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Assessment Performance of Petrol Chemical Plastic Waste with Coconut Fibre for Building Blocks

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ABSTRACTS

This project work is focused at investigating the assessment performance of blocks made with coconut fiber and plastic waste compared to blocks made with normal fine aggregate and cement. a total of 96 blocks were produced in which 90 was used , 48 was made from just fine aggregate and cement while 42 was made from coconut fiber, plastic waste , cement and water. The total size of all the block was 6 inches the blocks were subjected to various test such as water absorption, compressive strength test and flexural strength test. The water absorption rate for sandcrete block range from 3.49% to 5.29% while for coconut fibre and plastic waste blocks range from 6.35% to 9.68%. The compressive strength test for pure blocks ranges from 27 KN to 46KN while for coconut fiber and plastic waste block range from 27 KN to 50KN. The flexural strength test also range from 0.47N/mm2 to 1.42N/mm2 for pure sandcrete blocks and 1.096N/MM2 to 1.816N/MM2 for coconut fibre and plastic waste.

Keywords: Assessment, Performance, Petrol Chemical Plastic, Coconut Fibre For Building Blocks

INTRODUCTION

The vast volume of waste generated and disposed of annually is largely due to urbanization and changing human lives. There are human actions that generate garbage, such as product manufacture and post-use. However, the majority of these wastes are disposed of in landfills. However, the high expenses of landfilling, along with its ineffectiveness in some less developed areas and land-space consumption, can be a significant barrier to waste management. The amount of solid trash produced grows every year, but only a small fraction is recycled and landfilled, and a considerable proportion of wastes, such as plastic wastes (PW), is deposited directly or indirectly in the marine environment..(Awoyera & Adesina, 2020)

Plastic wastes are one of solid wastes that are produced in vast amounts and pose a danger to our planet's sustainability. When plastic debris reaches the ocean, it causes damage to the ecosystem, economy, and aesthetics, according to reports. Plastic garbage is projected to be generated in the amount of 300 million metric tons each year. Because of its wide range of applications, such as in automotive, industrial, packaging, and healthcare, large amounts of plastic trash are generated all over the world. According to research by the Environmental Protection Agency, only 7% of the many tons of plastic garbage generated each year is recycled, roughly 8% is burnt, and the rest is landfilled. However, due to the high expense and energy connected with landfilling, these wastes have ended up in bodies of water. Furthermore, plastic's limited biodegradability severely limits its recyclability and reuse.(Awoyera & Adesina, 2020)

To reduce the crucial amount of PW generated annually, notable efforts like source reduction, reuse, and landfilling have been used. However, because to rapid progress, the amount of PW generated has been steadily increasing. Finding effective alternative methods of recycling this plastic trash will thus go a long way toward ensuring a sustainable ecosystem. Recycling PW will help to protect the environment while also adding value to the material by allowing it to be used in a variety of industries, including as building. The ability to utilize these PW in construction applications would not only help to protect the marine environment, but it will also minimize the overall environmental damage posed by the manufacture of these plastics. Furthermore, the potential use of PW in building applications will assist the construction industry in meeting its sustainability goals. When the PW is implemented, it will result in significant reductions in energy usage and carbon emissions..(Awoyera & Adesina, 2020)

MATERIALS AND METHODS

Plastic is a very common material that is now widely used by everybody in this world. Plastic has many advantages as it is compact and light in weight. Common plastic items that are used are bags, bottles, containers and food packages. The great problem with plastic is its disposal. Plastic is made of polymer chemicals and they are not bio degradable. This means that plastic will not decompose when it is buried. Though plastic is a very useful material that is flexible, robust and rigid they become waste after their use and they pollute the atmosphere. Recycling is processing used materials (waste) into new products to prevent waste of potentially useful materials. The increase in the popularity of using environmental friendly, low cost and lightweight construction materials in building industry has brought about the need to investigate how this can be achieved by benefiting to the environment as well as maintaining the material requirements affirmed in the standards. To protect the environment as well as to take advantage of plastic, recycling procedure is used. The use of waste plastic bottles for the production of bricks is an optimal method to solve the problem of storing waste materials and to optimize the cost for the production of building materials. In this study, plastic bottle waste in bottle factory will be used to incorporate with cement and sand to produce sand bricks. The bricks will then be tested to study the compressive strength, water absorption and efflorescence. In the recent past research, the replacement and addition have be done with the direct inclusion of polyethylene or plastic fibre, polyethylene terephthalate (PET) bottles in shredded form, chemically treated polyethylene fibre, PET in aggregate form by replacing natural coarse aggregate. Most of replacements have been done by volume calculation, and showed the decreased in compressive strength as the plastic fibre increased. In this study, recycled plastic bottle have been introduced in crush form as the fibre. The replacement has been done by weight calculation instead of volume calculation.

