IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 3, April 2025
Impact Factor: 7.67

Ecological Bricks by the Use of Plastic Waste

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Abstract: *Effort is made under this UG level study to make use of waste plastic to manufacture bricks. Plastic waste along with being non-biodegradable also causes land and water pollution. Among the various types of plastics used, Polyethylene (PE) is one of the most used. It is usually used in single use plastics such as carry bags, plastic bottles etc. One viable solution to using this plastic waste can be bricks with the use of such plastic. Main objective of the work was to develop an efficient plastic waste disposal system which has become a nuisance due to its large amount of dumping and non-biodegradable nature and to reduce the consumption of natural resources, like clay. Under the work plastic waste was collected and melted to mix with river sand. This mixture was placed in mould for getting the brick of size 190 mm X 90 mm X 90 mm. The mould was then Sun dried for two days and the brick was removed from the mould for curing. Compressive strength was recorded 3.5 N/mm2 for no plastic to 19.2 N/mm2 for 30% plastic. Water absorption was found to be 20% for no plastic and 11% for 30% plastic. The results were found to be encouraging and the increase in compressive strength with the increase of plastic and decrease in water absorption could be helpful to use such bricks for construction purpose replacing the normal clay bricks.*

Keywords: Ecological, compressive strength, non-biodegradable, water absorption

I. INTRODUCTION

Brick is one of the most common masonry units used as building materials. Building materials like bricks, concrete block, tiles are popularly used in construction and the materials are expensive and find it difficult to afford easily. A large demand has been placed on building material industries especially in the last decade owing to the increasing population which causes a chronic shortage of building materials. Recycling of waste plastic in construction work as raw material alternative may contribute in the exhaustion of the natural. Plastic is a non biodegradable waste material. Plastic waste is increasing due to increase in population, urbanization and development [7]. Many people throw out plastic after using it. It is not decomposed easily and affects the growth of plants. So, vegetation gets affected. It is also harmful to animals when consumes it. Plastic waste is increasing due to increase in population, urbanization and development. To overcome these defects, we can use the plastic in construction sector as raw materials in different ways. The reuse of plastic waste in building constructions, industries are considered to be the most practicable applications. Plastic can be reused in various sectors like marketing, manufacturing and transportation etc. Plastic waste along with being non-biodegradable also causes land and water pollution [5]. Among the various types of plastics used, Polyethylene (PE) is one of the most used. It is usually used in single use plastics such as carry bags, plastic bottles etc. One viable solution to using this plastic waste can be Plastic bricks [8]. These bricks will eventually be able to enhance our management of plastic along with promoting sustainable development. Traditional Bricks are made by clay, which puts stress on soil and also leads to soil erosion. The use of plastic sand bricks can be beneficial and would help to reduce waste. Thus, the use of plastic bricks is a promotion to sustainable development and eco conservation at the same time. For effective plastic waste management, it is necessary to carry out the working a systematic step by step manner. For this areas where waste management is required is studied out and then which techniquesofwastecollectionanddisposalwillbethemostsuitableisbeinganalyzedandcarriedout.Plasticw as contains high amount of polythene bags and crisp bags which is further collected and used form an a factoring of newly designed plastic brick which proves to be cost effective and be used in a proper way rather than disposing or burning it in the atmosphere [1]. Also the waste disposing techniques of plastic waste such as pyrolysis, chemical decomposition of waste, land filling, in cine ration, composting are quiet time consuming techniques and does not offer to clear out large

DOI: 10.48175/568

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quantities of waste in a short period of time. Hence this method of using soft plastic waste for a beneficial purpose of making out bricks which are very light in weight and gives high pressure handling capacity would prove to be very useful as it would minimize the plastic waste at a large extent.

