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Study on Mechanical Properties of Type S-A Concrete Pavement Blocks With Waste Fibres

Mr. K. Jagadeesh[1], Ms.V.karpagam[2], Mr. Y. Ibrahim[3]
[1, 2] *Assistant Professor, Department of Civil Engineering, Noble Engineering College, Parth Vatika, Bhesan Road, Junagadh, Gujarat- 362310, India.*
[3]*Assistant Professor, Department of Civil Engineering, BSAR CRESCENT UNIVERSITY, Vandalur, Chennai – 600048, india.*

Abstract: ***The concrete pavement blocks are used extensively in construction. It is mainly used in garden and pavements for easy drainage of water. The concrete pavement block is having a good compressive strength but it is weak in tensile strength, so it is needed to add tensile nature to these concrete blocks. In this study, the tensile strength behavior and durability of the pavement blocks are taken into consideration. The concrete pavement blocks were added with fibres such as coir fibre, waste tyer fibre, and polyester fibre in a proportion of 0.5% and 1% to the pavement block and determining the mechanical properties of the pavement block. From the various test conducted, it is observed that polyester fiber is having a good durability and high strength.***
Keywords: Polyester fibre, Coir fibre, Waste tyre, Pavement blocks.

I. INTRODUCTION

Concrete Pavement blocks are manufactured using cement, fine aggregate and coarse aggregate. In this the fibres such as coconut fibre, rubber fibre, and recron fibre are added in small quantity for improving the mechanical properties of the pavement block. The coconut fibres and rubber fibres are available abundant in nature, so it can be used in the pavement block manufacturing. The various tests such as workability, water absorption, compressive strength test , acid and alkali test and abrasion test is to be made on the pavement blocks and it is compared with the conventional and the results are to be studied. The addition of natural fibres in the pavement blocks is the new concept and it leads to the use of waste materials such as coconut fibre , rubber and recron fibre and it reduces the material wastage.

A. Coir Fibre

Coconut fibre is naturally abundant in nature.the husk from the coconut palm comprises of 30% weight of the fibre and 70% weight of the pith material. The fibre are extracted from the husk by several methods such as retting, which is traditional way, decortications, using bacteria and fungi, mechanical and chemical process, for the production of building and packaging materials, used as alternative material for fine aggregate or coarse aggregate or it can be used as a additional material in concrete



Fig 1.1 Coir fibre

B. Rubber Fibre

The concrete mixed with waste rubber added in different volume proportions is called rubberized concrete and is an infant technology. And it can be added to the pavement block which is also an concrete block pavement. Partially replacing the coarse or fine aggregate of concrete or adding rubber as additional material in some quantity of small waste tire cubes can improve qualities such as low unit weight, high resistance to abrasion, absorbing the shocks and vibrations, high ductility and brittleness and so on to the concrete. Moreover the inclusion of rubber into concrete results in higher resilience, durability and elasticity. In constructions that are subject to impact effects the use of rubber in concrete will be beneficial due to the altered state of its properties.

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Fig 1.2 Rubber Fibre

C. Polyester Fibre

Recron Fibre is India's only hollow Fibre specially designed for filling and insulation purpose. Made with technology from DuPont, USA, Recron Fibrefill adheres to world-class quality standards to provide maximum comfort, durability, and ease-of-use in a wide variety of applications like sleep products, garments and furniture. Reliance Industry Limited (RIL) has launched Recron 3s fibres with the objective of improving the quality of plaster and concrete. Application of Recron 3s fibre reinforced concrete used in construction. The thinner and stronger elements spread across entire section, when used in low dosage arrests cracking. Recron 3s prevents the shrinkage cracks developed during curing making the structure/plaster/component inherently stronger.

Table 1.1 specification of recron

Cut length	6mm,12mm,24mm
Tensile strength	About 6000 kg/cm^2
Melting point	250° C
Dispersion	Excellent
Acid resistance	Excellent
Alkali resistance	good



Fig 1.3 Polyester fibre

D. Concrete Pavement Block Type S-A

Segmented concrete paving is a system of individual shaped blocks arranged to form a continuous hardwearing surface overlay. Over the past two decades, paving composed of segmental blocks has become a feature of our towns and cities. It is to be found in commercial industrial and residential areas, in the paving malls, plazas, parking areas and bus stops. It has been successfully used for embankment walls, slope protection and erosion control. The engineering and specification aspects have been satisfactorily solved, and this type of paving has a proven performance and service record. Paving block thicknesses vary between 50 – 80 mm. The thicker the blocks the better the pavement will resist vertical deformation and horizontal creep. However, there is a cost implication and thickness selection should be based on application. Generally for domestic use, 50 – 60 mm blocks are adequate. For industrial use an 80mm.

