Utilization of Solid Waste to Produce Eco-Friendly Bricks

B.Dhanalaxmi, K.N Sujatha, E.Rakesh Reddy

Abstract– urbanization lead to a vast generation of solid waste and discharge of these waste materials became a major problem. Dumping and landfilling of solid waste leads to environmental degradation i.e ground water contamination through leaching, which results in soil pollution and also impact on human health. In recent years, the utilization of solid waste as become more potential to recycle the valuable material and decrease the volume of solid waste, other pollutants and dumping cost. This paper is concern to reuse and recycle the available solid waste generated from paint industry. to find a socio-economic, eco-friendly solution, waste trash can be recycled for the preparation of bricks, which sustain a cleaner environment. The increased quest for sustainable and eco-friendly materials in civil construction works. It is useful to provide sustainable and potential solution in the construction field.

Keywords: eco-friendly products, industrialization, solid waste, recycle.

I. INTRODUCTION

The conventional materials which are predominantly used in construction process, such as concrete type bricks, hollow type blocks, solid blocks, pavement type blocks and floor tiles are generated from the already existing naturally available resources. This results in defragmentation of the environment due to vast exploration and which lead to depletion of naturally existing resources. Moreover, different kinds of noxious substances such as high level concentration of carbon monoxide, oxides of sulphur and nitrogen, and suspended particulates are released surplus into the open atmosphere during the operation phase and manufacturing of materials. These emissions creates toxic impact on environment and disturb the functioning phrases of environmental air, natural water resource, extensive soil, large flora species, fauna species and aquatic life, and it reflects on human health along with their living standard. Therefore, various concentrations in the environment may lead to degradation of prevailing atmosphere. To Improve sustainability and environmental conservation and has gained significance in our society in recent years. Due to more improvement in using sustainable, low cost, eco-friendly, lightweight and corpus construction materials in civil works has been emphasized to investigate as the growing needs, to improve the quality of environment and to maintain the materials requirements as per the standard.

Our world is facing severe crisis of over population. In recent year's different kinds of by-products, generated from various sources such as commercial, household, industries, hospitals, public places, etc. accumulated in very large quantities. Due to which pollution explosion is generated. To rectify this problem of environmental degradation and discharge of large quantities of solid waste in regular manner. The present work discuss about the new innovation preparing bricks from solid waste and tested against fire and other strength properties. This research paper has been shaped with an idea "utilization of waste to worth" in construction field for casting bricks using various kinds of waste materials.

II. SIGNIFICANCE:

Large amount of waste materials are produced around the globe due to anthropogenic metabolism in both developed and developing countries by industrialization rise in living standard and urbanization can be minimized to a greater extent. According to the World Bank statistics proposed globally on solid waste management sector, the global cities is presently producing about 1.3 billion tonnes of solid waste matter every year and it keeps recurring. This volume is expected to reach the peaks nearly to 2.2 billion tones by the year 2025 and waste trash accumulation rate is assumed to twice over the next two decades. One of the environmental impacts which can effect global due to generation of solid waste is the continuous emission of methane gas which is considered as a powerful and destructing greenhouse gas (GHG), and its impact on the environment can be felt within a minimum period of time. Flooding of land, air pollution and other inevitable health hazards are encountered. The amounts of waste material generated from the various productions and continuously increase to satisfy needs of the increasing living standard of population. On priority, the environmental laws and regulations in recent decades which have become more restrictive. Therefore, alternative methods recommended to choose for better management to utilize these wastes can be design and restored. Eco- friendly waste recycling has proved one of the best management to reduce and reuse the waste in the research field for decades. The management of waste reduces the negative impacts of their disposal. Many experiments have been performed to incorporate waste materials in the production of solid bricks including limestone dust particles, wood sawdust particles, rubber,

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processed waste tea particles, fly ash, sludge and polystyrenes.

III. MATERIALS AND METHODOLGY:

Unfired bricks are manufactured by using following material. 1. Solid Paint waste 2. Cement 3. Fly ash 4. Robo sand (quarry dust) 5.water 6. Bricks

1. Paint Remnants: Toxic but unwanted waste, this gathered hydrolysed paint motored and thoroughly combined with water and some decalcifying chemicals, known as both additives, are added is commonly referred as paint sludge or paint remnants. This viscous slurry can be classified as a hazardous waste therefore if this waste is disposed randomly on the surface. It might lead to degradation of soil fertility, and results in generation of leachate by which ground water gets containminated. Hence it is toxic to agricultural land, and it may even cause damage to the flora and fauna of that ecosystem, wherever this waste discharges. To recommend remedy for the manufacturer of the _paint sludge'unsatisfactory to the regulated principles of environmental law, which does not allow the existence of the paint sludge'within the chambers of the industrial unit, where it is manufactured, Maharani Paint industry management has developed a process through which industrial _paint sludge'could be recycled back to a product which is highly useful, and can be consumed without any hassle by the industry.

