RESEARCH ARTICLE

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The utilisation of End-of-Life Plastics for the production of paver blocks: A waste management and disposal strategy

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Abstract: The volume of municipal solid waste in developing countries continues to grow, yet disposal and management have become significant challenges. As a result, a proper disposal strategy is required. The feasibility of making paver blocks from plastic waste for construction work was investigated in this study. Paver blocks manufactured from plastic waste (PP and HDPE) and sand in varied proportions were evaluated for compressive strength, water absorption, and abrasion resistance. Paver blocks were manufactured with plastic (PP and HDPE) to sand ratios of 30:70%, 40:60%, 50:50%, 60:40%, and 70:30%, or PP30, PP40, PP50, PP60, and PP70, and HDPE30, HDPE40, HDPE50, HDPE60, and HDPE70. The paver blocks were inspected after 28 days. Compressive strength, LA abrasion, and water absorption of paver blocks increased from 30% to 40% HDPE, then fell to 70%. As paver block PP content grew from 30% to 70%, abrasion and water absorption decreased. The compressive strength of PP paver blocks declined from 30% to 50% PP, then increased somewhat, and then fell to 60% and 70% PP. PP60 and HDPE40 paver blocks had the highest compressive strength, abrasion value, and water absorption. HDPE40 pavers have lesser water absorption and more abrasion than PP60 pavers. PP60 water absorption and abrasion were 0.53% and 11%; HDPE40 was 0.03% and 24.2%. PP60 and HDPE50 have compressive strength, abrasion resistance, and water absorption of 20.09 MPa, 11%, and 0.53%, respectively, and 13.06 MPa, 12.1%, and 0.03%.

Keywords: Paver blocks, Polypropylene (PP), High-density Polyethylene (HDPE), Compressive Strength, Abrasion Resistance, Water Absorption

1. Introduction

The global annual primary plastic waste generation (in tonnes) for High-Density Polyethylene (HDPE) and Polypropylene (PP) as of 2015 was 40000000 and 55000000, respectively [1]. In general, plastic waste (End-of-Life plastics, ELP) production has risen from 5.5 to 100 million tons from the 1950s to the early 2000s [2]. It is currently 300 million tons per year across the world [3]. Therefore, plastic waste management is of great concern due to the rate of generation and its inability to degrade in the natural environment.

Plastics have become the material of choice due to their durability, lightweight, resistance to natural degradation processes, and cheapness compared to other materials. However, plastic has the disadvantage of being non-biodegradable, posing a health and environmental concern, and being difficult to reuse or recycle. Notwithstanding the low biodegradability of plastic waste and the potential for long-term negative environmental and health consequences, single-use polyethylene (HDPE) drinking water sachets and domestic products such as buckets, bowls, chairs, and tables made from polypropylene are widely used across Africa and Ghana in particular. The challenges associated with managing and disposing of these plastic wastes have necessitated the need to reduce and reuse recycling, which is beneficial in many ways. For example, it helps conserve and protect limited resources by using the waste as raw materials, decreases indiscriminate disposal and reduces landfilling to conserve land for alternative uses.

Furthermore, considering that high-density polyethylene and polypropylene are the world's second and third-largest plastic resins by production volume [4], there is a need to find an alternative use for the ever-increased waste from these plastics. One way of approaching and solving the negative influences associated with plastic waste is by converting these materials into other products [5]. One such product could be plastic concrete made by mixing cement and plastics, a cost-saving approach since the cost of cement keeps increasing in the market.

In recent years, there has been tremendous growth in the use of concrete, which is now projected to be approximately 30 billion metric tons per year globally [6]. The parallel pattern of increase in concrete use gives a perfect opportunity to reuse and recycle wastes like PP and HDPE as composite materials in concrete production. Plastic waste represents one of the most common types of solid urban waste surveyed 93 houses from Takoradi, Ghana, over five weeks and had 1334.98 kg of End-of-Life Plastics (ELP), accounting for 11.3% of the overall waste stream [7].