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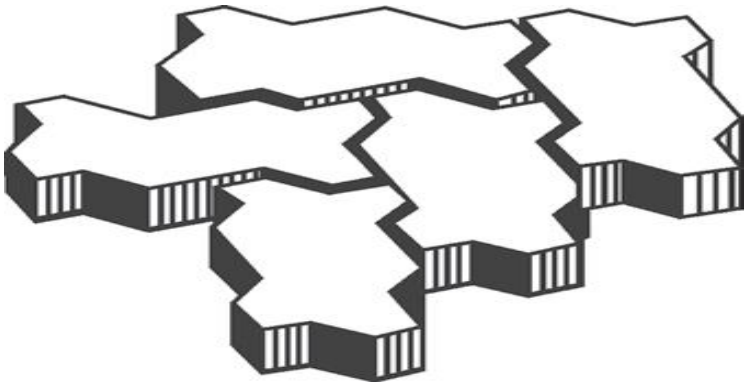
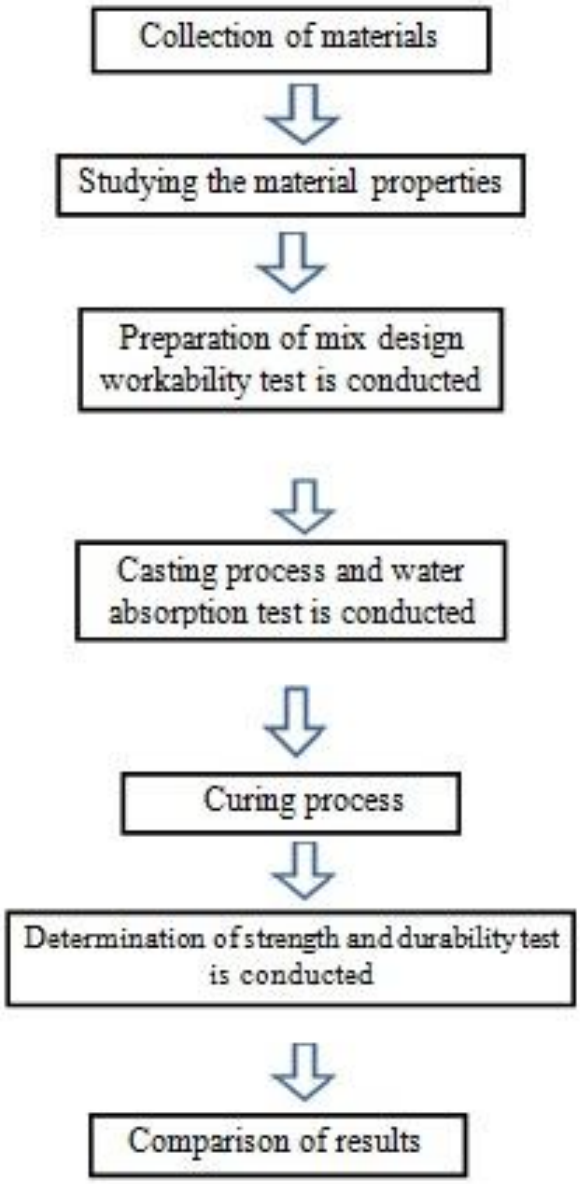


Fig 1.4 Type S-A concrete pavement block

II. METHODOLOGY



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III. RESULTS AND DISCUSSION

A. Water Absorption Test

The water absorption test results shows that the coconut fibre pavement block has less water absorbing capacity when compared to conventional block. While the 0.5% rubber and recron pavement block is also having less water absorption than the conventional one. But if the percentage of adding increases in rubber and recron it shows high absorbing capacity than the conventional block. The results are given in the below in Fig. 3.1 showing the variations of results.