II. LITERATURE REVIEW

Many researchers found the way of better plastic waste disposal through the use of waste plastic in manufacturing the bricks. Kognole et.al. studied on the 'Utilization of Plastic waste for Making Plastic Bricks'. Study revealed that Due to increasing population, the demand of plastic materials and necessary requirement also increases. Brick is largest materials used in the construction industries and occupied in very large amount of materials of the project especially in residential projects. We use various types of plastic with various combinations to produce different type of bricks. We find the different properties of bricks by conducting various tests on it. Among them compression and water absorption test is most common test conducted on bricks by the various researches. But the use of such types of bricks is very limited in the industry. Waste plastic, which is available everywhere, may be put to an effective use in brick making. Plastic sand bricks can help reduce the environmental pollution, thereby making the environment clean and healthy. Plastic sand bricks reduce the usage of clay in making of bricks. Plastic sand bricks give an alternative option of bricks to the customers on affordable rates. Water absorption of plastic sand brick is zero percent. We conclude that the plastic sand bricks are useful for the construction industry when we compare with Fly Ash bricks and 3rd class clay bricks.

Amir and Yusof research article 'Plastic in Brick Application' discussed on the use of plastic in bricks' manufacturing. The paper outlined the utilization of municipal plastic waste (MPW) in construction industries. Both the MPW and the construction industries are increasing rapidly and world's recycling rate of either Municipal Solid Waste (MSW) or MPW specifically is still low. Production of bricks is non-eco-friendly and a waste generating process because of the greenhouse gases released. Utilizing MPW as construction materials especially in production of bricks is one of a promising step towards a sustainable resources and waste management. Plastic waste can substitute either partially or completely one or more of the materials in brick production. Further research based on recent research and a better understanding in utilization of plastic waste in brick is needed to produce a high durability and quality of bricks as well as to achieve the optimum balance in all aspects especially in terms of cost and functionality. Authors concluded that A variety of plastic waste has been used in many ways in bricks production. The compressive strength of the bricks produced comply the standard outlined, which is more than the acceptable range outlined and a suitable proportion between plastic waste and other materials used need to be optimized to meet the standard outlined for manufacturing of bricks. Further research and development is needed to improve the quality and durability of plastic bricks. Research article, 'A Study of Manufacturing Bricks Using Plastic Wastes' by Kumar et.al., stated that plastic waste which is increasing day by day becomes eyesore and in turn pollutes the environment, especially in high mountain villages where no garbage collection system exists. A large amount of plastic is being brought into the tourist trekking regions are discarded or burned which leads to the contamination of environment and air. Hence, these waste plastics are to be effectively utilized. Low-density polyethylene bags are cleaned and added with sand at particular percentages to obtain high strength bricks that possess thermal and sound insulation properties to control pollution and to reduce the overall cost of construction; this is one of the best ways to avoid the accumulation of plastic waste which is an on-degradable pollutant. This alternatively saves the quantity of sand/clay that has to be taken away from the precious river beds/mines. The plastic waste is naturally available in surplus quantity and hence the cost factor comes down. Also coloring agents can be added to the mixture to attain desired shades. Hence in this thesis, an attempt is made to study regard the properties of the brick which is manufactured using plastic wastes. The present work deals with the manufacturing and analysis of bricks made with waste plastic (LDPE) and fine aggregates. The bricks produced are light weight, have smooth surface and fine edges, do not have cracks and have high crushing strength and very low water absorption. The bricks are manufactured by heating waste plastic to temperature range of 120 to 150 degree centigrade and mixing sand to the molten plastic. Authors further concluded that plastic bricks can a very good alternative of traditional earthen bricks. Plastic bricks can be used for partition walls and exterior walls; however they must not be used in load bearing walls. Cost of manufacturing per unit plastic brick is significantly lower than

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traditional earthen bricks, hence they are cheaper alternative. Plastic bricks are water resistant, hence can be used in underwater structures. Re- using plastic will reduce environmental pollution.

III. METHODOLOGY

Ichalkaranji is princely city in the state of Maharashtra in western Maharashtra located on the bank of river Panchaganga. It has economic base of textile industry hence attracted people from not only Maharashtra but also from India. It has accelerated the urbanization in neighboring areas of suburbs asking for better management of urban waste. It is immerging as dense populous city with present population 450000 according to census 2011. The town is situated 16 40 N latitude and 74 32 E longitude and on 556 m above MSL. Total area of IMC (Ichalkaranji Municipal Corporation) jurisdiction is 2752 hect. It has connectivity to near by industrial areas of Kolhapur and Sangali at distance of 25 km hence fostering industrial operations and employment there by harboring immigrants.