Earlier research has established the potential of PP and HDPE waste to replace aggregates in concrete, which presents a better option than landfilling and encourages a better disposal strategy [8, 9, 10, 11, 12]. Therefore, using plastic waste in construction will not only serve to remove plastics from the waste stream but may increase the properties of the concrete [5].

Research carried out by several researchers has reported on the engineering and strength properties of plastic concrete and paver blocks and mentioned that the engineering properties such as impact value, abrasion value and Los Angeles abrasion value of aggregates increased with the addition of a different percentage of plastics in research for the potential use of waste plastic as a modifier for asphalt concrete and cement paver [11] investigated the feasibility of using waste plastic as a partial replacement for sand and observed that density, compressive strength (CS), flexural strength and splitting tensile strength decreased as the plastic content increased [13]. However, water absorption increased with increasing plastic content. It was concluded that modified paver blocks would contribute to the disposal of plastics and also use waste plastic for the construction of a plastic-coated aggregate asphalt paver to serve as a process to dispose of waste in an eco-friendly manner by producing a flexible paver. The results showed an improved quality of paver and road with improved strength qualities. There was no water absorption, increasing CS and abrasion with increasing plastics used for coating [14].

Jassim (2017) looked at making plastic cement out of plastic and Portland cement and the results showed a possible combination of polyethylene waste and Portland cement of 60% and 40%, respectively. The density, water absorption, and CS decreased, ductility increased, and workability improved [15]. investigated the use of plastic scrap waste (SPW) and foundry sand (FS) to create bricks and reported an increased ductility potential of 85% strength greater than fired clay bricks; CS twice greater than that of clay-fired bricks; low water absorption [16]. explored the conversion of plastic waste into paver blocks in Ghana. The results showed that at 20% plastic composition, the water absorption of plastic-pit sand paver block (PPPB) and plastic-sea sand paver block (PSPB) was maximised. A larger quantity of plastic decreased the block water absorption but improved the CS. The results suggest that converting plastic waste into paver blocks is feasible and can help reduce the rapid accumulation of plastic waste [12]. In summary, the strength properties of the products (paver block, concrete) were determined by all the authors. However, the paver or concrete blocks that utilise the most plastics were not determined.

In this work, the most relevant knowledge about these properties will be documented to establish standards for producing paver blocks that will use the highest amount of plastic to enhance the proper management of plastics in the waste stream.

2. Materials and Methods

2.1 Materials

2.1.1. Fine Aggregate

The builder's sand (river sand) obtained locally from Tarkwa in the Tarkwa-Nsuaem Municipality was used as fine aggregate in the study. The parameters that define the quality of the fine aggregate, such as clay/silt, specific gravity, fineness modulus, and particle size/grading of the sand [17], were determined according to the British standard (Table 1). Fine aggregate consists of natural or manufactured sand with particle sizes ranging up to 9.5 mm (3/8 in). The fine aggregate was dried and passed through a 5 mm sieve to remove debris, roots, and particles larger than 5 mm per the fine aggregate requirement for concrete work that does not exceed 5 mm [17]. Sieve analysis was done to determine the particle size distribution. The fine aggregate used in this study is shown in Figure. 1

Table 1. Tests and Standards

SN	Test Conducted	Reference Standard
1.	Particle Size Distribution/Grading	BS 812: Part 103
2.	Specific Gravity	BS 1377:Part 2:1990
3.	Silt/Clay Content	BS 1377:Part 2:1990
4.	Fineness Modulus	BS 812:Part 103
5.	Water Absorption	BS 812:Part 2:1975

Figure 1. Fine aggregate for paver production

2.1.2 Polymeric Material

End-of-life plastics such as PP (buckets, tables, and chairs) and HDPE (water sachets) used for the study were collected from around Tarkwa in the Tarkwa-Nsuaem Municipality, located in the Western region of Ghana. The plastics were washed and cleaned to remove any dirt obstructing their melting and then shredded.