Fig.1 solid paint waste

2. Cement: Cement is a globally used binding material, a matter utilized for construction which helps in setting, hardens and combines with other supplementary materials, binding them together strongly. Cement is commonly used in binding sand and gravel (aggregate) together. Cement is combining with fine aggregate particles to prepare the traditional mortar for civil works, or with sea or river sand particles and gravel aggregates to prepare concrete mix. Cement grades manufactured for construction works are generally not organic in nature; usually lime or calcium silicate based compound, which can be classified as hydraulic and non-hydraulic, based on the adherences of the cement for setting with the presence of water level.

Fig.2 cement

Table no.1 physical characteristics of cement

Sl No.	Details	outcomes	As per Is 12269-1987
1	Normal Consistency (%)	32	
2	Specific Gravity	3.15	
3	Setting Time (in Minutes)		
	Initial Setting Time	122	Not less than 30
	Final Setting time	406	<600
4	Fineness by Air Blaine Apparatus (m2/kg)	256	>225

3. Robo sand: It is sand produced in the stone quarries. It is perfect replacement for the river sand utilization in the constructions. Robo sand is prepared by grinded or crushed granite collected from the good quarries crushed using higher technology 3-stage vertical shaft impact machinery. It is producing the largest form of concrete in PCC and RCC grades. The main advantages of Robo sand are cubical dimensions, proper gradation and lack of impurities. Advantages of Robo sand are cheaper, no impurities, sophisticated building strength and their physical properties, green sand.

4. Fly Ash: Fly ash, also called as "pulverized fuel as". It is the by-product of coal combustion and that contains particulates. Coal collected by the electrostatic separators or by mechanical methods from the fuel of gases of thermal power plants. Here pulverization means the coal powder. Depending on the source and composition of the coal used in combustion, the constituents of fly ash, which contain equitable mixture of silicondioxide (SiO_2)aluminum oxide (Al_2O_3) and calcium oxide (CaO), and other mineral compounds present in coal-bearing rock strata.

Thus brick contains fly ash, cement and fine aggregate. The cement varies from 15 to 25% in the fly ash and proportionate quantity of fine aggregate. In preparation of brick the use of fly ash gives enough strength and decreases the water

Fig.3 Fly ash content.

The strength of bricks prepared from fly ash is high comparatively to conventional bricks.

5. Water: Portable water was used for both mixing and curing operations of specimens. Water utilized for these operations should be free from suspended and other

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impurities. pH value of water should be maintained within standard limits as prescribed by IS: 456-2000 i.e. either it is less than 6 or more than 8. Water plays a vital role and it is important ingredient of concrete mixture. Thus it actively participates in the chemical reactions within the mixture. Since it combines to form a strength enhancing cement gel, therefore the quantity and quality of water are an important parameters which are to be studied carefully.

Physical properties of water:

pH : 7

Density : 1 gm/cc

6. Bricks: A brick is constructional building block utilized to make walls, pavements and other elements of masonry construction. Earlier, the term "Brick" referred to a unit composed of clay, but in recent decades it is denote as rectangular unit laid in mortar. A brick constitutes clay-bearing soil, sand, and lime, or concrete materials. Bricks are classified, based on its classes, types, materials, and sizes which varying along with region and time period, and these are produced in large quantities. Two basic categories of bricks are fired and non-fired bricks.

A popular invent has been introduced by researcher to incorporate various wastes into fired clay bricks production to assist the generation of normal and lightweight bricks. The use of various wastes in co-operation in clay bricks production generally has positive effects on their properties, even though they observed the decrease in performance in certain aspects.

Brick are the most arduous masonry entities. It has its widest range of products, with its unlimited assortment of varying patterns, textures and colors customised to the needs. In 1996, an industry has generated 300 million bricks in a place called Victoria, which were about 55% of the potential production at that instance. Brick has good durability and resistance which has developed and strengthen with time and to withstand to high competitive, technical and economical, with other systems of construction sector.

