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Utilization of Waste Paper Sludge to Produce Eco-Friendly Light Weight Bricks

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Abstract: ***In this project a parametric experimental study which investigate potential use of paper waste by producing a low-cost and light weighted composite bricks or building material. These alternative bricks were made with papercrete . The construction industry has been known as one of the largest consumer of non-renewable resources. On the other hand, more waste paper ends up in the landfills or dump sites than those recycled . The purpose of the research is to determine the weight compressive strength , water absorption capacity , fire resistance ,hardness etc . of papercrete brick using waste paper (newspaper) in order to determine their optness for use a building construction material . While using paper pulp with cement and sand the weight of the brick is approximately 50% less than conventional clay brick . Therefore papercrete brick will decrease the dead weight of the structures to significant amount. So it changes our design and building cost as in an economical point of view.***
Keywords: Paper Crete, Light Weight, Compressive Strength, Water Absorption, Eco-friendly.

I. INTRODUCTION

The constant developmental activities in civil engineering and growing industrial activities have created a continuous demand for building materials which satisfy all the stringent requirements regarding the short-term and long-term performance of the structure. As the structures of tomorrow become taller and more complex, the materials of construction will be required to meet more demanding standards of performance than those in force today (Fuller). Papercrete is a material originally developed 80 years ago but it is only recently rediscovered.

Papercrete is a fibrous cementitious compound comprising waste paper and Portland cement. These two components are blended with water to create a paper cement pulp, which can then be poured into a mould, allowed to dry and be utilized as a durable building material. It should be noted that papercrete is a relatively new concept with limited scope.

Paper is a thin material manufactured by squeezing together moist fibers of cellulose pulp derivative from wood, rags or grasses, and drying them into flexible layers. It is a useful material with various usages, involving writing, printing, packaging, cleaning, and a number of industrialized and construction processes.

The chemical composition of paper relies on the type or grade of paper. Usually most grades of paper contain organic and inorganic material. Organic part comprising of cellulose, hemi-cellulose, lignin, and or numerous compound of lignin (Na-lignate, etc.) might be 70% to 100%.

Inorganic part comprising of primarily filling and loading material as calcium carbonate, clay, titanium oxide, etc. might be 0% - 30% of paper. Paper crete is a tricky term. The name seems to imply a mix of paper and concrete, hence papercrete. But more accurately, only the Portland cement part of concrete is used in the mix-if used at all.

II. OBJECTIVES

The objectives of the investigation are ,

A. To utilize the waste material like paper , flyash , puarry dust etc . in the process of manufacturing of new type of eco-friendly light weight light weight bricks .
B. To construct and verify the strength of papercrete bricks .
C. To find out the water absorption capacity of papercrete bricks .
D. To reduce the environmental impacts caused by the burning and damping of waste papers .
E. The parercrete brick which satisfy the following characteristics : Required, Cost effective , Inflammable, Easily available

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III. METHODOLOGY

A. *Materials Used in Present Study*

1) *Cement:* Cement used in this study is 43 grade (opc) Ultratech conforming to I.S : 8112-1989.
2) *Sand:* Fine aggregate used for the study is river sand which is passing 4.75mm I.S : 3883-1970 is used.
3) *Quarry Dust:* Quarry dust is by- product which is formed in the processing of the granite stone which is broken down into coarse aggregate of different sizes the dust is selected from the nearest source as raw material which is as per specification I.S 383-1987.
4) *Fly Ash:* About 80 percentage of total ash is finally divided form . which is carried away with flue gasses and collected with electrostatic precipitation or other suitable technology . the Fly ash which Is collected for the study is collected from Vedanta limited known as Vedanta Limited known as Sesa Goa Limited Fly ash which is very fine compared to cement however some particle have size less than 1 micron in equivalent diameter .
5) *Water:* Water is an important ingredient of papercrete as it is involved in the chemical reaction with cement. potable water should be used for both for soaking and mixing of papercrete it should free from organic atter and P.H should be between 6-7 .
6) *Water Proofing Powder:* In this study paper is the major ingredient in papercrete mix and it ha high water absorption , hence to minimize water absorption water proofing powder is used Dr.fixit powder water proof is composed of waterproofing additives , disposed in inert fine filter it is an integral powder – water proofing admixture used for water proofing of concrete and cement plaster because it makes concrete cohesive , reduce porosity and improve water tightness meets the requirement of I.S : 2645-1983 standard .
7) *Waste Paper:* The waste paper used in the study is collected from shops . The waste paper used in this study is study is collected from shops . The paper is cut into small pieces by using paper cutter this small dimensions prevent paper from clumping when waste paper is assorted with paper so the paper expand evenly in the papercrete mix. Paper is a natural polymer which consists of wood cellulose. Cellulose is made of units of monomer glucose. Although containing several hydroxyl groups, cellulose is water insoluble. The reason is the stiffness of the chain and hydrogen bonding between two OH groups on adjacent chains. The chains also pack regularly in places to form hard, stable crystalline region that gives the bundle chains even more stability and strength .

