IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

An Overview On An Affordable And Ecological Way To Make Concrete Block With Fly Ash And Plastic Waste

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Abstract: With the alarming rise in plastic production and subsequent accumulation of plastic waste, there's an urgent need for sustainable solutions to mitigate environmental damage. This project explores the utilization of waste materials for brick production, aiming to develop eco-friendly construction materials. By incorporating plastic waste, particularly polyethylene terephthalate (PET), into brick formulations, the project aims to reduce reliance on traditional resources like clay, cement, and sand, thereby cutting costs and environmental impact. Various studies have been reviewed, indicating the effectiveness of incorporating plastic waste in bricks and optimizing their properties. The methodology involves characterizing raw materials, formulating concrete mix designs, testing mechanical properties, and optimizing production processes. Through field trials and continuous improvement, the project seeks to revolutionize concrete production, promoting sustainability and circular economy principles while mitigating carbon emissions.

I. INTRODUCTION

The exponential rise in the production of plastic and the consequential surge in plastic waste have led the scientists and researchers look out for innovative and sustainable means to reuse/recycle the plastic waste in order to reduce its negative impact on environment.

Bricks are widely used construction and building material around the world. This project attempts to develop bricks from waste materials that are present in the environment without causing any damages to the environment. The main objective of this project is to prepare bricks by using the waste materials and to conduct field and laboratory test on them. The bricks are prepared by using waste materials.

The bricks are prepared by varying the composition of the waste materials (10% - 50%). Verified the material properties as per Indian standards code (IS 1077- 1992) procedures. The test results are compared with the test results of standard bricks. These wastes are also used to reduce the quantity of clay used in the production of bricks. This will provide an alternative application for various bricks depending upon their respective characteristics.

India approximately produces 40 million tons of solid waste of which 12.3% is plastic which is discarded mainly in form of waste water bottles. PET is basically thermo plastic resin composed of phthalates. But unfortunately recycling of PET is much lower than its usage and this gap is dramatically increasing forcing to innovate a method for high recycling of this material. A possible application is, to use PET fibres as short fibres reinforcement in structural concrete. The solution proposed solves the problem of its disposal and in the process, render new properties to the construction. The PET bricks were casted with raw materials of pet plastics, cement, fly ash, fine aggregate, and coarse aggregate and water. The water content ratio was taken as 0.3

This study aims to reduce the cost of the bricks and usage of clay, cement, sand for brick manufacturing.the results of the compressive strength and impact resistance of fly ash bricks with the addition of least expensive plastic wastes (FAB-P).

Implementing plastic waste in construction materials is a sustainable disposal method to overcome plastic pollution. The current study aims to optimize the integration of plastic waste in cement bricks regarding their thermomechanical properties in order to develop an ecofriendly building material. Polyethylene terephthalate (PET) and high-density polyethylene (HDPE) partially substituted cement with different ratios (0, 2.5, 5, 7.5, 10, 20%). The type that achieved better

thermomechanical performance further replaced the other brick components; sand and coarse aggregates to deter- mine the optimum replacement scenario and best design mix.

RESEARCH METHODOLOGY

Pooja Lamba, et. al., conducted an experiment on Recycling/reuse of plastic waste as construction material for sustainable development. Materials used were Waste plastic PET (Polyethylene terephthalate) HDPE (high-density polyethylene). We found out that the writer of the paper look out for innovative and sustainable means to reuse/recycle the plastic waste in order to reduce its negative impact on environment.

YaraEl-Metwally, et. al., conducted an experiment on Optimization of plastic waste integration in cement bricks. Materials used are Opc, Pet / Hdpe, Fine Agg, Coarse Agg, Water. Test conducted are Compressive strength test, Water absorption test. After reviewing this paper we got to know how they used plastic and integrated in cement bricks in order to develop ecofriendly bricks.

S.Kanchidurai, Dr K Saravana Raja Mohan conducted an experiment on Comparison of effectiveness of fly ash bricks with addition of plastic waste. Materials used are Fly ash, Pet / Hdpe, Cement, Water. After studying this paper we understood that integrating plastic waste with fly ash in bricks increases the performance of the bricks, This study aims to reduce the cost of the bricks and usage of clay, cement, sand for brick manufacturing.