MATERIALS

The materials used in the production of plastic and coconut waste blocks

1) Plastic waste
2) Fine aggregates (sand)
3) Mould
4) Engine oil (lubricant)
5) Cement
6) Coconut fibre
7) Weighing balance

COLLECTION OF MATERIALS

In this project, the following materials were used

Plastic waste: - plastic waste used in this project was gathered from the surrounding in landmark university omu aran, kwara state, Nigeria.

Figure 1: Shows the processing of the burn plastic waste

Fine aggregate: - fine aggregate (sand) was obtained in Landmark University, which is commonly known as sharp sand and was the fine aggregate. The sand was free from debris and was sharp.it is a granular material used as filler material in the sample constituent.

Engine oil: - engine oil was gotten from bovas filling station in offa garage Ilorin kwara state. It is use as a form of lubricant to help the removal of the moulded blocks from the mould

Cements: - Normal Portland cement (Dangote cements) was utilized as a stabilizer. Stabilizers can be made from a variety of materials, including cement, lime, and more. Because there is very little clay in the soil, the scientists elected to employ cement as a stabilizer. Most researchers prefer to utilize cement in small amounts as soil stabilizers. In comparison to lime, cement offers higher strength and bonding.

Coconut fibre: - was gotten from a remote area in epe, lagos state .and was transported directly to Water absorption test

In this test, bricks are weighed in dry condition and let them immersed in fresh water for 24 hours. After 24 hours of immersion, those are taken out from water and wipe out with cloth. Then, brick is weighed in wet condition. The difference between weights is the water absorbed by brick. The percentage of water absorption is then calculated. The less water absorbed by brick the greater its quality. Good quality brick doesn't absorb more than 20% water of its own weight.

Procedures

1) Dry the specimen in a ventilated oven at a temperature of 105°C to 115°C till it attains substantially constant mass.
2) Cool the specimen to room temperature and obtain its weight (M_1) specimen too warm to touch shall not be used for this purpose.
3) Immerse completely dried specimen in clean water at a temperature of 27+2°C for 24 hours.
4) Remove the specimen and wipe out any traces of water with damp cloth and weigh the specimen after it has been removed from water (M_2)
5) Water absorption, % by mass, after 24 hours immersion in cold water

$$W = M_2 - M_1/M_1 \times 100$$

Compressive Strength Test

Concrete testing and concrete compressive strength are essential pieces of knowledge for structural design. To ensure that the concrete grade specified in the structural design is satisfied, a mix design is performed as the initial stage in evaluating compressive strength. Concrete's strength is measured by concrete cube testing, sometimes referred to as cylinder testing.

Procedure

1. The specimens were taken out of the water after a predetermined curing period and left to dry.
2. The specimen was positioned in the machine so that the load was applied to the sandcrete blocks' opposing faces.
3. The specimen was centered on the machine's base plate.
4. The movable piece was gently turned by hand until it made contact with the specimen's top surface.
5. The load was constantly applied at a rate of 140 kg/cm2/minute until the specimen failed gradually, without shock.
6. The maximum load at failure was noted.

Flexural Strength Test

The flexural test assesses the tensile strength of concrete indirectly. It assesses an unreinforced concrete beam or slab's capacity to survive bending failure. The results of a concrete flexural test are expressed as a modulus of rupture (MR), which is measured in MPa or psi.

Apparatus/Equipment

1. Sandcrete mold
2. Tamping bar
3. Flexural test machine

Figure 2: Flexural strength test

Figure 3: tested samples after crushing

RESULTS AND CONCLUSION

This chapter shows the analysis of the results of the various tests conducted. The study aims to show the assessment performance of petrol chemical plastic waste with coconut fibre for building blocks. All specimens were produced, and tests were carried out as described in chapter three.

Water Absorption

Based on the experimental program discussed in chapter three , this chapter presents the test results, analysis and discussions which were

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done on building blocks.Water absorption test After 28 days of manufacture, a cold water absorption test was conducted on each mix using two specimens from each design mix sample. Dry weights were recorded, and samples were then placed in the curing tank for 24 hours before being removed to determine their weight after immersion.

