

Effect of Aspect Ratio of Recycled Plastic Strips on Mechanical Behavior of Concrete at Different Ages.

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Received:	20/8/2025	Accepted:	28/10//2025	Published:	30/10/2025
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Abstract

Concrete is one of the most important structural materials used in construction. The development of life has led to the appearance of a lot of waste, which affects and threatens the environment, such as plastic and household organic waste, etc. Recently, modern methods have been found to dispose of waste by recycling it using a new approach, which is green production. The reference concrete used in this research paper has a compressive strength of 37.14 MPa. Plastic water bottles, also chemically known as polyethylene terephthalate, were transformed into rectangular strips with a width of 2 mm, a length of 20 mm, and 30 mm. Thus, the aspect ratios 10 and 15. The percentages of fiber strips were 1, 2, and 3% of concrete weight for each aspect ratio. The present research examined the behavior of concrete behavior after adding plastic waste as fibers at aspect ratios of 10 and 15 at rates of 1, 2, and 3% by weight of concrete. Additionally, ninety-eight specimens were examined. Cubes ($150 \times 150 \times 150$ mm) were examined at ages 7, 14, 28, and 56 days, and 21 cylindrical specimens (150×300 mm) were examined at 28 days of age. Moreover, the workability of the fresh mixture was studied along with strength, tensile strength, ultrasonic pulse velocity, absorption and weight loss of hardened concrete. In this study, the results showed that the slump decreased with an increase in the fiber percentage, approximately 30 and 40 mm, respectively. The compressive strength was better at an aspect ratio of 15 compared to 10. Furthermore, the tensile strength of all ratios increased (13, 10.4, and 5.5%) at an aspect ratio of 15, which also reduced absorbability. The results showed a gradual but slight weight loss. In general, the result was better at an aspect ratio of 15.

Keywords: Absorption, Aspect ratio, Compressive Strength, Tensile Strength, UPV pulse velocity, Waste plastic strips.

Introduction

Concrete is one of the most widely used structural materials in construction, road pavements, precast structures, airports, and all other structures. This is due to many reasons, including its ease of preparation and transportation, workability, strength, and durability, in addition to being fairly inexpensive to manufacture. In general, concrete consists of basic materials: cement, coarse and fine aggregate, and water. It is used in residential buildings, hospitals, dams, nuclear facilities, etc. Concrete consists of the basic ingredients: cement, water, sand, and gravel. The active ingredients that form the paste are water and cement, while gravel and sand are used as fillers. The strength and hardness of concrete depend on several factors, including the type of cement and water, the chemical interaction between them, and the gradation

of the aggregates. It is possible to add special materials to develop and improve concrete properties and thus increase the life of the concrete structure. [1,2]

As a result of the development of life, a lot of waste has appeared that threatens the environment, for example, concrete waste, ceramic waste, glass waste, plastic waste, household organic waste, etc. The impact of these wastes on the environment became very clear. This led to the urgent need to find ways to get rid of them by burning them, burying them in the ground, or throwing them in the seas and oceans [3,4]. Zongyun et al. (2025) illustrated that plastic plays crucial role in lifestyle of humans. The waste plastic increased and reached approximately 90 % of the total waste. Therefore, the recycling of it has become necessary and urgently needs [5]. Maryam et al. (2025) reported that the increase in rates of global plastic waste has been a concern. This increase is creating a real challenge for scientists, particularly as area space reduces and incineration processes release toxic fumes harm human health. Reusing waste is a sustainable solution to these problem. Some studies have reported data indicating that more structural studies on this waste plastic are needed in order to discover effective ratios of plastic for concrete to reduce the harm caused by plastic pollution [6]. Recently, modern methods have been found to dispose of waste by recycling it using a new approach, which is green production [7].

The study focuses on plastic waste; it has become an important part of our daily lives. It is found in tableware, water bottles, food packaging containers and disinfectant containers, which are its most important sources, Microbeads are found in some cosmetics, cleaning products, and fibers used in clothes. The remains of wrecked cars, which consist of mixed plastic materials and some rubber, negatively impact human health as a result of its use in packaging, food containers, medical supplies, and other items [8].

Figure 1 shows the cumulative amount of plastic waste production. In 2015, only 16% of this waste was recycled, and it is expected that by 2050, 33% of the generated waste will be recycled. However, non-recycled waste will still have an effect on the environment [9].