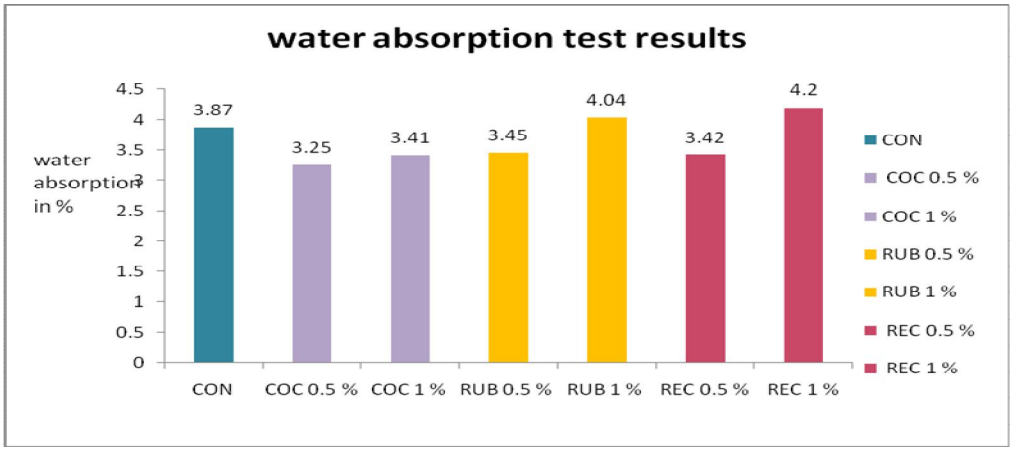


Fig 3.1 Water absorption test result

B. Strength Test Results

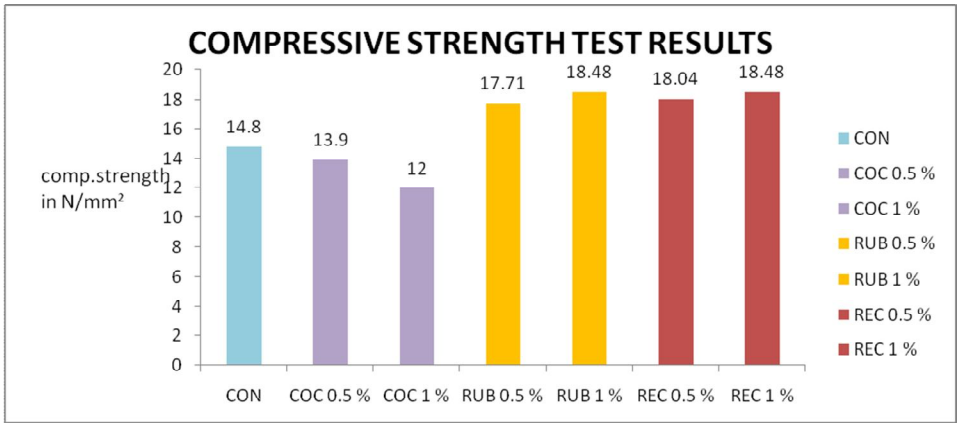


Fig 3.2 compressive strength test result

The strength test results shows that coconut fibre pavement block is having less strength than the conventional pavement block. Whereas the other two fibres, rubber and recron shows a very high compressive strength than the conventional one. So these two fibres can be added to the pavement block to increase the strength.

C. Tests For Durability

For the durability test , the pavements are placed in acid and alkali solution for 14 days and it is tested for weight loss and compressive strength after the 14 days.

1) Acid Test: The acid test is conducted by placing the specimens in acid solution. for this test specimens are placed in tubs containing acid solution. 3% of H_2SO_4 acid solution is mixed with water and the specimens are placed in it. Before placing the specimens it is weighed & after 60 days the specimen is taken out and it is weighed again and the compressive strength test is to be done for those specimens.