Table 1: Normal Sandcrete Blocks after 28 days

DRY WEIGHT	WET WEIGHT	WATER ABSORBPTION
17.0	17.9	5.29
17.1	18.0	5.26
17.2	17.8	3.49
17.3	18.1	4.62
17.5	18.4	5.14
17.6	18.4	4.55

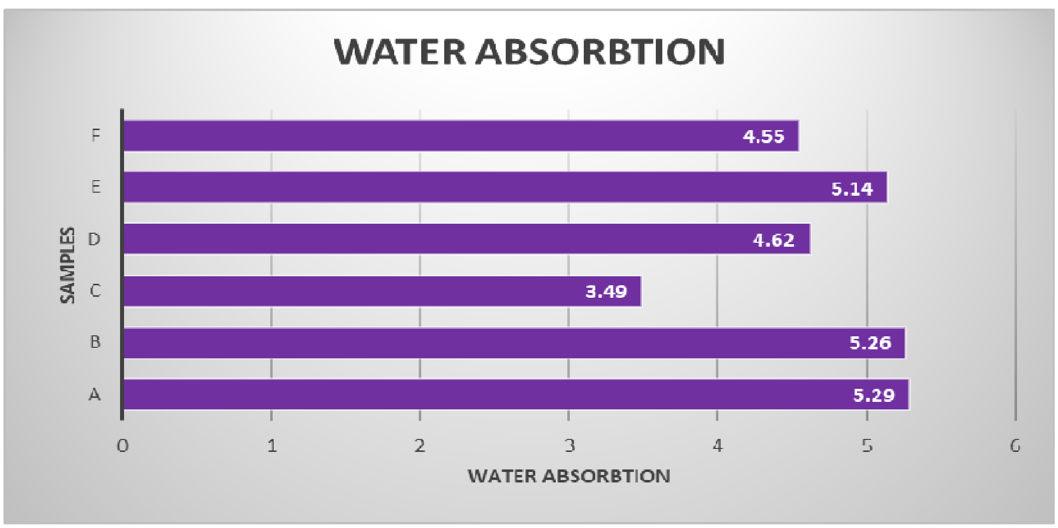

Figure 4: Water Absorption for blocks made from coconut fibre and plastic waste at 28 days

Table 2: Water Absorption for blocks made from coconut fibre and plastic waste at 28 days

Dry Weight	Wet Weight	Water Absorbtion
18.9	20.1	6.35
18.9	20.3	7.41
18.6	20.4	9.68
18.9	20.7	9.52
18.8	20.6	9.57
18.9	20.7	9.5

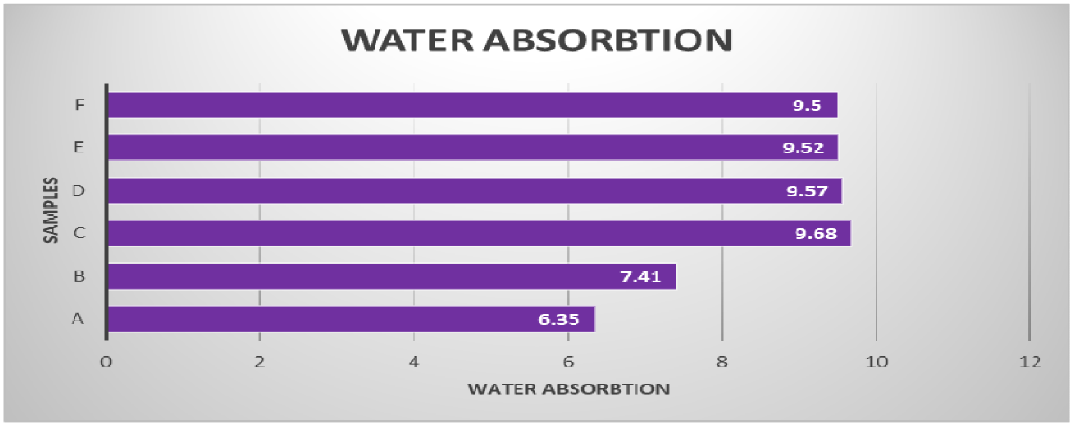

Figure 5: Water Absorption Test Result

After being submerged in water for 24 hours with 12 sandcrete blocks (six regular and six with coconut fiber and plastic waste), it was found that the blocks with coconut fiber and plastic waste absorbed more water than the other 6. According to my results, the highest water absorption for sandcrete blocks is 5.29%, while the lowest is 3.49%, and the highest absorption rate for blocks made of coconut fiber and plastic waste is 9.68%, while the lowest is 6.35%. The fact that the concrete buildings made with coconut fiber and plastic waste passed the water absorption test demonstrate that the standard water absorption shouldn't be higher than 12% at maximum

Compressive Test

The samples that are created are put through a crushing test to evaluate their durability and mechanical qualities in order to calculate their compressive strengths. Three samples of a certain mix design are tested, and the compressive strength value for that mix is calculated as the average of those three results.