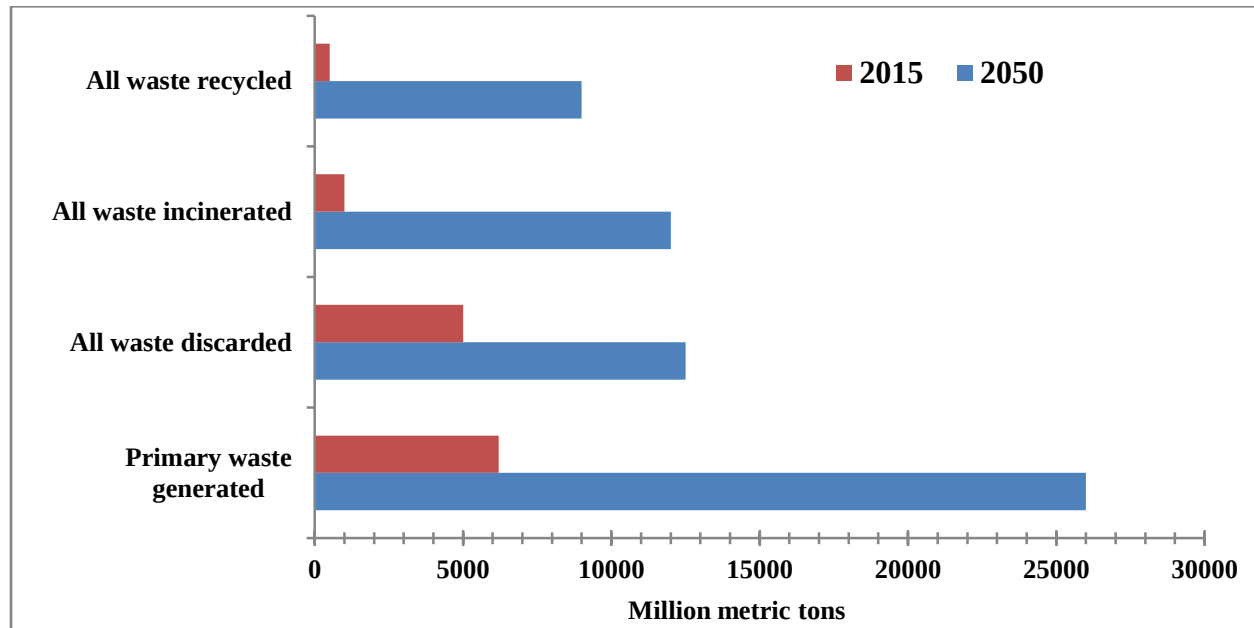


Figure 1 shows the cumulative plastic waste generation (data in 2015 and data expected until 2050) [9].

The largest component of plastic waste is low-density polyethylene (LDPE) at about 23%, followed by 17.3% of high-density polyethylene, 18.5% of polypropylene, 12.3% of polystyrene, 10.7% of polyvinyl chloride, 8.5% of polyethylene naphthalene, and 9.7% of other types [10,11,12].

Some studies have reported data indicating that there are 150 million metric tons of plastic waste in water bodies and the amount is increasing every year. This causes harm to marine life and the environment [13]. Moreover, human consumption of microplastic particles ranges between 39,000 and 52,000 particles every year after plastics decompose into microplastics, which humans ingest, which may cause harm to health [14].

Ismail and Al-Hashmi (2007) aimed to determine the efficiency of reusing plastic waste in concrete production. Plastic waste was used as a partial replacement for sand at 0%, 10%, 15%, 20% and was prepared and tested at room temperature. Additionally, measuring precipitation, fresh density, dry density, compressive strength, bending strength, and rupture were determined. Curing ages in water ponds were 3, 7, 14, and 28 days. The results showed a decrease in compressive strength, while flexural strength was 30.5% lower than the reference mix when 20% plastic waste was added and tested at 28 days. The dry density decreased to 2223.7 kg/m³, which is below the threshold for lightweight concrete, while the fresh density decreased by 5%, 7%, and 8.7% for the 10%, 15%, and 20% replacement levels, respectively. Additionally, slump test values were lower than those of the reference mix [15].

Robert (2024) reported that using raw plastic milk bottle fibers modified with silica fume (SF) to determine the compressive, flexural, and tensile strength of concrete by examining the microscopic structure of the composite through electron microscopy (SEM) and X-ray

technology (EDS) to determine the effect of SF as a modification technique. It was found that there was a good correlation between SF and plastic fibers. The modified fibers enhanced the mechanical strength and increased the density and bonding of the fibers compared to the results of the unmodified fibers, which decreased the mechanical strength by 16%, the bending by 16.6%, and the tensile strength by 11%. The current observational studies found the impact evaluation of plastic waste consolidation as reinforcement in cement concrete and observed its effect on the physical and mechanical properties of concrete. The test was conducted on concrete cubes at 7, 14, and 28 days. The basic concrete had a compressive strength of 30 MPa, and both coarse and fine aggregates were replaced with plastic waste [16].

