hence the recycled aggregates can be used in proper proportion for good strength and use.

Nor Fazlin, Faial, Shahidan and Abdullah (2018) they have proposed a detailed study paper on "The effect of water-cement ratio on cement brick containing high-density polyethylene (HDPE) as a sand replacement". In the present world most of the waste thrown is plastic and it can't be degradable by itself, so it has to be recycled and used in other fields such as construction because it has a wide range of use in the construction field. They have studied the replacement of High-density polyethylene (HDPE) in the cement sand brick production. By using this they want to show that the water absorption can be changed. They have also shown that the HDPE replaced brick has higher compressive strength.

Eliza, Jandecy (2018) they have published a paper on the topic "Use of clay sludge water treatment plant sludge to produce ceramic brick". The authors have said that the waste which is produced on the earth is damaging the environment day by day. The waste which is produced in the wastewater treatment plant is also producing a lot of damage to nature, so they have decided to make use of the sludge. There thought is to replace the clay matter used to make ceramic tiles and use the sludge as one of the materials in the tile making. So they replaced the clay matter and up to 10%, 12%, 15%, 18%, etc by weight with the sludge material. They

have also tested the water absorption, specific mass, strength, fire resistance, etc from the tile with replaced sludge matter and they concluded that the sludge material can be replaced up to 18% of the clay material.

Gaurav, Ajay (2018), they have made a study paper on "A practical proposal for utilization of water hyacinth: recycling in fired bricks". The world is developing itself day by day and in this process, it has also developed a way to use recycled products in fields like construction. The authors have made a study on replacement of water hyacinth in the brick making by its weight. This can be used by acquiring the ASTM standard codes. The mix of the WH in the brick makes the porosity of the brick high so the optimum weight added in the brick should be 10% by weight of the brick and it also saves the 7% fuel in the firing of the bricks.

Qasim Afsal, Safeer, Wasim, Ali Ahmed and M. Rizwan Riaz (2019) they have made a project on "Characterization of sustainable interlocking burnt clay brick wall panels an alternative to conventional bricks". Interlocking burnt clay bricks are Most suitable for brick masonry because the bricks have good strength, high interlocking capacity, good compressive strength. These burnt clay bricks are made up of waste marble powder as substituent by the authors, and they want to know the mechanical and physical properties of the bricks. So they made research by adding the WMP in 10%, 20%, and 30% ratios by weight of the bricks. The low interlocking bricks can be made by using WMP. The usage of WMP decreases compressive strength. The 10% WMP burnt clay bricks are suitable for the construction of the good brick masonry. The authors have concluded that the use of the WMP interlocking burnt clay bricks is a potential option for sustainable masonry wall leading and it is eco-friendly and economical construction.

Dr. Dauda Gana, Dr. N.A. Nwankwor, Dr. T.J. Tika (2019) they have done a detailed study on "The properties of laterite soils as they affect the stability of bitumen stabilized bricks". In this paper, they have done a detailed study on the laterite soils and how they affect the bitumen stabilized bricks. They first have done the tests on laterite soil that is the liquid limit, plastic limit, swell index, optimum moisture content, etc. They have also done the particle size distribution so that they can know the soil can blend with

the bitumen emulsion to envelop the particles to prevent moisture movement in the bricks.

Falan, Reda Attalla, A.F.Gelany (2020) They have done a detailed investigation report on "The technology of mud bricks from the sacred architecture in ancient Egypt to the greenhouse revolution (Luxor city, Egypt)". In this study they have found that the Egyptians who are very advance in technology in those days have constructed their houses with the bricks that are mud bricks by this we can say that brick industry is the oldest form of industries in ancient Egypt, and it is known as "dbt" and "Dbt" in the ancient Egyptian language. Egyptians did the bricks with a mixture of clay from the Nile and straw. In the city Luxor there are different bricks made up of different materials that are the clay, Nile clay, Portland cement, white shale, red shale, and rarely some villages used myna lime brick in Luxor. In Luxor, the bricks are of two types they are Red bricks and white bricks. These properties are known in their investigation. The authors have concluded that this ancient brick-making has selected quarries for their making. Today our home bricks are foundations of the green architecture revolution.