$F_c = {}^{P}/_{A_c}$

Where:

F_c =Compressive strength F_{cu} (N/mm^2)

P=Maximum load at failure (KN)

A_c = Cross-sectional area (mm^2)

The table below shows the result of compressive strength tests at 7 days

Table 3:Sandcrete blocks after 7 DAYS

Sample	Sample Weight	Compressive Strength (KN)
A	19.5	30
B	17.5	28
C	19	31
D	18.1	27
E	19	30
F	19.5	28

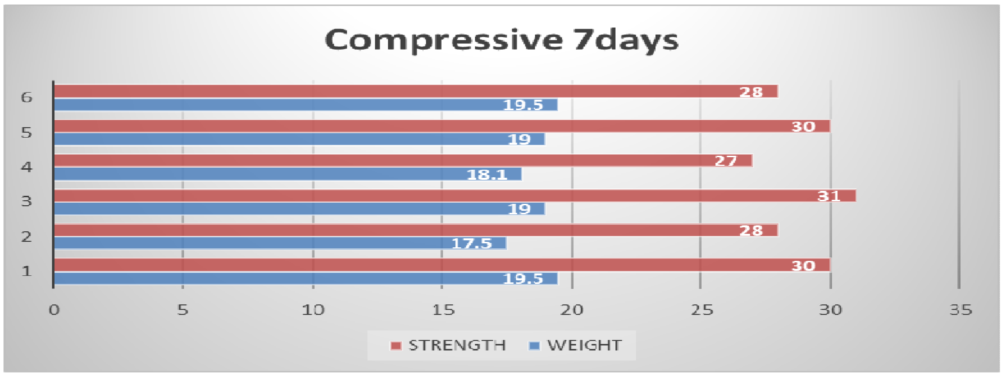

Figure 6: Compressive Test Result after 7 days of curing

The compressive strength of the blocks is shown in the table and the picture above after seven days of curing. The compressive strength is fairly low in comparison to blocks after 28 days. The fact that only 9% of the block reaches full strength after 7 days of curing illustrates the importance of appropriate curing for block strength. The control sample has the highest compressive strength, whereas the strength at 10% is the closest to that of the control sample.

Table 4: shows the result of the compressive strength test at 14 days

Sample	Sample Weight	Compressive Strength (KN)
A	17.2	30
B	17.1	27
C	17.0	30
D	17.3	21
E	17.5	32
F	17.6	32

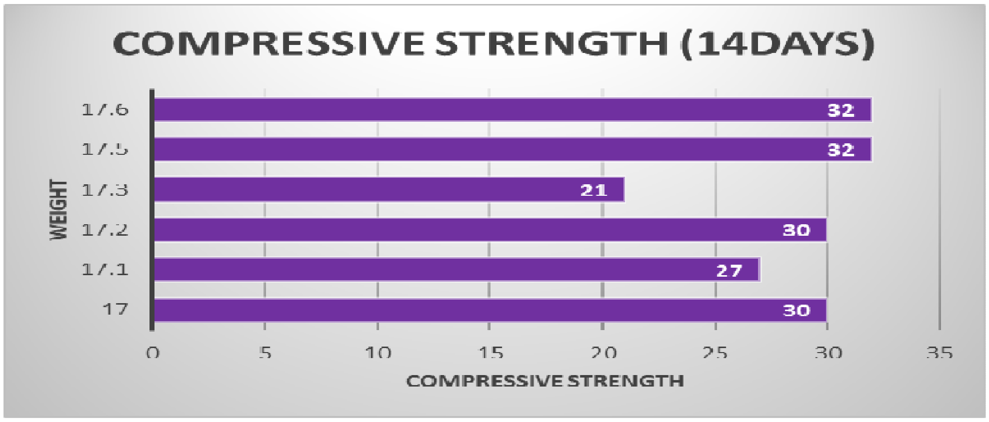

Figure 7: compressive strength result after 14 days of curing

It was observed that the compressive strength after 14 days of curing was relatively high compared to that of 7 days. Sample E and sample F had the highest strength while sample D had the lowest

Table 5: Compressive Strength test result

Sample	Sample Weight	Compressive Strength(KN)
A	17.0	35
B	17.2	43
C	17.3	41
D	17.2	45
E	17.4	38
F	17.2	46