All recent studies have shown that evaluating changes in compressive strength, external force, workability, and durability. It was found that using waste as a sustainable alternative to traditional reinforcement materials in concrete. The rebound hammer test showed the surface hardness of the concrete and the results were similar to the residue-free concrete. It was observed that compressive strength decreased by 46%, 55%, and 58% when plastic aggregates replaced 10%, 12%, and 15% of the mix, respectively [17].

I examined the effect of adding fibers from recycled plastic from plastic water bottles with dimensions of 20×2 mm and 30×2 mm. to a concrete mix with a reference compressive strength of 37.14 MPa, at a ratio of 1, 2, and 3% by weight of concrete. However, the influence of the aspect ratio of recycled PET strips on both mechanical and durability properties of concrete at different ages has not been thoroughly investigated. Therefore, this study aims to investigate the properties of fresh concrete, such as workability and the properties of hardened concrete at different curing ages, for different curing ages of 7, 14, 28, and 56 days, using fibers with aspect ratios of 10 and 15. The study used 98 standard concrete cubes ($150 \times 150 \times 150$ mm) and 21 standard cylinders (150×300 mm).

1. EXPERIMENTAL PROGRAM

2.1 Materials used

2.1.1 Cement

Locally manufactured Ordinary Portland cement of the Badush/Nineveh expansion type was used [ASTM C150/C150M-22]. The physical properties and the chemical composition of mortar cement were evaluated using a compression-flexural cement tester (Figure 2). The results are listed in Tables 1 and 2, respectively.

Table1: The physical Composition of the used Cement [18]

Property	Test result	Standard IQ
Initial setting time	120 min	≥ 45 (min.)
Final setting time	255 min	≤ 375 (min.)
Compressive strength (MPa)		
at 3 days	21.0	≥ 12.0 (MPa)
at 7 days	33.8	≥ 19.0 (MPa)



Figure 2. Compact-Line, 300 and 300/15 Kn. Top-of-the Rang Automatic, Compression-Flexural, Cement Tester.

Table2: The chemical Composition of the used Cement

Chemical Composition	Value %	Limits %	Chemical Composition	Value %	Limits %
SiO ₂	20.34	---	C3S	47.6	---
Al ₂ O ₃	4.81	---	C2S	22.4	---
Fe ₂ O ₃	3.51	---	C3A	6.79	---
CaO	61.5	---	C4AF	10.7	---
MgO	2.29	No more 6	L.S.F	91.37	---
SO ₃	1.58	2.5	Solid Solution	16.1	---
Free Lime	0.55	---			
Loss on Ignition	1.94	3			
Insoluble Residue	0.46	0.75			
Total 96.99	96.98	---			

2.1.2 Physical properties of the fine and coarse aggregate.

River aggregates, both fine and coarse, were used, in accordance with ASTM standard specifications [19], The maximum aggregate size is 20 mm and specific gravity for fine and coarse aggregates 2.65[20], 2.68[21] respectively.

The aggregates were in a saturated surface-dry (SSD) condition. Sieve analysis was conducted on the aggregate, as shown in Figure 3.