B. *Test performed were as follows*

1) *Mould Preparation:* After collecting all aterial amould is prepared a wooden modular mould is prepared of size 190mm*90mm*90m holes are made without any hole or linkage to avoid leakage .
2) *Pulp Generation:* The paper which is collected cannot utilize immediately . It should be made into a paper pulp before mixing with other ingredients. The paper are wet in a tank for 3-4 days otherwise until the paper degrades into a paste like form . then the paper are taken out from water and mixing are done manually.
3) *Compression Test:* The test was held by compression testing machine after the 14^{th} and 28^{th} day from the date of casting of papercrete brick. Papercrete bricks never fail catastrophically ,it just compressed like a squeezing rubber .Therefore great care must be considered while testing the papercrete brick because in papercrete brick load should be applied up to half compression only the papercrete brick are having elastic behavior and less brittleness ,due to the structure was not fully collapsed ,when the papercrete bricks fails at higher load only the outer faces cracked and peeled out .A brick that used for construction should have compressive strength more than 3.5N/mm2.
4) *Water Absorption Test:* A brick is taken and it is weighed dry. It is then immersed in water for a period of 24 hours. It is weighed again and the difference in weight indicates the amount of water absorbed by the brick. It should not, in any case, exceed 20% of weight of dry brick.
5) *Hardness Test:* In this test, a scratch was made on brick surfaces. While the scratch was made with the help of finger nail on the bricks, very light impression was left on the fibrous concrete brick surface. Hence, this test results that fibrous concrete bricks are sufficiently hard.
6) *Weight Test:* The ordinary conventional clay bricks weight varies from 3 – 4 kg but the papercrete bricks weight varies from 1 – 2 kg. The maximum weight is less than 2 kg only. All the bricks were weighed in a well conditioned electronic weighing machine. Sand based papercrete bricks are having weight 2/3rd of the conventional clay brick only.
7) *Soundness Test:* In this test two bricks were taken and they were stuck with each other. The bricks were not broken and a clear ringing sound was produced. Hence the bricks are safe to use.

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8) *Nailing:* Fibrous concrete bricks are less hard as compared to conventional clay bricks. Therefore, this test was performed to find out whether these bricks can hold the nails or not.
9) *Cutting and Glue:* Papercrete bricks can be cut into exactly two parts by using conventional saw blades.
10) *Fire Test:* A brick, which is employed for construction should not flammable in an exposed fire, so this test was carried out for the bricks .This test is conceded out only for fibrous concrete bricks and not for padobe brick.

IV. RESULT AND DISCUSSION.

1) *Compression Test:* The test was held by compression testing machine after the 14th and 28th day from the date of casting of papercrete brick. Papercrete bricks never fail catastrophically ,it just compressed like a squeezing rubber .Therefore great care must be considered while testing the papercrete brick because in papercrete brick load should be applied up to half compression only the papercrete brick are having elastic behavior and less brittleness ,due to the structure was not fully collapsed ,when the papercrete bricks fails at higher load only the outer faces cracked and peeled out .A brick that used for construction should have compressive strength more than 3.5N/mm2.