Figure 2. Shredded PP plastic

Figure 3. Shredded HDPE

2.1.3. Water Absorption Test

The water absorption test was carried out on the composite samples to ascertain their suitability for floor tiling. Air-dried specimens in the form of 50 * 50 * 50 mm^3 cubes were weighed to determine their masses and tested for water absorption based on BS 812: Part 2:1975.

At durations 7, 14, and 28 days, the blocks were immersed in cold distilled water at 25 °C for 24 hours. After 24 hours of immersion, the weight of the immersed sample was recorded after cleaning off the water on the sample. The water absorption of the specimen was calculated as a percent increase in mass resulting from water immersion. Lower water absorption implied better impermeability to water [18], as expressed in equation (1)

$$Water\ absorption = \frac{W2 - W1 \text{ X } 100}{W1} \qquad \text{Eqn (1)}$$

Where: W1 is the weight of the sample before immersion into water

W2 is the weight of the sample after immersion in water

2.1.4.Los Angeles Abrasion Resistant Test (Los Angeles Abrasion)

The percentage of wear and tear values of plastic-sand paver blocks produced in this study were determined through the Los Angeles abrasion (LAR) test with the BS 812: Section 105.1:1990 standard. First, the portion of a plastic-sand paver block sample that remained on the 1.70 mm (No. 12) sieve and a specified number of steel balls was placed in a huge rotating drum with a shelf plate attached to the exterior wall. Next, the drum revolved for 500 revolutions at 30–33 rpm (rpm). Afterwards, the oversize and undersized material of the 1.70 mm (No. 12) was recorded. Finally, the weight of the retained (oversize) material was compared to the weight of the original sample to estimate the percentage loss. For pavers, the abrasion value should be less than 30% [14].

2.1.5.Unconfined Compressive Strength Test (UCS)/ Compressive Strength Test (CS)

The UCS was performed after the paver blocks were air-dried for 7, 14 and 28 days to determine the paver block's compressive strength. Five ratio representatives were tested for compressive strength using C089-19 N Concrete compression machine 3000 kN automatic, Servo-plus evolution according to BS EN 12390-3:2019. The UCS test was repeated with four different specimens of the same mix ratio to enhance accuracy, and the average result was recorded as the block's compressive strength. Figures 4 and 5 show the UCS equipment with samples before and after the compressive strength test.

2.2. Mix Design

The mix designs for the preparations of PP and HDPE bonded sand samples were used to explore the effect of replacing cement with plastic of varying amounts of sand on the compressive strength, water absorption, and abrasion resistance of paver blocks. The ratio of the plastics to the sand was batched by mass 30:70, 40:60, 50:50, 60:40 and 70:30% to ascertain the mix design with the desired property. For easy identification of the paver blocks prepared, the PP paver blocks with additions ranging from 30% to 70% were labelled as PP30, PP4, PP50, PP60 and HDPE as HDPE30, HDPE40, HDPE50, HDPE60 and HDPE70. The plastic (PP or HDPE), after cleaning and shredding to size between 2.36 mm and 4.75 mm, was heated to roughly 200°C and 130°C in a furnace that utilised charred palm kernel shells as fuel. After the shredded plastic had reached the desired consistency after melting, a known mass of sand was added and stirred manually with a metal rod for 5 minutes until a homogeneous blend of plastic and sand was attained. The process flowchart used to produce the plastic-bonded sand paver blocks is shown in Figure 4.

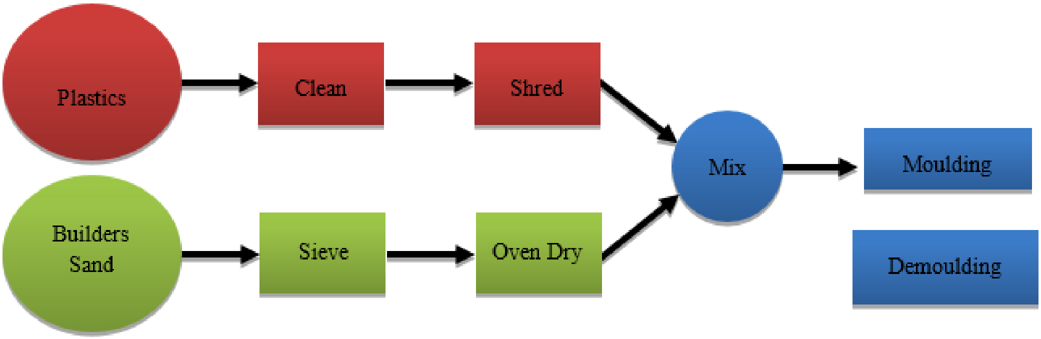

Figure 4. The Process Flowchart Used to Produce the PP Bonded Sand and HDPE Bonded Sand Paver Blocks