The Hon'ble Prime Minister, Shri Narendra Modi, in his 2019 Independence Day speech, announced the goal the phasing out of SUP by 2022. Since then, the Ministry of Environment, Forest and Climate Change, Government of India, has notified the Plastic Waste Management (PWM) Amendment Rules, 2021, which prohibit specified SUP items that have low utility and high littering potential by July 1, 2022. However, SUP is not confined to the plastic manufacturing or processing sector alone. A range of manufacturing and services sectors such as agriculture, public health, medical equipment, food services, etc., are all critically dependent on SUP. Thus, a well-designed and systematic strategy is needed to combat the SUP problem otherwise there is a risk of exacerbating the problem. In addition to policy and regulation, it will be critical to ensure that these policies and regulations get implemented and best practices aligned to the 5Rs (redesign, reduce, reuse, recover, recycle) of a circular economy approach to Ecological Bricks By The Use Of Plastic Waste SITCOE, Yadrav. plastics get adopted at national scale. In view of this, NITI Aayog, under the Chairmanship of Hon'ble Member Dr V.K. Saraswat, set up a committee to identify alternatives to plastics as well as technologies that make plastics biodegradable. The committee also assessed infrastructure needs, market readiness, and appropriate regulatory and policy approaches to facilitate the transition to plastic alternatives and sustainable plastics. The relative advantages and disadvantages of substitution, conversion technologies, and necessary procedures were carefully considered while developing alternatives. The Indian plastics industry started in 1945 and has been growing over the years. From 0.9 million tons in 1990 to 18.45 million tons in 2018, plastic consumption has grown 20 times since then11. The plastics industry is one of the biggest generators of employment in the country, valued to be around INR 5.1 lakh crore (USD 73 billion). Owing to near universal use of plastics in wide range of sectors, the plastics industry is one of the fastest growing in India. There are over 30,000 units that produce plastic materials in India. Approximately 90% of these units are small and medium-sized enterprises. The Plastic industry employs about 4 million people. In Financial Year (FY) 20 (till January 2020), plastic exports stood at USD 7.045 billion, with the highest contribution from plastic raw materials at USD 2.91 billion; plastic sheets, films, and plates at USD 1.22 billion; and packaging materials at USD 722.47 million.

IV. RESULTS AND DISCUSSION

Following tests on bricks were conducted:

4.1 COMPRESSIVE STRENGTH TEST

This test is done to know the compressive strength of brick. It is also called the crushing strength of brick. Generally, 3 specimens of bricks are taken to laboratory for the testing and tested one by one [11]. In this test, a brick specimen is put on compressive strength is put on Compressive Strength testing machine and applied pressure at a constant arte till it breaks. The ultimate pressure at which brick is crushed is taken into account. All three brick specimens are tested one by one and average result is taken as bricks compressive/crushing strength. The Compressive Strength of the brick is calculated by the formula = (max load taken before failure/ Area of the Brick surface) N/mm2. Compressive Strength = P/A

4.2 WATER ABSORPTION TEST

Bricks should not absorb water more than 12% by its weight. The bricks to be tested should be dried in an oven at a temperature of 105oC to 115oC till attains constant weight cool the bricks to room temperature and weight (W1) [10].

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Immerse completely dried and weighed (W1) brick in clean water for 24 hrs. at a temperature of 27±20oC. Remove the bricks and wipe out any traces of water and weigh immediately (W2). Water absorption in % by wt. = W2-W1 / W1 x 100.

4.3 SOUNDNESS TEST

This sound is carried out to find out that a clear ringing sound is produced or not when the two bricks are with each other without breaking any of the two bricks. If the two bricks are not broken after striking with each other and a clear ringing sound is produced, then it means that the bricks are sufficiently sound.

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