The major input for bricks is clay soil besides clayey soils, soft slate particles and shale, which are usually obtained from open pits with the degradation of drainage, and wildlife habitat. Clays used for brick production and their compositions are usually reliant on the vicinity from which the soil has been excavated. Different appropriate proportions of clays are constituted with silica, alumina, lime, iron, manganese, saw dust, sand, sulphur and phosphates. Bricks are usually durable, fire resistant, and require the least maintenance. The properties of bricks that evaluates quality of building blocks with their strength, fire resistance, durability, exquisiteness and adequate bond and mix proportions with mortar material.

Mix proportion of Bricks:

Bricks making in three proportions

Table no.2 Different proportions of materials

S.NO	Cement	Industrial waste	Fly ash	Quarry sand
S-1	30%	20%	20%	30%
S-2	30%	25%	20%	25%
S-3	30%	30%	20%	20%

There are four different operations are involved in the process of manufacturing of bricks:

Batching
Mixing
Moulding
Drying

Batching:

The ingredients are accurate and precise measurement of materials for making cement is known as batching. Weigh batching is the accurate methodology used globally of measuring the materials. For significant mix is manufacturing of bricks.

Fig 4: Batching

Mixing:

The materials are paint solid waste, Robo sand, fly ash and cement these are mixed and to get a uniform color then water is added to the mix it is get good uniform color. Work at site with use of brick making. Mixing is most important in manufacturing of bricks

Fig 5: Mixing

Moulding:The mould is placed at the ground and standard size of brick mould is 19*9*9cm. Apply the oil to the mould and place the mortar in the mould and compacting the mortar in the mould. After 5 minutes mould is removed from the bricks, and then placed in the sunlight. Within two days bricks will be harder.

Fig 6: Moulding

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Drying: Dehydration of bricks at lower temperature are carried out for sufficient strength. To avoid crack or crumble while holding, carrying and any in constructional phrase they must preserve and sustain the sufficient strength and shape while the conveyance and loading operations during construction. Therefore drying of the bricks is important process.

Drying of the bricks is done in two predominant ways:

(a) Artificial Drying: bricks are burnt at optimum temperature at about1200 C in a tunnel like structure where the temperature is maintained.

(b) Natural Drying: it is done by exposing the bricks to air circulation, generally avoided the direct Sun-light.

Fig 7: Drying

Crushing Strength or Compressive Strength Test on Bricks:

Crushing strength of the bricks is determined by placing the sample brick in a universal testing machine and performing a compression test. After placing the brick in Universal testing machine, apply load on it gradually until the sample brick breaks. Note down the value of failure load and evaluate the crushing strength. The minimum crushing strength of brick is calculated to be 3.50N/mm2.if it is less this recommended value of 3.50 N/mm2, then it is not endorsed for construction purpose.

Fig 8: Brick placed under compression testing machine

The following bricks results are tested on compression testing machine in different proportions for 7 days, 14 days and 28 days.