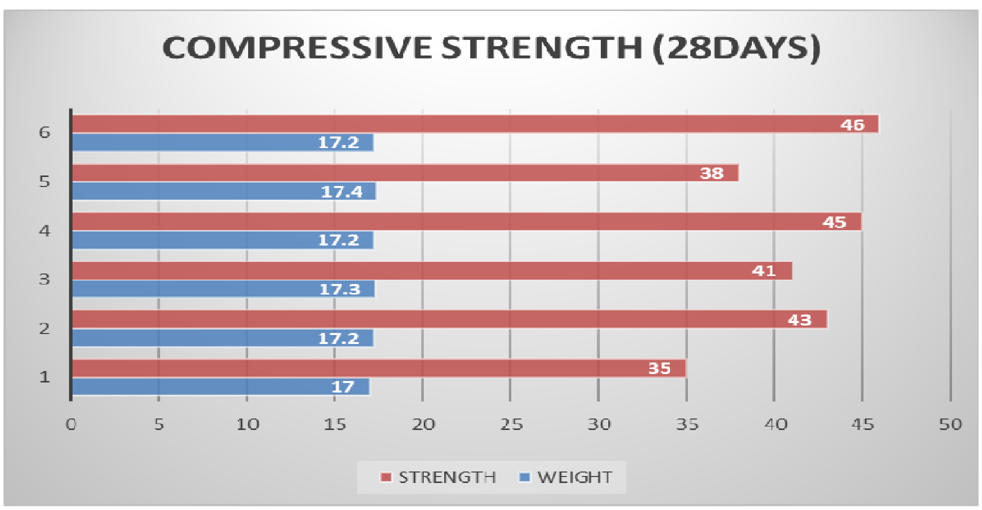

Figure 8: Compressive Strength after 28 days of curing

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The table and chart above shows the compressive strength of the blocks after 28 days, it shows that sample F had the highest while sample A had the lowest.

Table 6: Compressive strength for 7 days of sandcrete blocks mixed with coconut fibre in various percentage

Batch/Block Number	Surface Area (mm^2)	Maximum Load (P) (KN)	Compressive strength (N/mm^2)	Average compressive strength (N/mm^2)
0% Block 1	101250	3037.5	30	
Block 2	101250	2733.75	27	28.67
Block 3	101250	2936.25	29	
5% Block 1	101250	3240	32	
Block 2	101250	3138.75	31	31
Block 3	101250	3037.5	30	
10% Block 1	101250	2936.25	29	
Block 2	101250	3138.75	31	30.3
Block 3	101250	3138.75	31	
15% Block 1	101250	3936.25	29	
Block 2	101250	3037.5	30	30.3
Block 3	101250	3240	32	

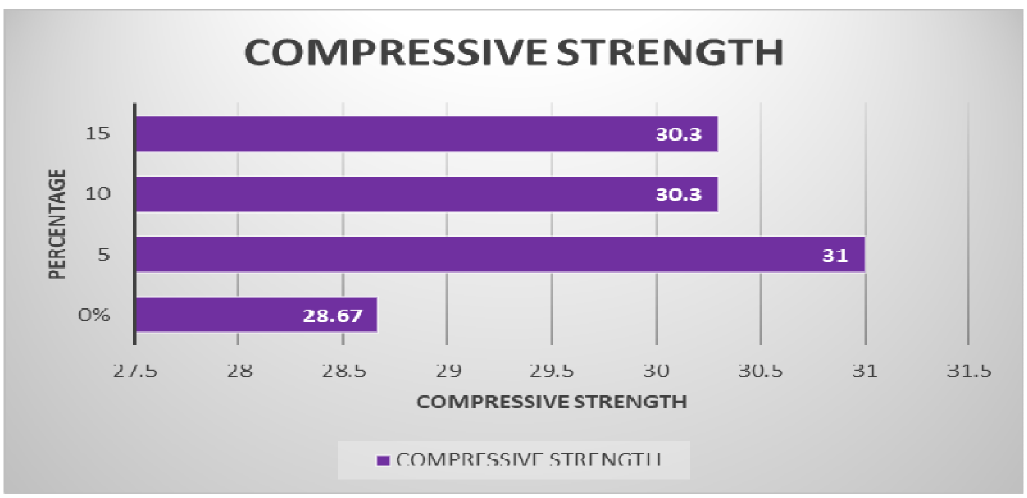

Figure 9: Compressive Strength after 28 days of curing

The table below shows compressive strength for 28 days of sandcrete blocks mixed with coconut fibre in various percentage, it was observed that the 5% mix sample had the highest compressive strength, while the one with 0% had the lowest strength.

Table 7: Compressive Strength Result for coconut fibre

Batch/Block Number	Surface Area (mm^2)	Maximum Load (P) (KN)	Compressive strength (N/mm^2)	Average Compressive Strength (N/mm^2)
0% Block 1	101250	3138.75	31	
Block 2	101250	3341.25	33	31.67
Block 3	101250	3138.75	31	
5% Block 1	101250	4050	40	
Block 2	101250	4050	40	39.67
Block 3	101250	3948.75	39	
10% Block 1	101250	4252.5	42	
Block 2	101250	4353.75	43	43.33
Block 3	101250	4556.25	45	
15% Block 1	101250	5062.5	50	
Block 2	101250	4961.25	49	47
Block 3	101250	4252.5	42	