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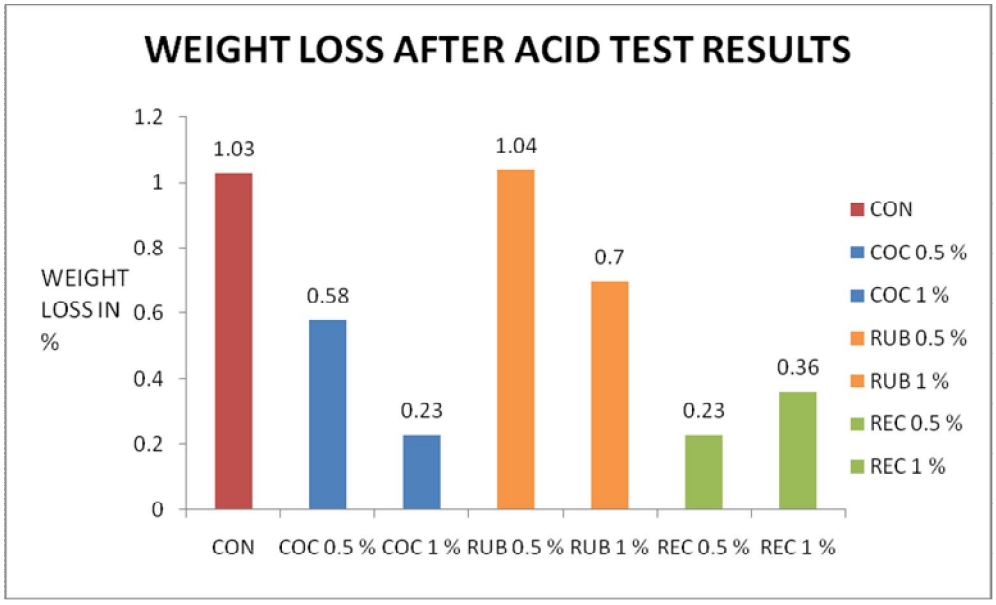


Fig 3.3 Weight loss after acid test

The values in Fig.3.4 shows the results after 60 days of acid immersion shows that there is no weight loss in 1% coconut and recron fibre block. while the other percentage fibres shows less weight loss than the conventional one.

The compressive strength test results for pavement blocks after it is placed in acid solution for 60 days shows that mostly all the fibres are affected in acid immersion and it shows less strength than the conventional pavement block.

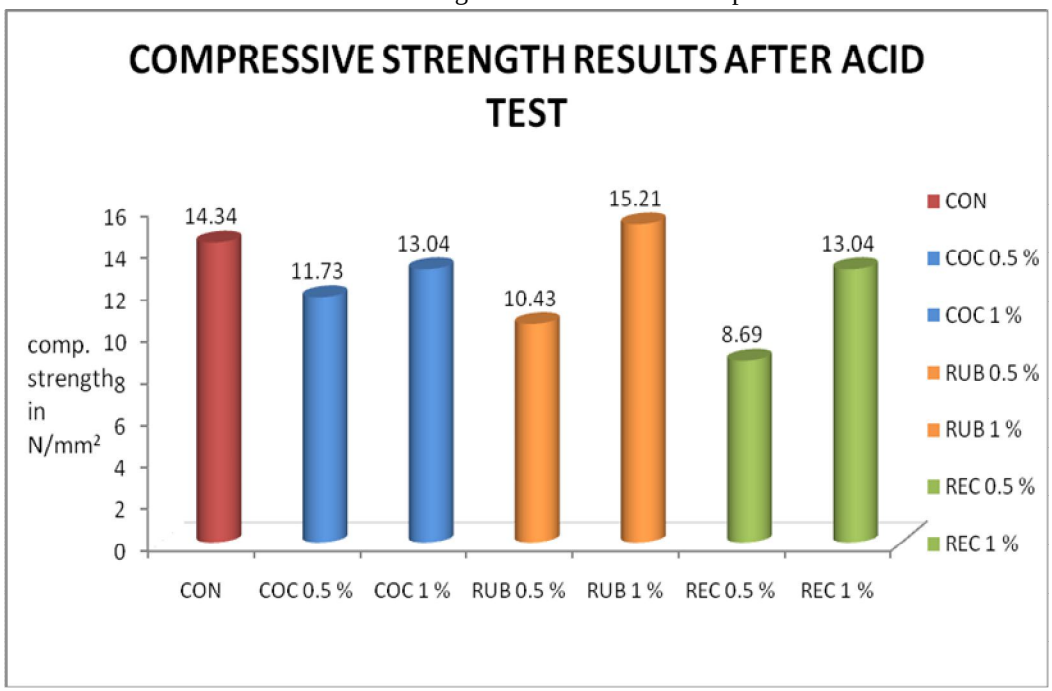


Fig 3.4 Compressive strength results after acid test

Only 1% rubber fibre shows a little high strength. The Fig 3.5 show the compressive strength test results below.

2) *Chloride Test:* The chloride test is conducted by placing the specimens in chlorine solution. For this test specimens are placed in tubs containing alkali solution. 3% of HCL solution is mixed with water and the specimens are placed in it. Before placing the specimens it is weighed & after 60 days the specimen is taken out and it is weighed again and the compressive strength test is to be done for those specimens.