2.2.1. Shredding and Melting Process

Shredding cuts the plastic into small sizes between 2.36 mm and 4.75 mm [12]. Plastic for the study was first cleaned, dried, and shredded with the shredding machine to enhance rapid melting. They were then shredded into 3 mm by the shredder blades, weighed and grouped into different proportions (masses 3, 4, 5, 6, and 7 kg).

Figure 5. Brass Molds

After drying in an oven, fine aggregates of the sand were weighed and grouped into proportions (of masses 3, 4, 5, 6, and 7 kg). The molten mixture was then cast into cubes in a greased brass mould of dimension 50 x 50 x 50 mm^3 (Figure 5), levelled with a press and hand-held trowel. This was done to remove air spaces to reduce randomly distributed voids within the block matrix before they were allowed to cool and harden at room temperature. The cast cubes were tested for compressive stress, water absorption and abrasion resistance.

3.Results and Discussion

3.1. Fineness Modulus of Sand

Fine aggregate is defined as material that passes through a 4.75 mm sieve. The fineness modulus (FM) of fine aggregate is lower than coarse aggregate according to BS 812: Part 103. The FM of fine aggregate should be between 2.0 and 3.5 mm. The fine aggregate gradation was done and recorded FM of 2.58. The content of particles finer than 600 um significantly impacts the workability of the mixture and consistency and is called fine aggregate [17]. The particle size distribution results (Table 2) defined the sand as fine aggregate based on the fineness modulus recorded, which conforms to the BS 812: Part 103 specification limits.

Table 2. Particle Size Distribution

Sieve aperture (mm)	Retained (%)	Passing (%)	Cumulative retained	Fineness modulus
5.000	0.0	100	0	2.58
2.360	3.0	97.0	3.0	
1.180	3.4	93.6	6.4	
0.600	5.3	88.3	11.7	
0.300	39.2	49.1	50.9	
0.150	35.4	13.7	86.3	
PAN	13.7		100.0	
Total			258.37	

3.2. Physical parameters (pH, EC, TDS)

A given amount of dry fine aggregate sample was used in this experiment. Before use, a sample was oven-dried, a wet sample of fine aggregate.

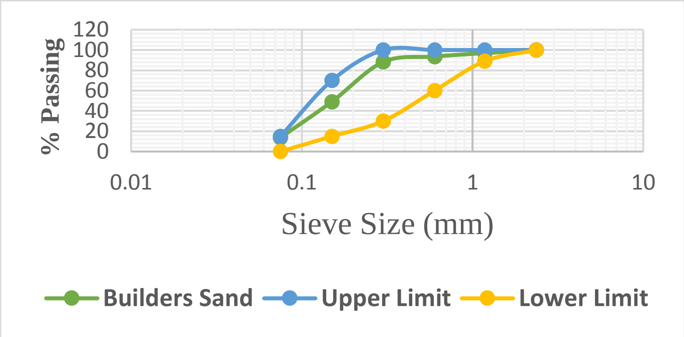

Figure 6. Grading curve of aggregate used in this study

The quantity retained in each sieve category was weighed and its percentage value was calculated against the total volume/ quantity measured. The sieve analysis results were used to calculate the levels of fineness, examine the passing and retained percentages, and plot the grading curve. Figure. 6 shows the actual grading curve that indicates the type of aggregate (fine aggregate) used in this study.