Alaa.A.Shakir, et. al., conducted and experiment on Development Of Bricks From Waste Material. The study in turn is useful for various resource persons involved in using industrial or agricultural waste material to develop sustainable construction material. The effect of use of plastic in brick are reviewed and enhance the performance in terms of making eco friendly and budget friendly. Various attempts were made to incorporate various waste material in bricks production such as natural fibers, textile laundry wastewater sludge, foundry sand, granite sawing waste, perlite, processed waste tea, sewage sludge, structural glass waste, PC and TV waste, fly ash, sugar cane baggase ash, organic residue, steel dust, bottom ash, rice husk ash, silica fume, marble and granite waste, municipal solid incineration fly ash slag (Chee-Ming, 2011-Raut et al, 2011). This review highlights the effects of various waste material on the bricks property like physical and mechanical properties as well as thermal insulation.

v.sasidharan, et. al., conducted an experiment on Comparative study of conventional brick with bricks made from waste materials. Materials used are Rice husk ash, Coconut fibre, Cement, Water. Test conducted are

Compressive Test, Impact test, Water absorption. The addition of rice husk , coconut fibre in the manufacture of bricks comparatively higher compressive strength than the cement and clay bricks. The bricks developed were also comparatively light in weight.

S. Alan, et. al., conducted an experiment on A Study on Mechanical Properties of fly ash Brick with Waste Plastic Strips. Materials used are PET, FLYASH BRICKS and CEMENT BRICKS. Test performed are Compressive strength, Water absorption, Impact test. By studying this paper we got to know that In this study PET and FLY ASH bricks results in better strength and plastic works as reinforcement. So from the study it was concluded that PET strip bricks have high compression strength.

Rajarapu Bhushaiah, Shaik Mohammad conducted an experiment on Study of Plastic Bricks Made from Waste Plastic. Materials used were Plastic , Cement , Sand , Water , Fly ash. Tests performed are Compressive strength , water absorption , Crushing test. By reviewing this paper we studied that Waste plastic, which is available everywhere, may be put to an effective use in brick. Plastic bricks can help reduce the environmental pollution. 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.

Siti Aishah Wahid, et. al., Utilization of Plastic Bottle Waste in Sand Bricks. Materials used are Sand, Cement, water, Plastic. Test performed on the bricks are Compression test, Water absorption test. This paper tells that The comprehensive strength decreases with increasing waste plastic ratios. The use of waste plastic bottles for the production of bricks is an optimal method to solve the problem of storing waste materials. 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 clay bricks.

Tayfun Çiçek , Yasin Çinçin conducted an experiment on Use of fly ash in production of lightweight building bricks. Materials used are Fly ash, Cement, water. Test performed on the bricks are Compression test, Impact test. This paper tells that Fly ash is one of the coal combustion products of coal burning power plants. The properties of the real-size fly ash/lime bricks produced under optimum conditions are summarized The number of the studies concerning with the characterization and industrial utilization of y ash have increased substantially over the years. These studies focus primarily on properties, classification and determining possible areas of usage of fly ash.