Table.1: Compressive Test result for 14 days

No. of days	mix	No. of samples	Compressive strength	Average Compressive test
14 days	Mix 1	Sample 1	1.858	1.563
	Mix 1	Sample 1	1.339	
	Mix 1	Sample 1	1.494	
	Mix 2	Sample 2	2.886	2.793
	Mix 2	Sample 2	2.721	
	Mix 2	Sample 2	2.773	
	Mix 3	Sample 3	2.986	2.920
	Mix 3	Sample 3	2.900	
	Mix 3	Sample 3	2.876	
	Mix 4	Sample 4	3.436	3.464
	Mix 4	Sample 4	3.580	
	Mix 4	Sample 4	3.368	
	Mix 5	Sample 5	3.720	3.667
	Mix 5	Sample 5	3.650	
	Mix 5	Sample 5	3.633	
	Mix 6	Sample 6	3.638	3.694
	Mix 6	Sample 6	3.580	
	Mix 6	Sample 6	3.868	

Table. 2: Compressive Test result for 28 days

No. of days	mix	No. of samples	Compressive strength	Average Compressive test
28days	Mix 1	Sample 1	2.456	2.543
	Mix 1	Sample 1	2.338	
	Mix 2	Sample 2	3.755	3.474
	Mix 2	Sample 2	3.980	
	Mix 2	Sample 2	3.887	
	Mix 3	Sample 3	4.832	3.923
	Mix 3	Sample 3	4.980	
	Mix 3	Sample 3	4.959	
	Mix 4	Sample 4	5.322	5.228
	Mix 4	Sample 4	5.278	
	Mix 4	Sample 4	5.085	
	Mix 5	Sample 5	5.982	6.178
	Mix 5	Sample 5	6.228	
	Mix 5	Sample 5	6.326	
	Mix 6	Sample 6	7.321	7.098
	Mix 6	Sample 6	6.976	
	Mix 6	Sample 6	6.998	

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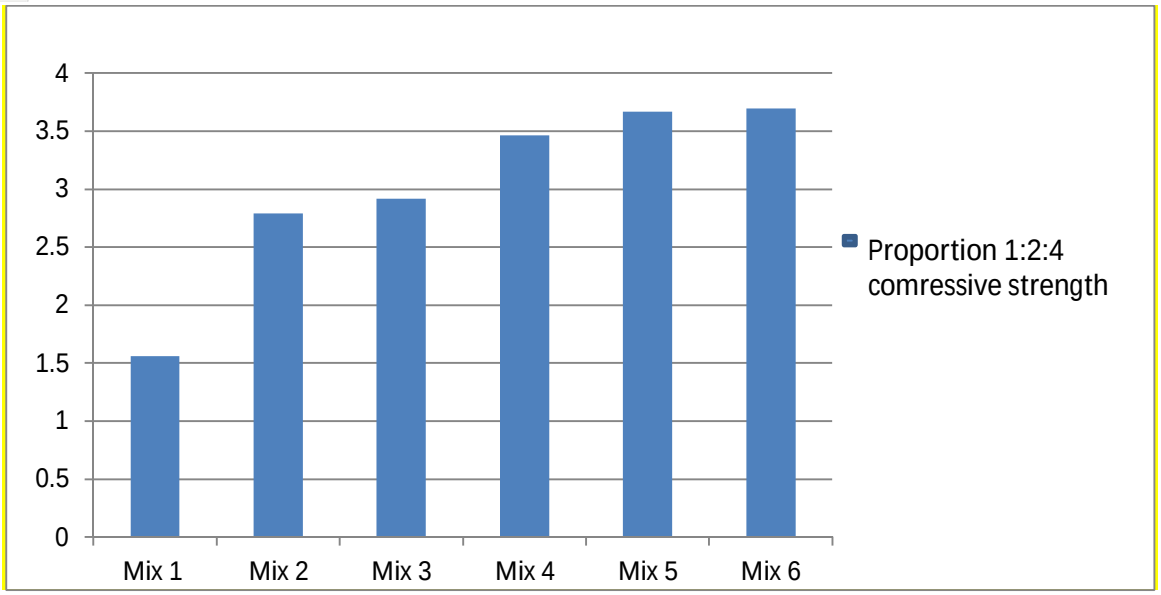