3.3. Silt content of the sands

Concrete's characteristic strength is determined by its constituent materials' quality and their mix ratios; the higher the clay/silt in the sand, the lower the characteristic strength [19]. Therefore, to ensure the strength of the hardened blocks is not affected, the silt content of the sand for the paver blocks was determined as 3.03% (Table 3), which was within the required quality standard of not more than 8%, according to IS 2386-2.

3.4. Specific gravity/Water Absorption of Sand

The specific gravity of an aggregate is an excellent predictor of its quality. A low specific gravity can indicate a high level of porosity and, as a result, a lack of tensile strength and durability. The specific gravity of the fine aggregate used for this study was 2.68, which was within the quality requirement for aggregate for concrete work between 2.6 and 3.0 [20]. Also, aggregates used for the study had a low water absorption value (0.08%) of less than 3%, which is by BS 812-2 followed in this study, according to BS 8007.

3.5 Water Absorption Test

The results of water absorption versus percentage plastics (PP and HDPE) are shown in Figure 7 and Figure 8.

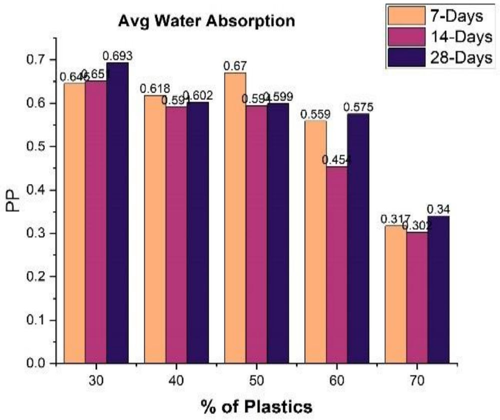

Figure 7. Avg Water Absorption, PP

The results show that the paver blocks produced from the recycled PP and HDPE absorb water after immersion into water for 24 hours. Water absorption of paver blocks produced with PP and HDPE plastics shows a general trend of decreasing water absorption with increasing plastic content. The water absorption trend remains unchanged for various mixed ratios for various curing ages.

The amount of water absorbed for all the curing age fall within the specified standard limits of not greater than 5% according to BS 13338:2003 for all plastic additions. The paver blocks made with **PP** and **HDPE** recorded water absorption between 0.3-0.69% and 0.02-0.06%, respectively. Comparatively, the **PP**-paver blocks recorded high water absorption than the **HDPE**-paver blocks. It is clear from the results obtained that paver blocks produced with **PP** and **HDPE** exhibited a low water absorption property. This implies that the paver blocks can resist absorbing water and could be used for floor and wall tiles for bathroom, kitchen, and water log areas.

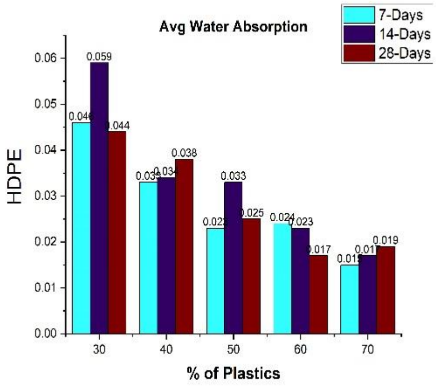

Figure8. Avg Water Absorption, HDPE

3.6 Los Angeles Abrasion Resistant Test (Abrasion Resistant Test)

The abrasion value of **PP**-and **HDPE** paver blocks is presented in Figure 9. The data generally show a decrease in abrasion resistance with an increasing plastic percentage addition. The results correlate well with previous findings [21], where paver block's abrasion values (wear and tear) reduced with an increasing percentage of plastics. The abrasion values recorded by paver blocks made with **HDPE** were 30, 24.2, 18.5, 12.1 and 10.1%, with a plastic component of 30%, 40%, 50%, and 60%, respectively. Also, the abrasion resistance value for paver blocks made of **PP** were 28.2, 20.5, 16.7, 11.0 and 8.2%. All the abrasion resistance recorded from the various mix ratios of paver blocks made with **HDPE** and **PP** were within the acceptable range of less than 35% for paver blocks [22]. The abrasion values recorded qualify the paver blocks produced for usage in the construction industry; a paver block with high resistance to wear and tear is appropriate. The paver block with a better abrasion resistance is **HDPE**70. The test outcomes indicate an improvement in wear and tear with an increase in the percentage of plastic content. Abrasion values show specimen toughness and abrasion resistance.