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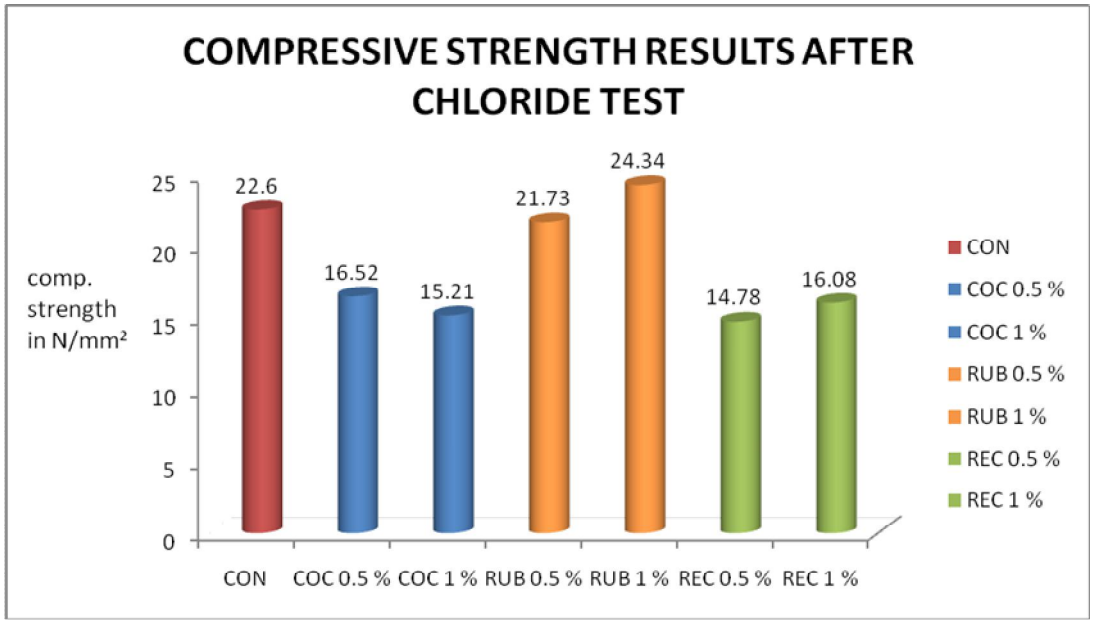


Fig 3.5 Compressive strength results after chloride test

D. Abrasion Test

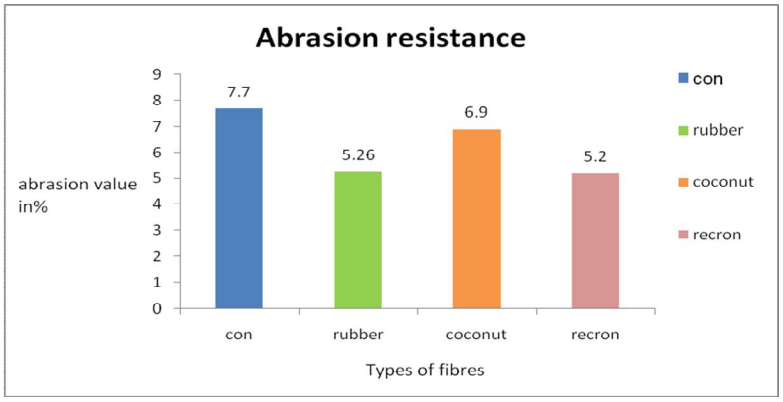


Fig 3.6 Abrasion resistance

The abrasion results shows that the abrasion value of all the fibres pavement block is less than the conventional block.so the abrasion resistance of all fibres pavement block is good.

IV. CONCLUSION

From the water absorption test , it was found that the addition of coconut fibre of 0.5%, 1% in pavement block has less water absorbing capacity than the conventional block. Results from slump test indicates that rubber fibre has less slump value of 15 mm. The compressive strength results show that 0.5% and 1% addition of rubber and recron fibre gives very high compressive strength value of around 18 N/mm^2. While coconut gives less than the conventional one.The compressive strength of conventional is 14.8 N/mm^2.Weight loss of pavement blocks after 14 days of acid immersion shows that the fibre pavements weight loss is less than the conventional block. While the compressive strength test results shows that mostly all the fibres are affected in acid immersion and it shows less strength than the conventional pavement block. The abrasion test results shows that abrasion value of all fibres is less than the conventional one. so the fibre pavements show high resistance to vehicles. The project work shows that the rubber and recron fibres can be added as additive material to the pavement block, since it gives more compressive strength and more resistance value. But the addition of coconut fibre adversely affect the strength value. Addition of fibres to pavement block is affected in acid environment because the strength after acid test gives very less strength. Chloride test results shows that increase in weight in all pavement blocks and also the compressive strength also increases considerably except polyester fibre. It shows decrease in