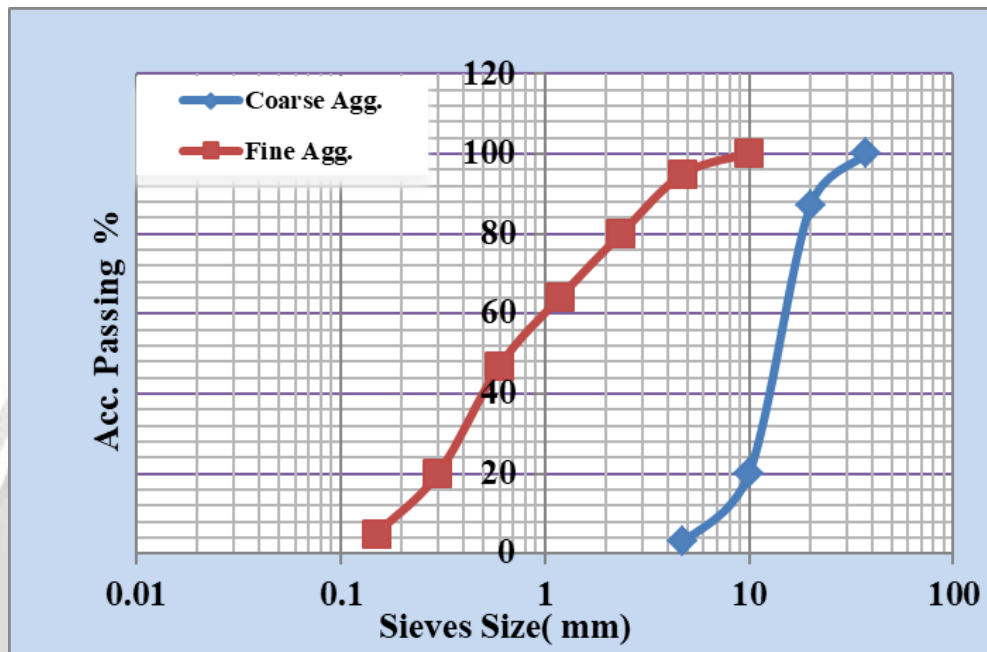


Figure 3. Shows gradation of natural fine and coarse aggregate [19].

2.1.3 Plastic strips.

Plastic water bottles, chemically known as polyethylene terephthalate [22], cut transformed into rectangular strips with a width of 2 mm, lengths of 15 mm, and 30 mm (Figure 4), Resulting in aspect ratios of 10 and 15. Mechanical fiber specifications are listed in Table 3. The percentage of fiber strips were 1%, 2%, and 3% by weight of concrete for each aspect ratio.



(A)



(B)

Figure 4. Plastic Strips that using in this study. A: Dimensions (20 ×2mm). B: Dimensions (30 ×2mm).

Table 3: Mechanical fiber specifications.

Dimensions (mm)	Aspect ratio (Length/ width)
20 ×2	10
30 ×2	15
Tensile strength 11 MPa[23] Density was 1.31 g/m ³ [22]	

2.2.Experimental Procedure

The basic mixture was designed according to the British D.O.E method [19], with reference compressive strength of 37.14 MPa. In this current study, three percentages of plastic strips (1,2, and 3%) were add to reference mixture for each aspect ratio (Table 4). A slump test was used for measuring workability for fresh concrete, in accordance with ASTM C143 [24]. Then the samples were cured in water. Room temperature and humidity were 25°C and 70%, respectively (Figure 5A, B) [25]. After that, for each concrete mixture, 12 cubes (150,150,150 mm) were prepared according to the BS standard [26]. In addition, three cylinders (150 × 300 mm) were prepared according to the ASTM standard [27].

Table 4: Mix Proportions of mixture

mix	Cement Kg/m ³	Sand Kg/m ³	Gravel Kg/m ³	Water Kg/m ³	Aspect ratio	Plastic strips %	Plastic strips Kg/m ³
1	400	640	1100	160	0	0	0
2	400	640	1100	160	15	1	23
3	400	640	1100	160	15	2	46
4	400	640	1100	160	15	3	69
5	400	640	1100	160	10	1	23
6	400	640	1100	160	10	2	46
7	400	640	1100	160	10	3	69

I performed compressive strength testing for cubes (Figure 6A). This test method consists of applying an axial compressive load to molded specimens within a prescribed range until failure. The compressive strength of the specimen was calculated by dividing the maximum load at failure during the test by the cross-sectional area of the specimen. Tensile strength testing (indirect method) was conducted on cylindrical specimens (Figure 6B). (Figure 7) shows an oven used to dry samples for 28 days to the absorption test. Then ultrasonic pulse velocity (UPV) was

performed at ages 7, 14, 28 and 56 days Figure8. The unit weight (density) of solid samples was calculated at 28 days.



(A)



(B)

Figure 5. The samples during curing in the water at the room temperature and humidity 70% (A): cube (B): cylinder.



(A)



(B)

Figure 6. illustrates samples tests (A): Compressive strength testing for cubes. (B): Tensile strength (indirect method) for cylinders. Compression Tester: LCD model. Catalog No.: B-001/LCD; Serial No.: 020112/19.



Figure7. shows oven type ELE Emiation Hemel Hempstead, Hentfordshire HP2 7HB, England Ser: D2a.88C184.



Figure8. shows ultrasonic concert tester. Ultrasonic pulse velocity (UPV) was performed at ages 7, 14, 28 and 56 days.

3.RESULTS AND DISCUSSIONS

3.1 Slump Test.

The workability of the reference concrete mix was 150 mm when the slump test was performed. After adding the waste, the readings at an aspect ratio 10, the readings decreased (150, 135, and 120) mm. At an aspect ratio 15, the results were 145, 130, and 110 mm for addition ratios of 1%, 2%, and 3%, respectively. Figure 8 displays the relationship between aspect ratio and concrete slump. In Figure (9), it was noted that the readings of concrete mixtures decreased with increasing fiber percentage. The results at the aspect ratio of 15 were less than at 10 by about 8.3% for an addition ratio of 3% as well as 2%. At an addition rate of 1%, the reading did not change at an aspect ratio of 10. In contrast, at 15, the decrease rate was approximately 3.3%. This slump may be due to several reasons, including the absorption of a portion of the mix water by the plastic fibers. The higher the aspect ratio, the greater the surface area. This increases absorption, reducing the mix water content and thus decreasing the reading. Moreover, the cohesive and frictional forces between the fibers and the concrete leads to greater cohesion and, consequently, less slump [6].