Under this study, as shown in Figure. 9, the abrasion value of **PP**-and **HDPE** paver blocks decreased with an increase in the percentage of plastic. The test showed good abrasion results where the wear and tear of the paver block reduced with an increasing percentage of plastics, which was observed by with an increase in the percentage of plastic content [21]. The abrasion values recorded by paver blocks made with **HDPE** were 30, 24.2, 18.5, 12.1 and 10.1%, with a plastic component of 30%, 40%, 50%, and 60%, respectively. All the abrasion values recorded were with the performance in the construction industry; a paver block with high resistance towards wear and tear is appropriate. The paver block with a better abrasion resistance is HDPE70. Also, the abrasion resistance value for paver blocks made of PP were 28.2, 20.5, 16.7, 11.0 and 8.2%. All the abrasion resistance recorded from the various mix ratios of paver blocks made with HDPE and PP were within the acceptable range of less than 35% for paver blocks [22]. The test outcomes indicate an improvement in wear and tear with an increase in the percentage of plastic content. Abrasion values show specimen toughness and abrasion resistance.

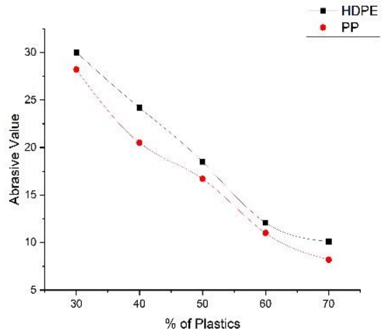

Figure 9. Abrasion Resistant Test

3.6.1. Unconfined Compressive Strength

The compressive values of PP and HDPE plastic-sand paver blocks measured in the laboratory are shown in figs 10 and 11 below.

The CS of the paver blocks specimen containing PP and HDPE at 7 days, 14 days and 28 days of curing are presented in Figure 10 and Figure 11, respectively. The CS of concrete specimens increases with the curing period [21], but the general trend of the CS of the paver blocks produced in this research decreased slightly with cement replacement by PP and HDPE at various ratios. When the plastic content increased from 30% to 70%, the CS of the PP plastic-sand pavers blocks decreased at each curing period, except the CS value of PP replacement ratio of 30%, which decreased slightly at curing day 14 from 14.4 MPa to 14.1 MPa.

The strength increased significantly on day 28 from 14.1 MPa to 15.4 MPa. At the replacement ratio of 70%, the strength increased on day 14 from 15.8 to 16.8 MPa and decreased slightly on day 28 from 16.8 MPa to 16.0 MPa. However, there was a slight difference in the strength within the curing age as the plastic content increased. As the plastic replacement ratio increased from 30% to 70%, at 7 days of curing, there was an increase when plastic increased from 30% to 70% replacement, then a slight decrease from the replacement up to 50%. There was a significant increase in strength from 50% replacement to 60% and then a significant decrease from 60% to 70% replacement.

Table 3. One-way ANOVA Test on results of compressive strength of PP-sand paver blocks

ID	PP30	PP40	PP50	PP60	PP70
PP30	*	0.2005	0.9828	0.0051	0.0343
PP40	0.2005	*	0.2961	0.0235	0.7569
PP50	0.9828	0.2961	*	0.0102	0.1372
PP60	0.0051	0.0235	0.0102	*	0.0149
PP70	0.0343	0.7569	0.1372	0.0149	*

Table 4. One-way ANOVA Test on results of Compressive strength of HDPE-sand paver blocks

	HDPE30	HDPE40	HDPE50	HDPE60	HDPE70
HDPE30	*	0.0049	0.9534	0.0985	0.0036
HDPE40	0.0085	*	0.0059	0.0002	0.0000
HDPE50	0.9534	0.0059	*	0.0685	0.0024
HDPE60	0.0985	0.0002	0.0685	*	0.0026
HDPE70	0.0036	0.0000	0.0024	0.0026	*