Fig.1 compression test result for 14 days

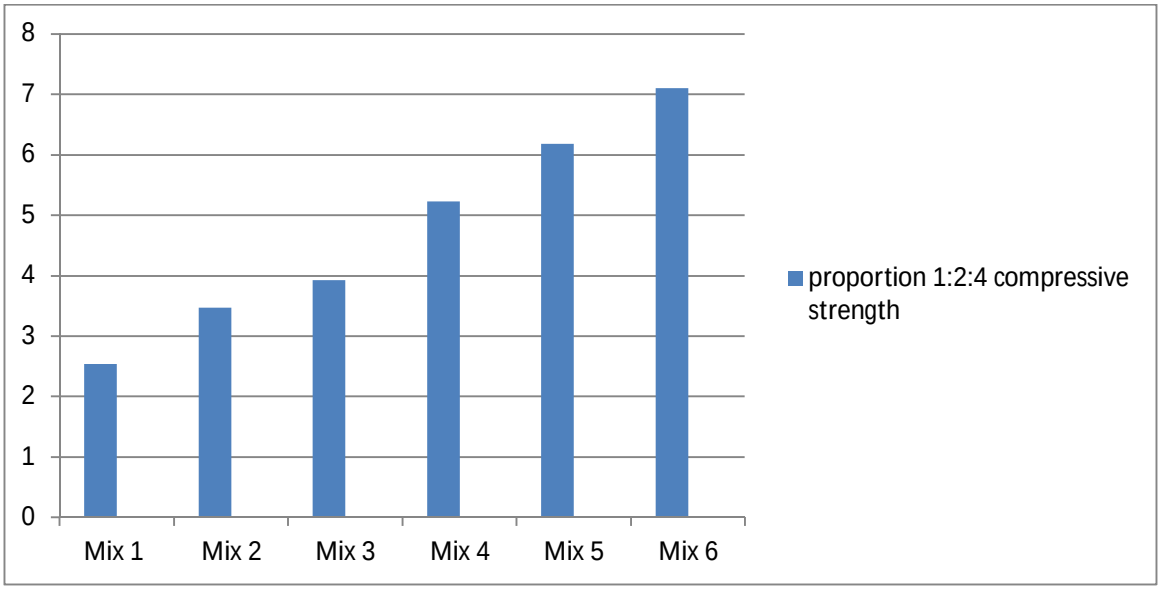


Fig.2 compression test result for 28 days

2) Water Absorption Of Papercrete Bricks

The test result for water absorption is illustrated below

Water absorption test is required to check whether the bricks are suitable for water logged areas or not .As per standard s the bricks should not absorb water more than 20 % of its original weight .

Table. 3: Water absorption value for different mix

Sr. no.	Types of mix	Water absorption (%)
1	M1	18.71
2	M2	11.94
3	M3	13.42
4	M4	7.207
5	M5	10.46
6	M6	9.11

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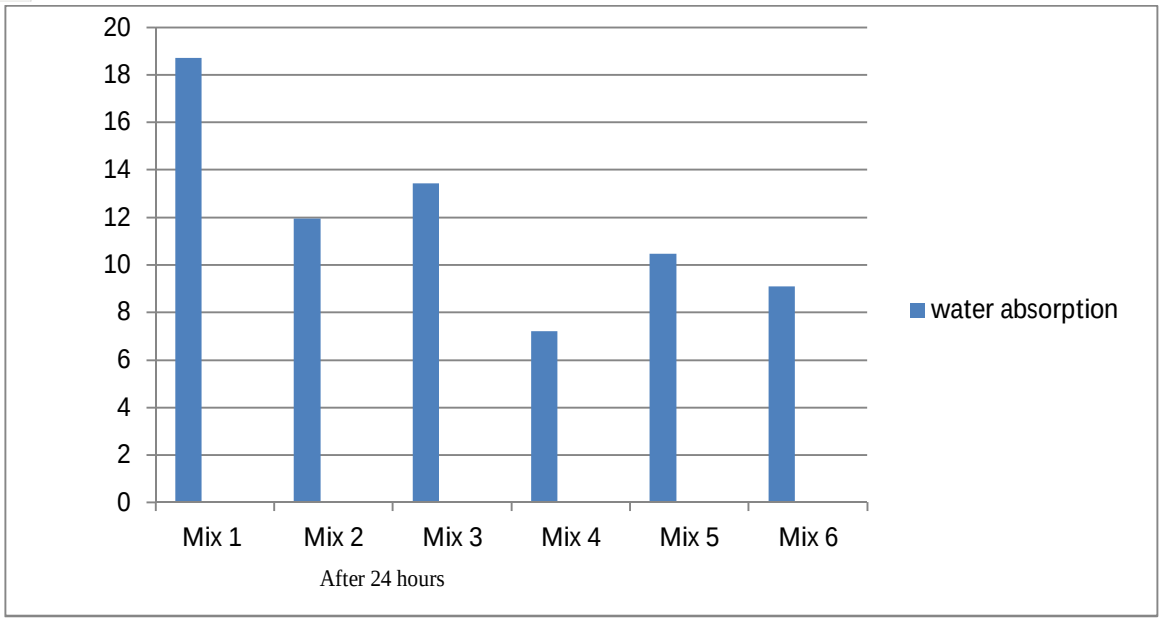