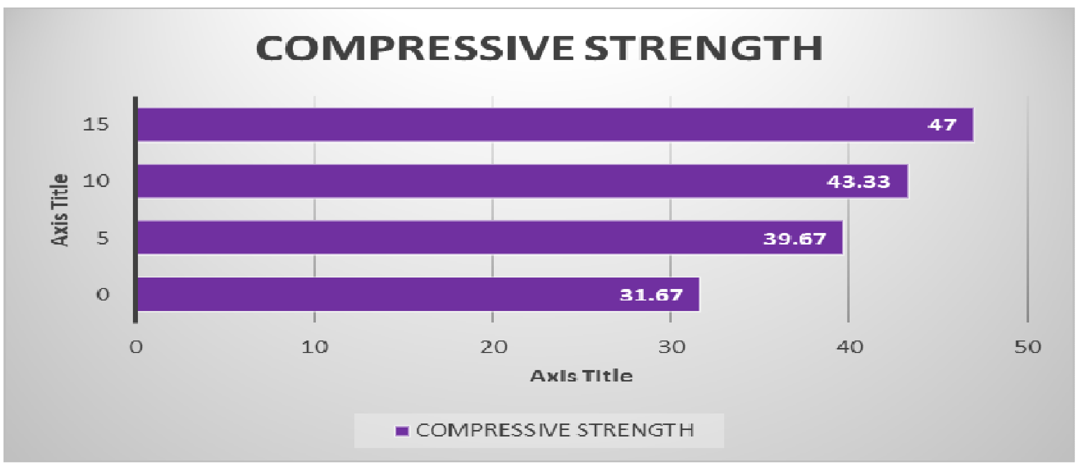

Figure 10: Compressive Strength test result

According to my observation from the tables above, it was noticed that the more coconut fibre and plastic waste was added to the block the stronger the block becomes, looking at the table above and chart above the 15% had the highest compressive strength. The 28 days curing sample of 15% content of oconut fibre and plastic waste had the overall highest compressive strength.

FLEXURAL STRENGTH

Test was conducted on a total of 24 sandcrete blocks. Three sandcrete from each mix batch were tested for 7 days and 28 days of curing. The flexural strength test was calculated based on BS EN 12390-3 using the formula below.

$F_b = pl/bd^2$

Where:

F_b = Flexural strength

b = width of specimen (mm)

d = failure point depth (mm)

l = supported length (mm)

p = max Load (kg)

Table 8: the flexural strength test for sandcrete blocks after 7 days of curing.

Sample	sample Weight	Max Load	Flexural Strength
A	17.0	14	0.83
B	17.2	8	0.47
C	17.3	9	0.53
D	17.2	11	0.65
E	17.4	9	0.53
F	17.2	10	0.59

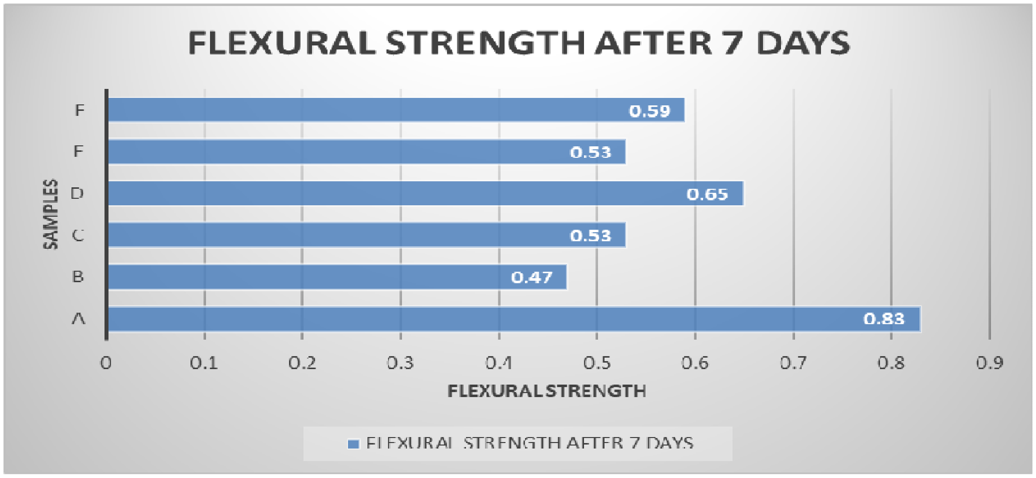

Figure 11: Flexural strength after 7 days of curing

According to the table and chart above sample A had the highest flexural strength with 0.83 and sample b had the lowest flexural with 0.47.