IV. RESULTS AND DISCUSSION

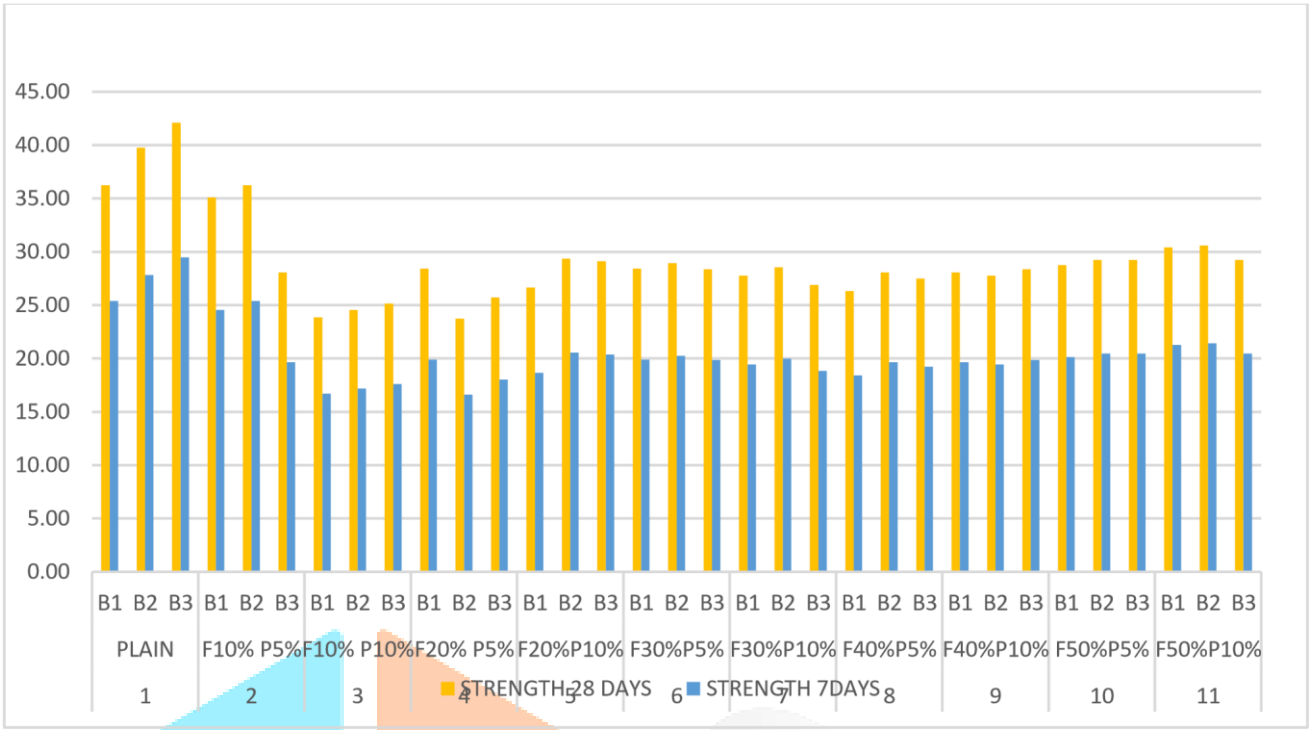
6.1 COMPRESSIVE STRENGTH TEST RESULTS

Table 5: brick details for compressive strength

SL NO	TYPE OF BRICK	RICK NO	WEIGHT In kg	LOAD kg	AREA	STRENGTH 28 DAYS (kn/mm2)	STRENGTH 7DAYS (Kn/mm2)
1	PLAIN	B1	3.68	620	17.1	36.26	25.38
		B2	3.88	680	17.1	39.77	27.84
		B3	3.885	720	17.1	42.11	29.47
2	F10% P5%	B1	3.6	600	17.1	35.09	24.56

		B2	3.56	620	17.1	36.26	25.38
		B3	3.5	480	17.1	28.07	19.65
3	F10% P10%	B1	3.55	408	17.1	23.86	16.70
		B2	3.6	420	17.1	24.56	17.19
		B3	3.5	430	17.1	25.15	17.60
4	F20% P5%	B1	3.5	486	17.1	28.42	19.89
		B2	3.5	406	17.1	23.74	16.62
		B3	3.45	440	17.1	25.73	18.01
5	F20%P10 %	B1	3.485	456	17.1	26.67	18.67
		B2	3.395	502	17.1	29.36	20.55
		B3	3.45	498	17.1	29.12	20.39
6	F30%P5 %	B1	3.55	486	17.1	28.42	19.89
		B2	3.6	495	17.1	28.95	20.26
		B3	3.6	485	17.1	28.36	19.85
7	F30%P10 %	B1	3.65	475	17.1	27.78	19.44
		B2	3.6	488	17.1	28.54	19.98
		B3	3.62	460	17.1	26.90	18.83
8	F40%P5 %	B1	3.51	450	17.1	26.32	18.42
		B2	3.49	480	17.1	28.07	19.65
		B3	3.6	470	17.1	27.49	19.24
9	F40%P10 %	B1	3.5	480	17.1	28.07	19.65
		B2	3.5	475	17.1	27.78	19.44
		B3	3.49	485	17.1	28.36	19.85
10	F50%P5 %	B1	3.52	492	17.1	28.77	20.14
		B2	3.45	500	17.1	29.24	20.47
		B3	3.5	500	17.1	29.24	20.47
11	F50%P10 %	B1	3.46	520	17.1	30.41	21.29
		B2	3.5	523	17.1	30.58	21.41
		B3	3.6	500	17.1	29.24	20.47