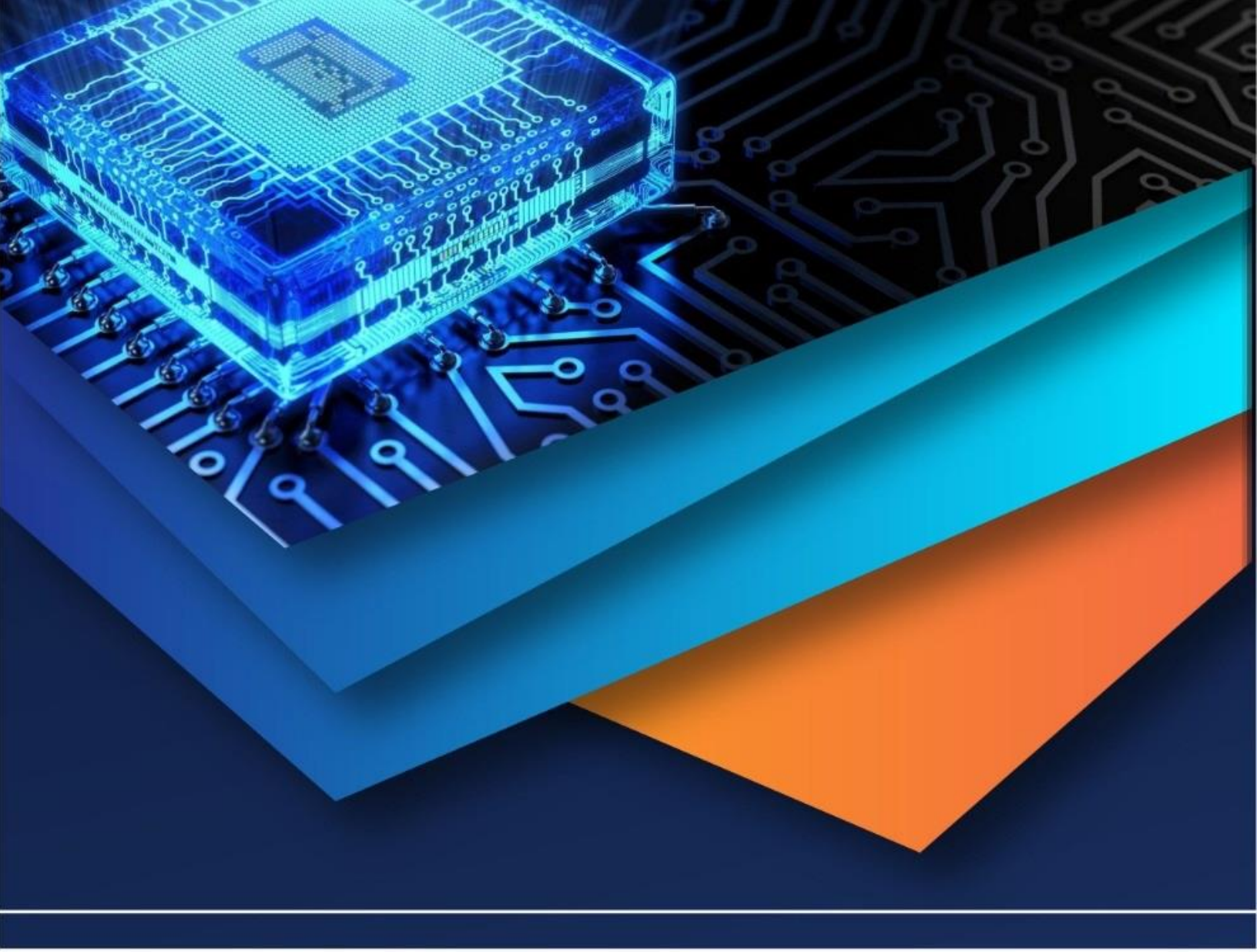
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compressive strength. Fibres are available free in nature, which is a waste material. It gives more strength than the conventional block.

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