Table 9: Shows the flexural strength test for sandcrete blocks after 28 days of curing.

sample	sample weight	max Load	flexural Strength
A	17.0	15	0.89
B	17.2	16	0.95
C	17.3	15	0.89
D	17.2	20	1.19
E	17.4	21	1.24
F	17.2	24	1.42

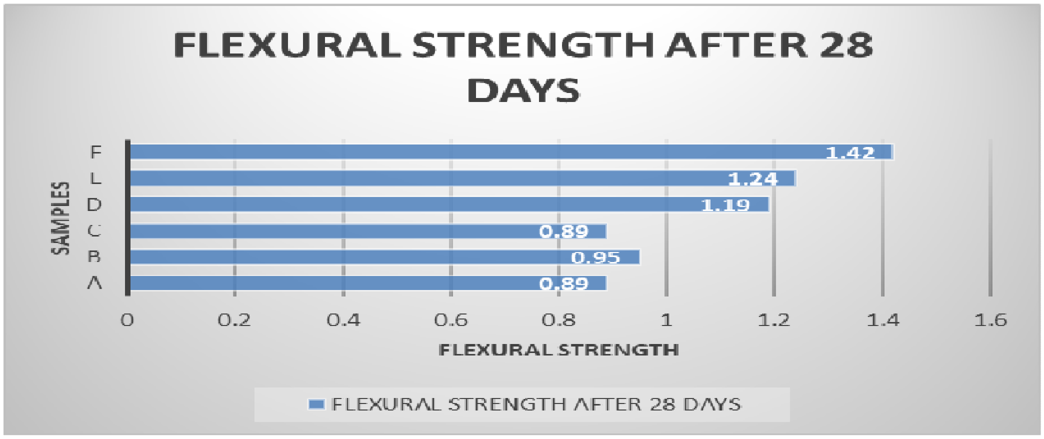

Figure 12: Flexural strength after 28 days of curing

According to the table and chart above sample f had the highest flexural strength and sample A and sample C had the lowest.

Table 10: Shows the flexural strength for plastic waste and coconut fibre blocks after 7 days

Batch/Cube	Max load (kg)	Average Load (Kg)	Average Flexural Strength (MPa)
0% Beam 1	12		
Beam 2	11	12.67	1.126
Beam 3	15		
5% Beam 1	11		
Beam 2	13	12.33	1.096
Beam 3	13		
10% Beam 1	13		
Beam 2	12	18.3	1.157
Beam 3	14		
15% Beam 1	12		
Beam 2	12	17.67	1.571
Beam 3	14		

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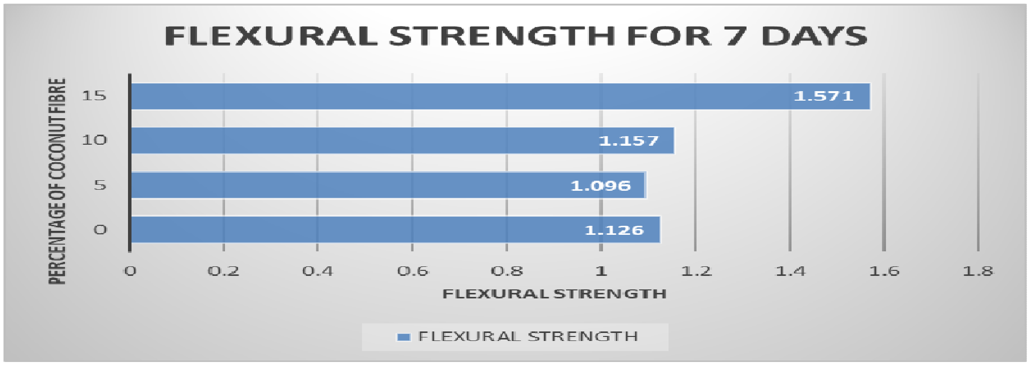

Figure 13: Flexural strength result after 7 days of curing

According to the table and chart above the block with 15% CF and PW had the highest flexural strength after 7 days.

Table 11: Shows the flexural strength for plastic waste and coconut fibre blocks after 28 day.

Batch/Cube	Max load (kg)	Average Load (Kg)	Average Flexural Strength (MPa)
0% Beam 1	11		
Beam 2	18	14.33	1.274
Beam 3	14		
5% Beam 1	10		
Beam 2	15	12.67	1.126
Beam 3	13		
10% Beam 1	17		
Beam 2	16	17.67	1.571
Beam 3	20		
15% Beam 1	21		
Beam 2	18	20.33	1.81
Beam 3	22		