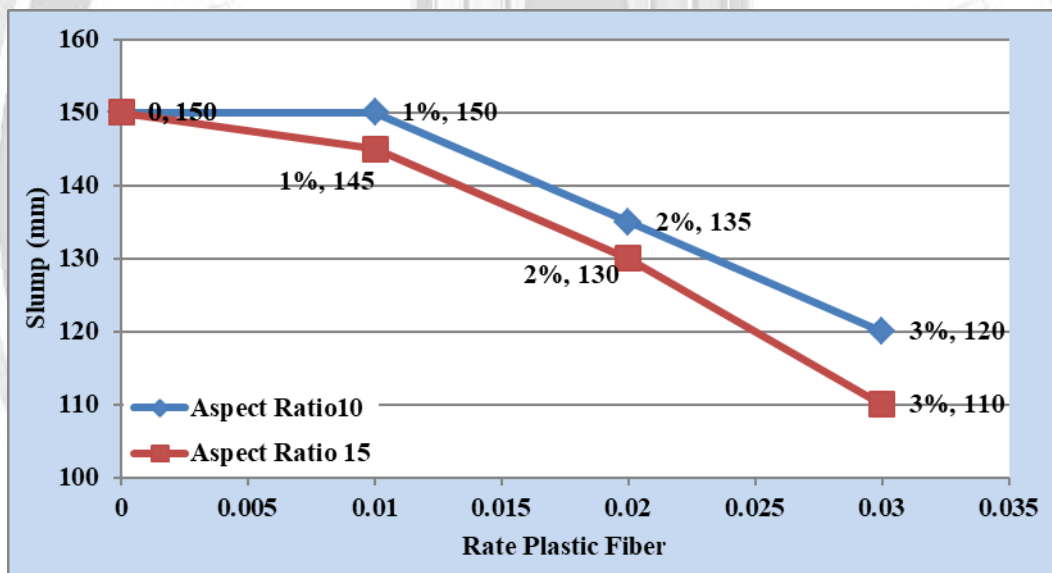


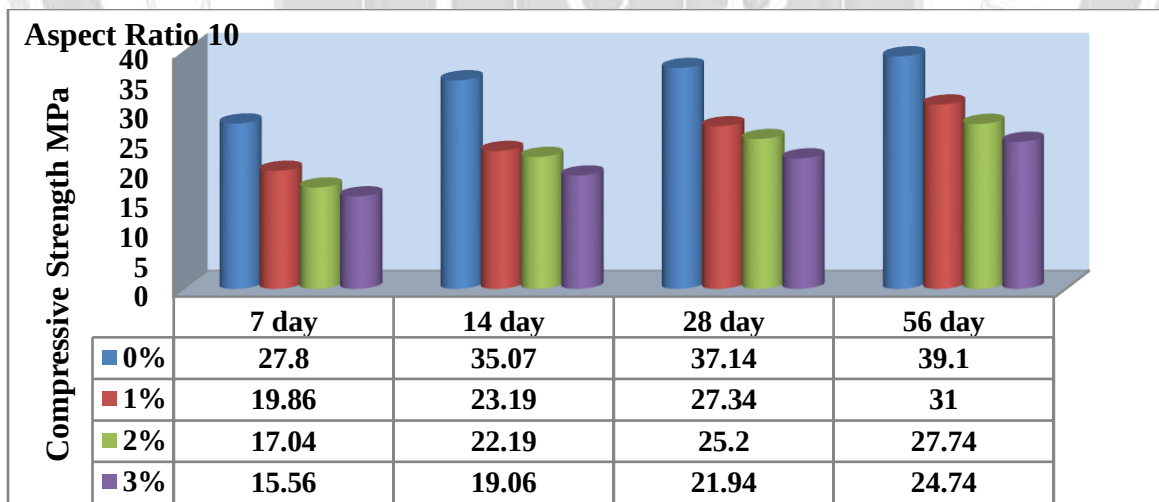
Figure 9. The relationship between the aspect ratio (10, 15) and concrete slump.