graph 1 : showing the compressive strength values for 7 and 28 days of curing



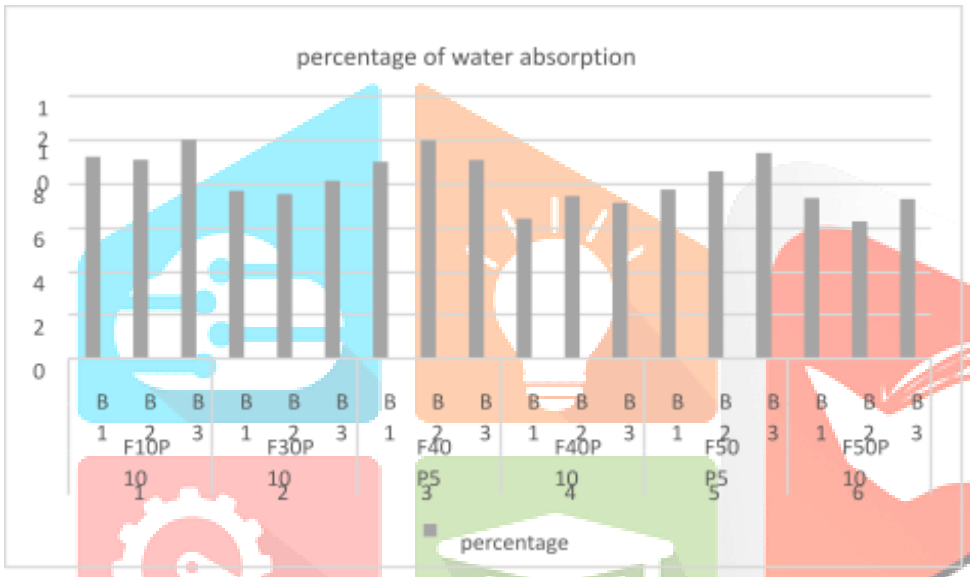
The table seems to be organized into different types of bricks, possibly with varying compositions or manufacturing processes (plain bricks and those with certain percentages of additives).
Each type of brick has multiple instances (B1, B2, B3) with different properties like weight, load capacity, and compressive strength.
The compressive strength values at 7 and 28 days of curing are provided, indicating how the strength of the bricks develops over time with curing

2 WATER ABSORPTION RESULTS

table 2: brick details for water absorption test

sl no	brick type	rick no	initial wt in kg	final wt in kg	percentage
1	F10P10	B1	3570	3900	9.2436975
		B2	3515	3835	9.1038407
		B3	3590	3950	10.027855
2	F30P10	B1	3575	3850	7.6923077
		B2	3580	3850	7.5418994
		B3	3560	3850	8.1460674
3	F40P5	B1	3440	3750	9.0116279
		B2	3420	3762	10
		B3	3630	3960	9.0909091
4	F40P10	B1	3430	3650	6.4139942

		B2	3490	3750	7.4498567
		B3	3500	3750	7.1428571
5	F50P5	B1	3490	3760	7.7363897
		B2	3435	3730	8.588064
		B3	3400	3720	9.4117647
6	F50P10	B1	3400	3650	7.3529412
		B2	3500	3720	6.2857143
		B3	3485	3740	7.3170732



Graph 2 : water absorption graph

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