IV. RESULTS

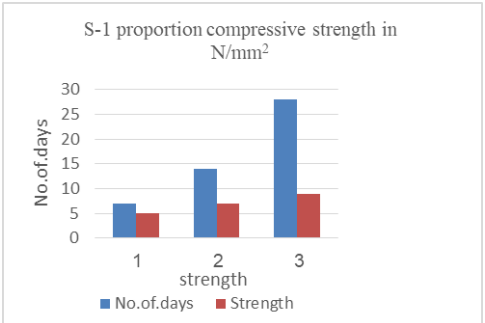

Fig 8 a: S-1compressive strength results

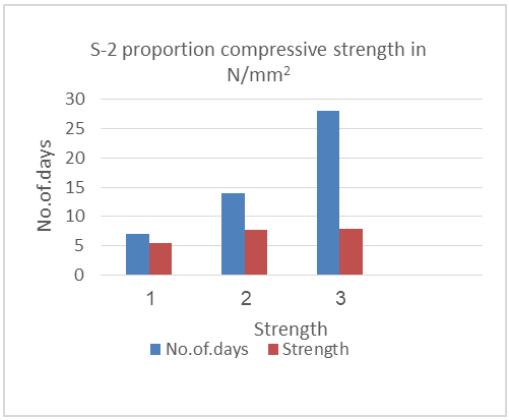

Fig 8 b: S-2 compressive strength results

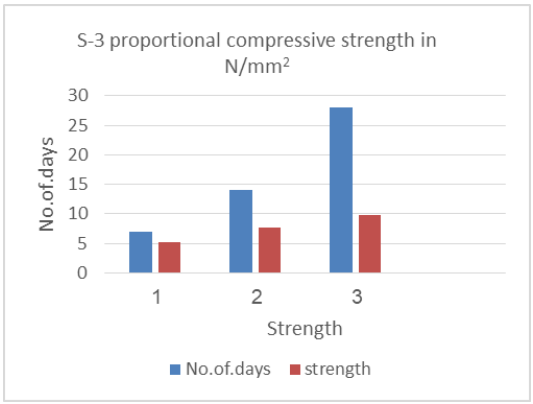

Fig 8 c: S-3 compressive strength results

Bricks compressive strength is compared between in bar charts. It will be easily found out the results. Paint waste bricks are compared to conventional bricks is less compressive strength. As per results these bricks are comes under 2nd class bricks.

V. CONCLUSION

The consequences of the present study conducted has proven that the brick making methodology effectually acceptable for solid waste (Paint sludge) and material (cement, quarry dust, and fly ash). Bricks were hardened within 2 days from manufacture time. Mixed binders (cement, fly ash and quarry dust) brick is recommended for external use in construction. This study also concludes that the construction raw materials can be replaced with industrial waste by products during manufacturing in some extended composition to increase the environmental safety. Compared to normal brick paint sludge brick is light in weight and transportation will be easy. The demand for the constructional materials has been rapidly increasing with the needs of construction both in rural and urban areas. These bricks are the sustainable, economical and eco-friendly building material. Bricks which are made from the paint waste is found to have compressive strength is greater than the conventional bricks. It is observed that when amount of cement is increased, strength also increases. When the strength is depends on the size of the particle, increases the strength by reducing the size of the particle.

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REFERENCES:

1. Text book construction materials and concrete technology. Andreola, F., L. Barbieri, I. Lancellotti, P. Pozzi, 2005. Recycling industrial waste in brick manufacture. Part 1. Journal of Material Construction, US Environmental protection Agency, Solid Waste, 2014 (March) (2014).
2. M. Safiuddin, M.Z. Jumaat, M. Salam, M. Islam, R. Hashim, Utilization of solid wastes in construction materials, International Journal of Physical Sciences. 5 (13) (2010) 1952-1963.
3. Aubert JE, Husson B, Sarramone N (2006). Utilization of Solid Waste Incineration (MSWI) Fly Ash in Blended Cement: Part 1: Processing and Characterization of MSWI Fly Ash. J. Hazardous Mater., 136: 624-631.
4. Xue Y, Hou H, Zhu S, Zha J (2009). Utilization of Municipal Solid Waste Incineration Ash in Stone Mastic Asphalt Mixture: Pavement Performance and Environmental Impact. Construction and Building Materials, 23: 989-996.
5. Chee-Ming Chan, 2011. Effects of natural fibers inclusion in clay bricks: physic mechanical properties. Journal of International Journal of Civil and Environmental Engineering, 1: 51-57.
6. Cheng-Fang Lin, Chung-Hsin Wu, Hsiu-Mai Ho, 2006. Recovery of municipal waste incineration bottom ash and water treatment sludge to water permeable pavement materials. Journal of Waste Management, 26: 970978.]
7. USEPA, Technology Resource Document—Solidification/Stabilization and Its Application to Waste Materials, USEPA, June 1993 (EPA/530/R- 93/012).
8. [C.F. Pereira, M.R. Pinero, J. Vale, Solidification/stabilization of electric arc furnace dust using coal fly ash analysis of the stabilization process, J. Hazard. Mater. B 82 (2001) 183–195.
9. Miss. Shrutakirti A. Mahajan*1, Dr. M. Husain *2 – "Utilization of Waste Sludge in Brick Making". http://www.ijettjournal.org-ISSN: 2231-5381
10. 1.Dina M. SADEK, 2. Walid S. EL- SAYED, 3. Ashraf M.A HENIEGAL, 4. Ayman S. MOHAMED-"Utilization Of Solid Wastes In Cement Bricks For An EnvironmentalBeneficial"-ANNALS OF FACULTY ENGINEERING HUNEDOARA – International Journal Of Engineering
11. Kanthe V.N.(1), Chavan P.G.(2)-"Solid Waste Used As Construction Material".IOSR Journal of Engineering (IOSRJEN) ISSN: 2250-3021 ISBN: 2878-8719 PP 75-77 National Symposium on engineering and Research. www.google .com