3.2. Compressive Strength.

Figure 10 illustrates the compressive strength at different ages 7, 14, 28 and 56 days for aspect ratios of plastic waste (10 A and 15 B) and the percentage decrease in compressive strength at age 28 days (C). Generally, it was noted that the compressive strength gradually decreased with the age and fiber ratio of the plastic waste at the aspect ratios of 10 and 15. It has

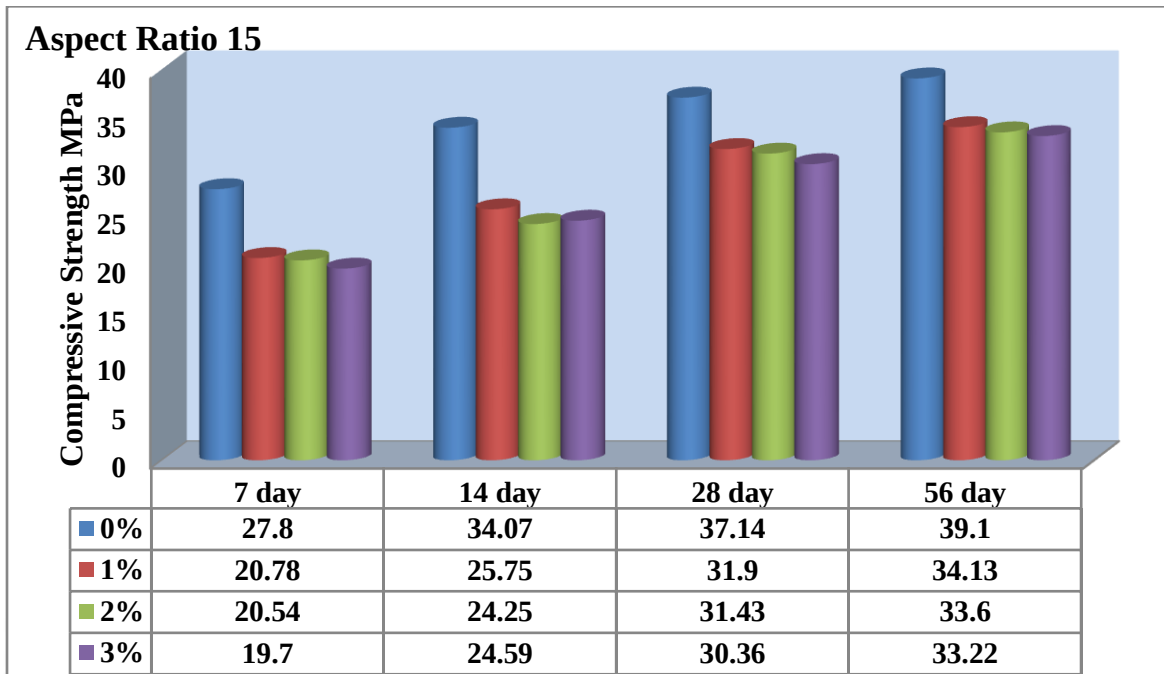
been estimated that compressive strength at 7 days, the compressive strength in Figure 10A was (20.78, 20.54, 19.7 MPa) The readings were nearly constant across the three additive ratios (1%, 2%, and 3%), with decreases of approximately 25%, 26%, and 29%, respectively. At 7 days of age, in Figure 10B, the decreases in compressive strength were 28.5%, 38.7%, and 44%. From the above, the results were better at an aspect ratio of 15, as the decrease in compressive strength was less than at an aspect ratio of 10. At the age of 14 days for aspect ratio 15 (Figure 10B), the results were almost equal for the added percentages of 1, 2, and 3%, which were the best (25.75, 24.25, and 24.59 MPa), compared to its aspect ratio 10 in Figure 10A (23.19, 22.19 and 19.06 MPa). Furthermore, at the age of 56 days for aspect ratio 15 (Figure 10B), the results were almost equal for the added percentages of 1%, 2%, and 3%, which were the best (34.11, 33.6, and 33.22 MPa), compared to aspect ratio 10 in Figure 10A (31, 27.74, and 24.74 MPa).

As shown in Figure 9C, the percentage decrease in compressive strength varied according to the aspect ratio. The compressive strength of the reference mixture was 37.14 MPa at 28 days. At the age of 28 days, the decrease in compressive strength reached almost 50% at each addition ratio. When adding 1%, the decrease was 14.11-26.39% with similar trends for the remaining ratios. The results indicated that the best ratio was recorded at an aspect ratio of 15. The important reason for the low compressive strength of concrete is the low strength and stiffness of waste in failure zones compared to natural aggregate. The low plastic absorption capacity also leads to increased porosity of the concrete mixture and air content in the mixture due to the plastic fibers [28, 29]. A mixture containing waste at an aspect ratio of 15 was better than 10. When the aspect ratio was reduced by one-third, the compressive strength was reduced by half. The higher the aspect ratio of added waste, the better the concrete properties in compressive strength. At the aspect ratio of 15 at ages 7, 14, 28, and 56 days, the resistance results were similar at the addition ratios of 1, 2, and 3%. On the other hand, the results of the samples at ages 7, 14, 28, and 56 days in Figure 10A showed a clear and very gradual decline in resistance at the different addition ratios.