Hindavi, V. Rahul (2020) They have published a paper on the "Design development of sustainable alkali-activated bricks". Housing demand is increasing day by day and a large number of construction materials are used. The authors have done the replacement of industrial waste in brick-making and this could reduce the damage to nature and increase the workability because the waste from industries is abundant and can be obtained from any corner of the world. These bricks are cast by using stone dust and co-fired blended ash with alkali activator. By using this material the bricks are lower in density, lower in water absorption, and also in thermal conductivity. The potential significance of co-fired blended ash and stone dust is good for sustainable alkali-activated bricks.

J.O. Alinylene, U.T. Igba, B.G. Adigun (2020) they have done a significant study on "Effect of waste PET on the structural properties of burnt bricks". In this study, they have said that the PET is used for packaging and carrying purposes because of its resistance towards pressure and force. But the use of PET is non-degradable so it’s harmful for nature because it takes 100 years for melting and decomposition of PET. This PET is used

in bricks with 10%, 15%, and 20%, and the bricks are fired at 900 degrees Celsius. These bricks are then tested for shrinkage, compressive strength, water absorption, etc. The bricks compressive strength has come low for 15% and 20% PET bricks and the 5% PET bricks and 10% PET bricks have some reasonable strengths which can be used for the construction. They have concluded that less than 5% PET can be used in the brick-making under controlled conditions.

CONCLUSION

Bricks made up of domestic sludge have high compressive strength, low water absorption, and nil efflorescence than the bricks which are made up of natural clay bricks or soil made bricks. The industrial sludge brick has good compressive strength similar to that of normal brick. The sludge which is dried is free of cost and can be available easily, after doing some tests on the sludge it showed that sludge has some similar properties to that of soil. The higher percentage of the sludge (domestic sludge and industrial sludge) decreases the compressive strength of the brick and also increase in water absorption.

In this project, we have incorporated the use of dry domestic and industrial sludge in brick up to 50% (10%, 20%, 30%, 40%, and 50%). Due to the easy availability of the sludge, the cost of the brick is reduced. Even in the high temperatures, the sludge brick has no black or greyish marks due to the heat.

The use of the dried domestic and industrial sludge in the brick making will change the future way of seeing the construction. We know the replacement of soil with raw sludge decreases in strength this is the reason to use the dried sludge in brick making. As we know there is a great demand for brick in both rural and urban areas due to that we are digging the soil for brick making, by using this method replacing sludge with soil will help to reduce some of the damage made to the mother earth. In rural places, the bricks demand is much higher than the urban places because of this demand sludge bricks are very useful.

Removing the impurities from the sludge will take more time and money and sludge treatment is also not possible because it’s the leftover waste. So here we are using dried domestic and industrial sludge in replacement to some of the soil directly,

this showed us some miraculous results like these bricks have high compressive strength when compared to that of normal brick which we have made. As we see in the results of domestic sludge bricks containing 20% sludge has higher strength than the normal brick and water absorption is less for the brick too, same for the industrial bricks. When we compare both domestic and industrial sludge bricks than the domestic brick has high strength. For both the sludge bricks 20% sludge replacement is the ideal replacement and showed good results.

Care should be taken during the mixing process because with the increase in sludge more than 30% shows a reduction of its strength and increase in water absorption. The use of sludge in the brick can save industrial disposal, land pollution, cost and produce a greener brick for construction. From this research environmental effects from wastes and disposal problems of waste can be controlled and reduced. A better measure by an innovative construction material is formed through this project.

ACKNOWLEDGEMENT

Authors are thankful to Management of St. Martin's Engineering College and Principal Dr. Santosh Kumar Patra for continuous encouragement towards research publication.

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