Fig.3 Water absorption test values for different trial mix

3) *Hardness Test:* In this test, a scratch was made on brick surfaces. While the scratch was made with the help of finger nail on the bricks, very light impression was left on the fibrous concrete brick surface. Hence this test results that fibrous concrete bricks are sufficiently hard.

4) *Weight Test:* Lightweight bricks are also the important objective of this project. So, all the bricks were tested whether they are having less weight or not. All the bricks were weighed in a well-conditioned electronic weighing machine. The following are the weight of the brick. Observation: As the percentage of aggregate increases the weight of brick will also be increases. As the paper sludge increases the weight of the brick decreases.

Table. 4: Observation For Weight Of Bricks

Mix Proportion	M1	M2	M3	M4	M5	M6
1:2:4	21.06 KN/mm2	22.76 KN/mm2	26.81 KN/mm2	27.17 KN/mm2	27.31 KN/mm2	28.12 KN/mm2

5) *Soundness Test*



Figure. 4 Soundness Test on Brick

In this test two bricks were taken and they were stuck with each other. The bricks were not broken and a clear ringing sound was produced. Hence the bricks are safe to use

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6) Nailing Test



Figure. 5 Nailing Test on Bricks

Fibrous concrete bricks are less hard as compared conventional clay bricks. Therefore, this test was performed to find out whether these bricks hold the nails or not. A nail was hammered in the brick and a screw was also screwed into the brick. From this test it was observed that fibrous bricks can sufficiently hold the nail. Also screws worked well and holds a considerable weight.

7) Cutting and Glue Test

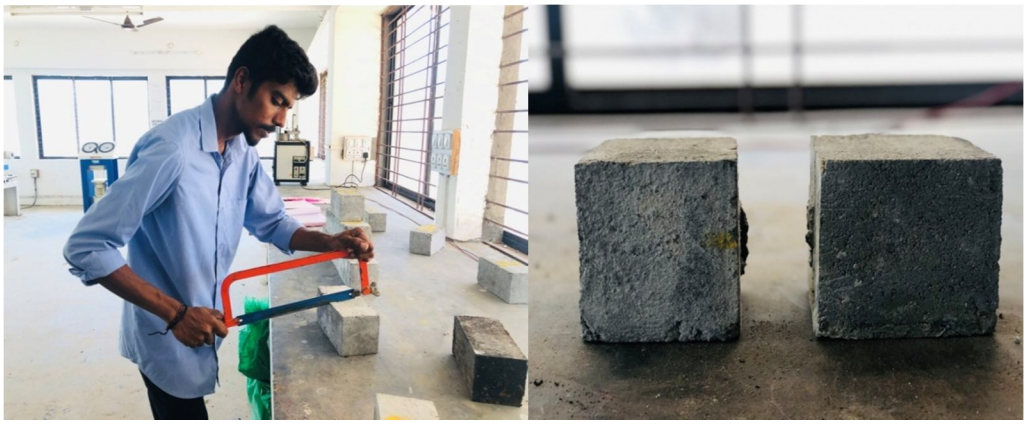


Figure.6 Cutting Test on Bricks

A lot of bricks are wasted on site during the process of cutting only. The labors could not able to cut the bricks exactly what they want. But papercrete bricks can be cut into exactly two parts by using conventional saw blades. Many cut bricks arc wasted in now a day. But the two fibrous concrete brick pieces can be hold together by putting a medium amount of glue on the bottom piece. Hence papercrete bricks could be employed in the application of calling for quick assembly by cutting the parts required to size in advance and letting the user simply glue them together.