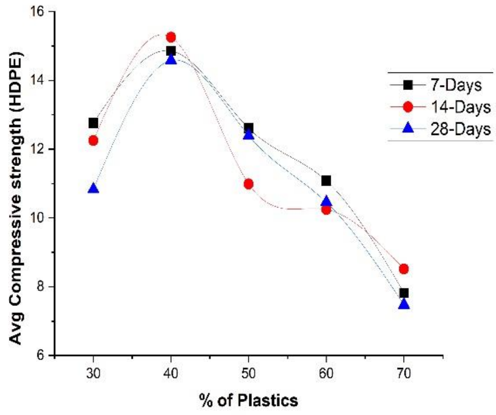

Figure 10. A graph of Avg CS of PP based on % plastics

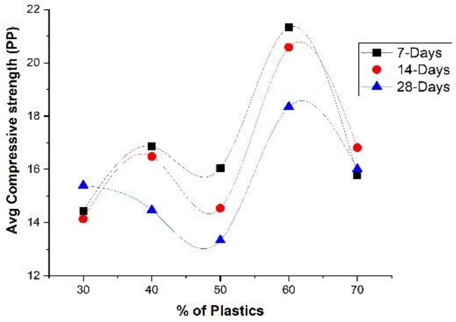

Figure 11. A graph of Avg CS of HDPE based on % plastics

The CS of the paver containing 30% HDPE after 7 days of curing was observed as 12.77 MPa and reduced by 0.52 MPa to 12.25 MPa by 14 days of curing and was further reduced by 1.42 MPa to 10.83 MPa. The trend changed with 40% and 70% of HDPE replacement of sand, where there was an increase from 7 days to 14 days of curing, but decreased afterwards; thus, CS were 14.86 MPa for 7 days and increased by 0.39 MPA but reduced by 0.67 MPa after day 14 of curing. The paver blocks containing 50% and 60% HDPE had the CS reduced from 7 days to 14 days, then increased up to 28 days of curing. The CS of 50% HDPE paver blocks was 12.61, 10.99, and 12.39 MPa for 7 days, 14 days and 28 days, respectively. CS of 60% HDPE paver block at the curing of 7 days, 14 days and 28 days were 11.08, 10.25 and 10.46 MPa, respectively. The CS of paver blocks made with PP showed a different trend where all the mixed ratios recorded a CS that reduced with increasing curing days except the mixed ratio with 30% PP that recorded CS that reduced at 14 days of curing and then the CS increased at 28 days. Paver blocks with 30% PP had CS of 14.45, 14.14 and 15.40 MPa for curing days 7, 14 and 28, respectively. In this present work, there was a general reduction in the CS, which may be caused by adhesive strength between the surface of the waste plastics and the sand [8], which could be a result of weak bonding, inadequate compacting of the paver blocks which resulted in pores deformation and cavities [21]. The CS of the paver blocks decreased with an increasing percentage of plastic replacement after recording the maximum CS at a specific mixed ratio. The paver block produced with HDPE and sand had the highest CS with a mixed ratio of 40% HDPE and 60% sand. Paver blocks produced with PP and sand had the highest CS when mixed in a ratio of 60% plastic and 40% sand. The CS of the paver blocks decreased with an increased percentage of plastic replacement in this research; the same trend was noticed by [13], who recorded a reduction in the CS with an increased percentage of plastic. In the paver block. Though the CS generally decreases with an increasing percentage of plastic (Figure 10), the CS of the various paver blocks produced were within the global standard threshold of 0.69-17.24 N/mm^2 for paver products, suitable for applications in the non-traffic area such as walkways, footpaths, pedestrian places, landscapes, and waterlogged areas. For solid waste management and disposal strategy, paver blocks produced with the utilisation of large volumes of plastic waste are the ideal optimum mixed ratio encouraged [23]. Fig 11 shows that some of the CS for various mixed designs had no statistical difference between the strength. For instance, paver blocks labelled HDPE30 and HDPE50 showed no statistical difference, meaning the CS for these paver blocks are significantly the same. Thus, instead of producing paver blocks with a ratio of plastic (HDPE): sand of 30:70, a paver block with a ratio of 50:50 of HDPE: sand would be preferred based on environmental considerations. The optimal mixed ratio to utilise the highest amount of plastic waste in the production of paver blocks is the plastic sand ratio of 50: 50 (HDPE50) and 60:40 (HDPE60). Still, HDPE50 is the ideal mix between these two mixed methods because it showed a strong no difference between HDPE 30 instead of the HDPE60, which shows a slight closeness with the HDPE30. The paver blocks produced using PP as plastic to replace cement also show some similarities in the CS of the paver blocks produced with different mixed ratios showing no significant difference. The mixed ratio that was very close in CS to PP30 and utilised the most plastics was PP50 with a P-value of 0.98, so instead of producing paver blocks with plastics: sand ratio of 30:70, paver blocks with a ratio 50:50 that utilised more plastics in the paver blocks is preferred.