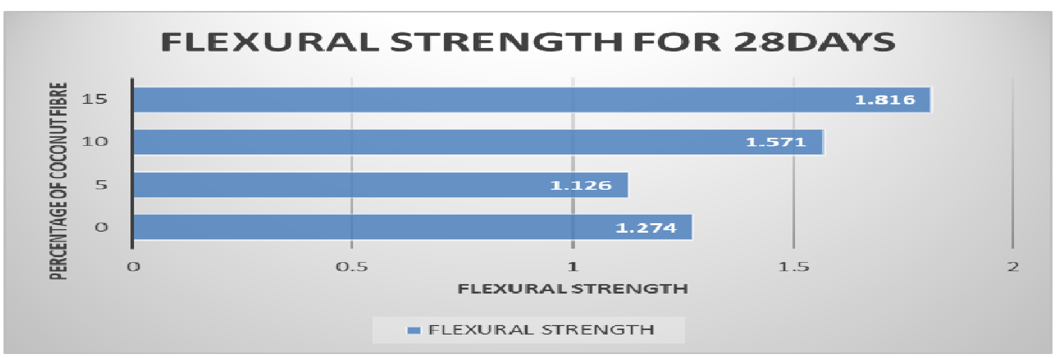

Figure 14: Flexural strength result after 28 days of curing

According to the table and charts above, the 15% of CF and PW had the highest flexural strength 1.816 and the one with 5% had the lowest strength with 1.126 after 28 days

CONCLUSION

In Nigeria plastic waste and coconut fibre are generally seen as a waste substance that has negative effects on the environment especially the atmosphere (when burning coconut fibrefor cooking , and when plastics are left exposed in water bodies, they cause harm to the aquatic habitat. In this project the use of plastic waste and coconut fibre waste as addition to sandcrete blocks to improve the strength. The following conclusions can be seen based on the outcomes of the various tests that were concluded:

1. All the tested samples all exhibited strength, at 15% of addition of coconut fibre and plastic waste had the highest strength after 28 days.
2. Melted petroleum chemical plastic and coconut fiber increased the flexural strength.
3. Utilizing coconut fibre and plastic waste will improve strength and durability of buildings.
4. When compared to 7 days and 28 days batches, all batches of blocks showed an increase in strength indicating the impact of curing.
5. It is advisable to make use of plastic waste and coconut fibre to help preserve the environment and aquatic bodies.
6. Samples containing coconut fibre absorbed more water when compared to regular blocks.

RECOMMENDATION

1. The coconut fibre must be cut evenly to ease removal of the block from the mould.
2. The petrol chemical plastic waste should be burnt in a controlled environment to prevent harm to the environment and passerby.
3. The petrol chemical plastic waste while melting must be observed to prevent it from burning.
4. By extending the curing period, further research and observation should be done to determine how curing affects blocks made of melted petroleum chemical plastic and coconut fiber.

5. To determine how it can be employed in the construction of concrete, more research on melted petroleum chemical plastic and coconut fiber is needed.

REFRENCES

Bahraini, A. (2018, July 17). *7 Types of Plastic that You Need to Know*. Waste4Change. https://waste4change.com/blog/7-types-plastic-need-know/

Tempa, K., Chettri, N., Thapa, G., Phurba, Gyeltshen, C., Norbu, D., Gurung, D., & Wangchuk, U. (2021). An experimental study and sustainability assessment of plastic waste as a binding material for producing economical cement-less paver blocks. *Engineering Science and Technology, an International Journal*. https://doi.org/10.1016/j.jestch.2021.05.012

s

Oa, A., & Oa, A. (2019). Public and Environmental Health Effects of Plastic Wastes Disposal: A Review. *Clinmedjournals.org*. https://doi.org/10.23937/2572-4061.1510021

Lamba, P., Kaur, D. P., Raj, S., & Sorout, J. (2021). Recycling/reuse of plastic waste as construction material for sustainable development: a review. *Environmental Science and Pollution Research*. https://doi.org/10.1007/s11356-021-16980-y

Ghabchi, R., Dharmarathna, C. P., & Mihandoust, M. (2021). Feasibility of using micronized recycled Polyethylene Terephthalate (PET) as an asphalt binder additive: A laboratory study. *Construction and Building Materials*, *292*, 123377. https://doi.org/10.1016/j.conbuildmat.2021.123377

Krishna. (2019, February 13). *Compressive Strength of Concrete | Cube Test, Procedure, Results & FAQ*. CIVIL READ. https://civilread.com/compressive-strength-of-concrete-test/

da Silva, T. R., de Azevedo, A. R. G., Cecchin, D., Marvila, M. T., Amran, M., Fediuk, R., Vatin, N., Karelina, M., Klyuev, S., &

Szelag, M. (2021). Application of Plastic Wastes in Construction Materials: A Review Using the Concept of Life-Cycle Assessment in the Context of Recent Research for Future Perspectives. *Materials, 14*(13), 3549. https://doi.org/10.3390/ma14133549

Prasad (2020). *Compressive Strength of Concrete and Concrete Testing*. [online] Structural Guide. Available at: https://www.structuralguide.com/compressive-strength-of-concrete/.

Rankin, G. A. (1916). Portland cement. *Journal of the Franklin Institute, 181*(6), 747–784.

A.J.Gana et el. (2019). Strength evaluation of different cement brands in the production of interlocking paving stones. IOP can, series: Earth and Environmental Sciences.