8) Fire Test



Figure. 7 Fire Test On Brick

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A brick, which is employed for construction should not flammable in an exposed fire, so this test was carried out for the bricks. This test was conceded out only for fibrous concrete bricks and not for padobe brick.

From the above test, it was observed that the fibrous concrete bricks did not burn with an open flame. They fumed like charcoal. But these brick would be reduced to ashes after burning several hours. If the interior plaster and exterior stucco is provided on the fibrous concrete bricks, the bricks won't burn. The only weak spot is inside the block, near electrical outlets, switches and other situations where wires gives through walls, into boxes etc. Properly wired places never cause a fire. If we apply the plaster without any hole or leakage on the bricks, it won't burn or fume inside because there will be a lack of oxygen for combustion.

V. CONCLUSSION

A. Considering the desirable compressive strength shown by the tested specimen ,it is clear that papercrete have an ability to provide an eco-friendly , light weight concrete block with use of less number of naturalresources . through the results obtain during compression test showed the papercrete bricks are acceptable for non load bearing wall only .

B. A Papercrete can be easily mould in any shape ,bricks are much easier for someone to lift to any desired height and very surface finish can be achieved .

C. Papercrete has good fire resistance .

D. Papercrete bricks are good sound absorbant; hence Paper is used in these bricks .so these can be easily used in auditoriums.

E. The weight of the brick is 2l3rd to 3l5th lesser than conventional clay bricks.

F. Due to less weight of these bricks ,the total dead load of the building will be reduced.

G. Since ,these brick are relatively weight and more flexible , these bricks are potentially ideal material for earthaquake prone areas.

H. Since the waste material are used it will reduce the landfills and pollution.

I. Using the papercrete brick is used in building total cost can be reduced from 20% to 25%.

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REFERENCES

[1] Akilesh Kushwaha Profes or Vinay Kumar Singh Chandrakar Dr. Gyanendra Singh Professor. Praveen Singh Tomar,2017, "Experimental study Of Waste Paper To Produce Environmental Eco-Friendly Bricks" International Journal for Scientific Research and Development(IJSRD) ,Volume 05, Issue 9 , 2017, ISSN : 2321-0613.

[2] Anokha Shilin, Feba Halus, Mariyam Habeeba M. K Merin Maria Johny, 2016, "Papercrete Management'' International Journal of Engineering Research and Technology (IJERT) , Volume 04, Issue 5 , May 2016 , ISSN : 2278-0181.

[3] G.V.S. SivaPrasad, P. Prasad Reddy, M. Swathi, P. D. V. KiranKumar, T. Praveen Raja, M. Naveen, 2015, "Study And Behaviour Of Some Properties Of Parercrete Brick With Modular Brick", International journal of Engineering and Research -Online (IJOER), Volume 3, Issue 3, 2015.