3.7. Abrasion vs Compressive Strength for PP and HDPE paver blocks

Comparative studies of the abrasion and CS for the PP and HDPE paver blocks were done. From Figure 12, the mixed ratio with the best abrasion resistance was PP70 which had an abrasion value of 8.2% but had the lowest CS. Comparing the PP70 to PP60, the abrasion resistance of both paver blocks was closer, 8.2% and 11.0%, respectively, but the CS for PP60 was greater than that of PP70. Based on the CS water absorption values obtained for PP paver blocks, the best-mixed ratio with the best CS suitable for higher utilisation of plastic waste was the PP60.

From Figure 13, the paver block with the best abrasion value was HDPE70. However, HDPE70 had the lowest CS. On the other hand, HDPE50 had not had the lowest abrasion value, was within the acceptable limit and had a high CS, thus using large volumes of HDPE in the production of the paver blocks. Therefore, based on the CS and water absorption, HDPE50 was considered the optimal mix for the paver blocks made with HDPE.

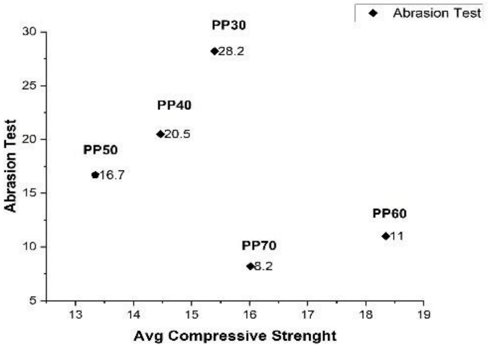

Figure 12. Abrasion vs Compressive Strength, PP

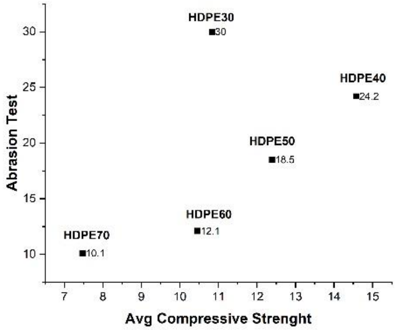

Figure 13. Abrasion vs Compressive Strength, HDPE

4. Conclusion

It was concluded that plastic wastes, PP and HDPE, which pose hazards to human beings, other animals, and the environment due to their poor management and disposal, can be used in producing paver blocks as a strategy for disposing of end-of-life plastics. Furthermore, these paver blocks could be used in the construction industry for walkways, waterlog areas, etc. From this study, the mixed ratios for PP-sand and HDPE-sand paver blocks that encourage a large volume of plastics in the production of the paver blocks and also meet the criteria for paver block production were PP60 and HDPE50, which had CS, abrasion resistance, and water absorption of 20.09 MPa, 11% and 0.53% for PP-sand paver block (PP60) and 13.06 MPa, 12.1% and 0.03% for HDPE-sand paver block (HDPE 50).

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