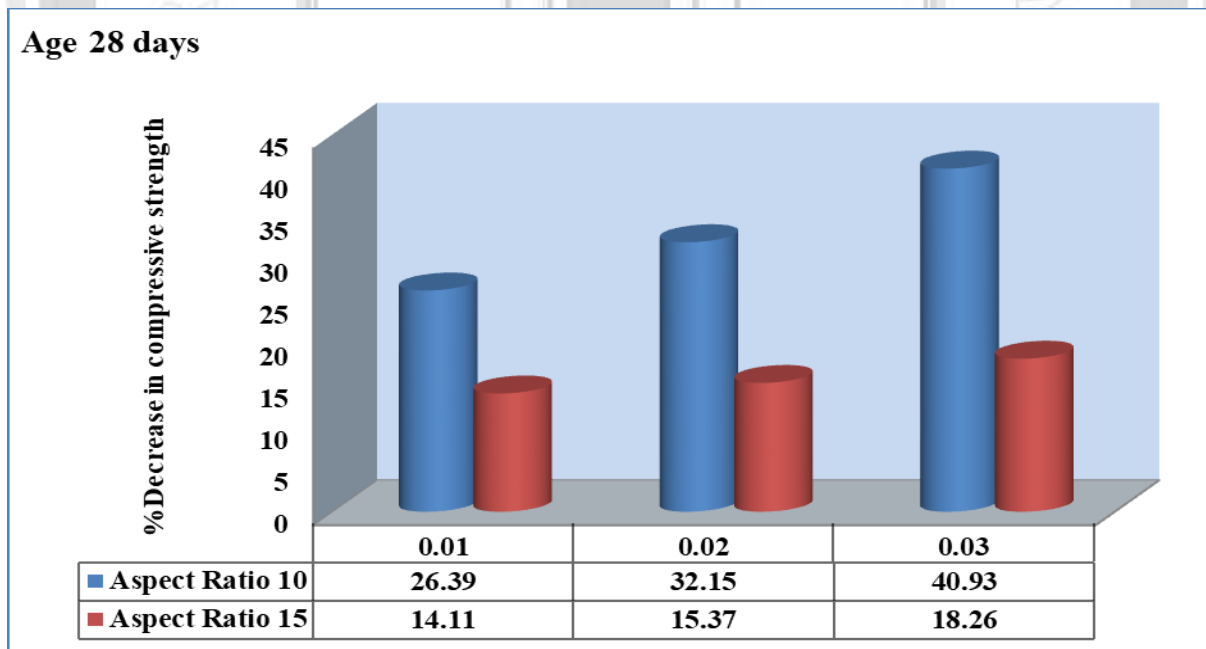
Compressive strength for aspect ratios of plastic waste 10.

(A)



Compressive strength for aspect ratios of plastic waste 15.

(B)



Compressive strength at 28 days of age for aspect ratios 10,15.

(C)

Figure 10. shows the compressive strength at different ages and aspect ratios of plastic waste. (A) 10, (B) 15. (C) percentage decrease in compressive strength at 28 days of age for aspect ratios 10 and 15.

3.3. Tensile Strength.

The important requirements to structural design are avoiding surface cracks and the tensile strength of concrete especially in huge concrete structures [30]. The tensile strength test of concrete was performed indirectly. The tensile strength was tested using cylindrical concrete specimens, using the splitting tensile strength test. The effect of plastic waste percentage and dimension on the tensile strength of concrete at 28 days was expressed as shown in Figure 11. In this study, it was shown the tensile strength increased at aspect ratio 15 for all percentages 1%, 2%, and 3%, (3.91, 3.82 and 3.65, respectively). The highest tensile strength (3.91MPa) was at the 1%, whereas the highest rate of increase was 13% [31, 32]. The increase in the tensile strength of concrete is due to the fact that the crack area (both sides of the failure plane) contains plastic fibers and the long overlap distance. The high tensile strength of the fibers led to an increase in the tensile strength of concrete containing waste with an aspect ratio of 15, where the fiber length was 30 mm. The results showed that the tensile strength of concrete containing waste with an aspect ratio of 10 decreased for all percentages 1%, 2%, and 3%, (2.09, 2.13 and 2.05, respectively). This decrease may be caused by the small overlap of the fibers in the failure plane, as the fiber length was 20 mm. This trend agrees with the findings of Maryam et al. (2025) [6], who reported that increased fiber length enhances the stress transfer capacity due to improved interfacial bonding.