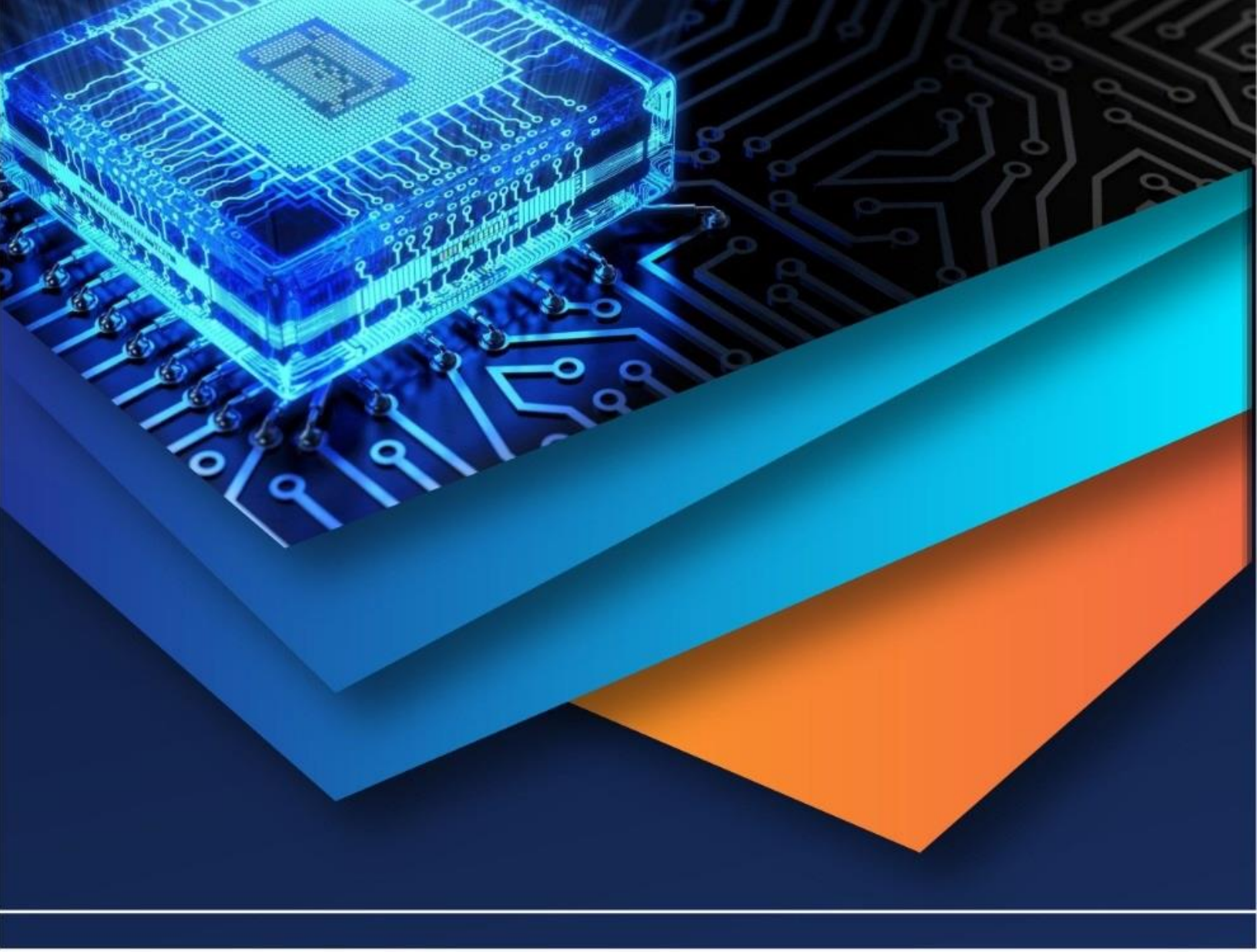
[4] Hartith Zaki, Iqbal Gorgis and Shakir Salih , "Mechanical Properties Of Papercrete" Journal of Engineering and Applied Science (ARPN) ,Volume 12, Number 24, December 2017, ISSN : 1819-6608

[5] Issac I. Akinwumi, Olasunkanmi M. Olatunbosun, Oluwarotimi M. Olofinnade, Paul O. Awoyera,2014, "Structural evaluation of lightweight concrete Produced using Waste Newspaper and Office paper" Civil and Environmental research, 2014, ISSN 2224-5790 (paper) ISSN 2225-0514(online) ,Volume 6, Number 7 , 2014.

[6] J. Santamaria, B. Fuller & A. Fafitis, 2007, "Structural Properties of a New Material Made of Waste Paper" Transaction on Modeling and Simulation (WIT), Volume 46, 2007, ISSN 1743-355X.

[7] K. Chandra. Prakash, B. S. MD. Khadeer, Sreenatha. M, Suresh. B, Prashant. N, July-2018, "Experimental Study On Papercrete Concrete By Adding Quary Dust'' International journal for Technological research in Engineering and management (IJAIEM) ,Volume05, Issue 4 , May 2018.

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