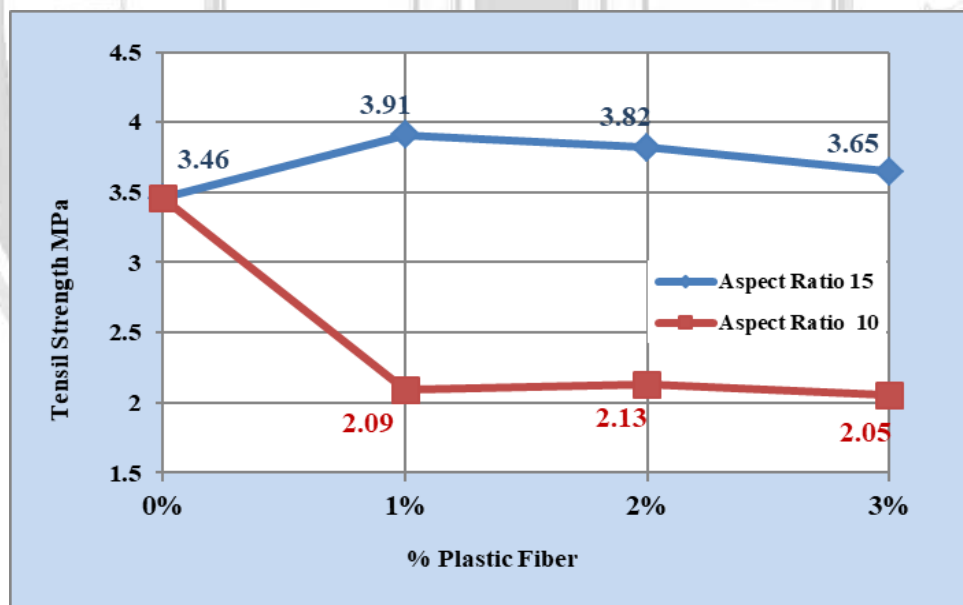
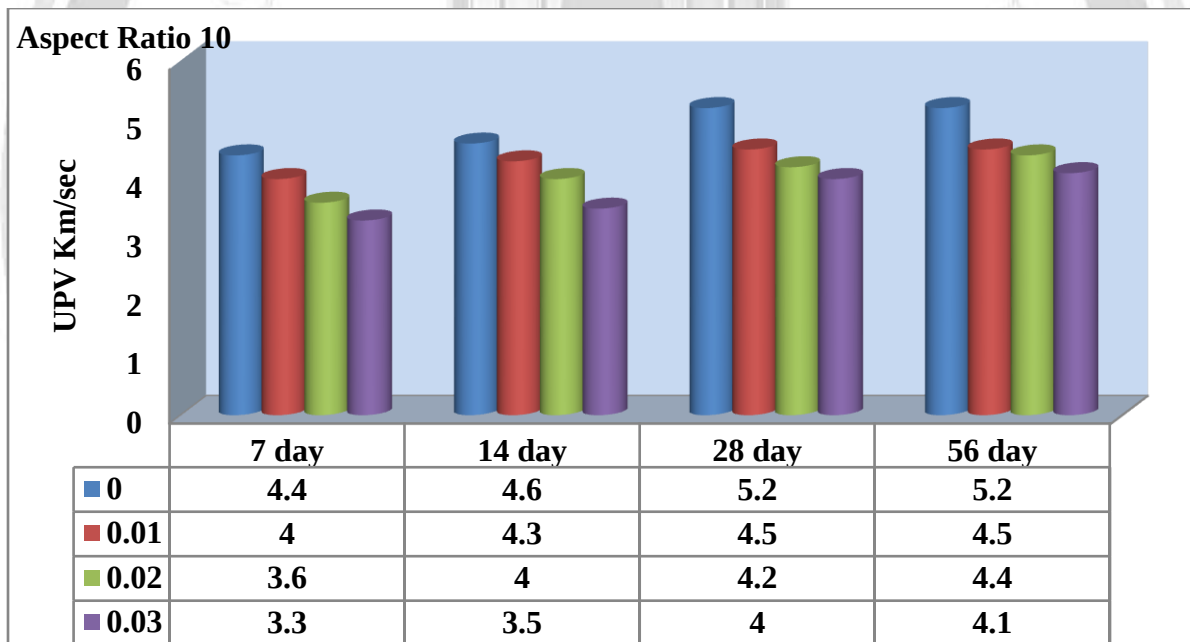


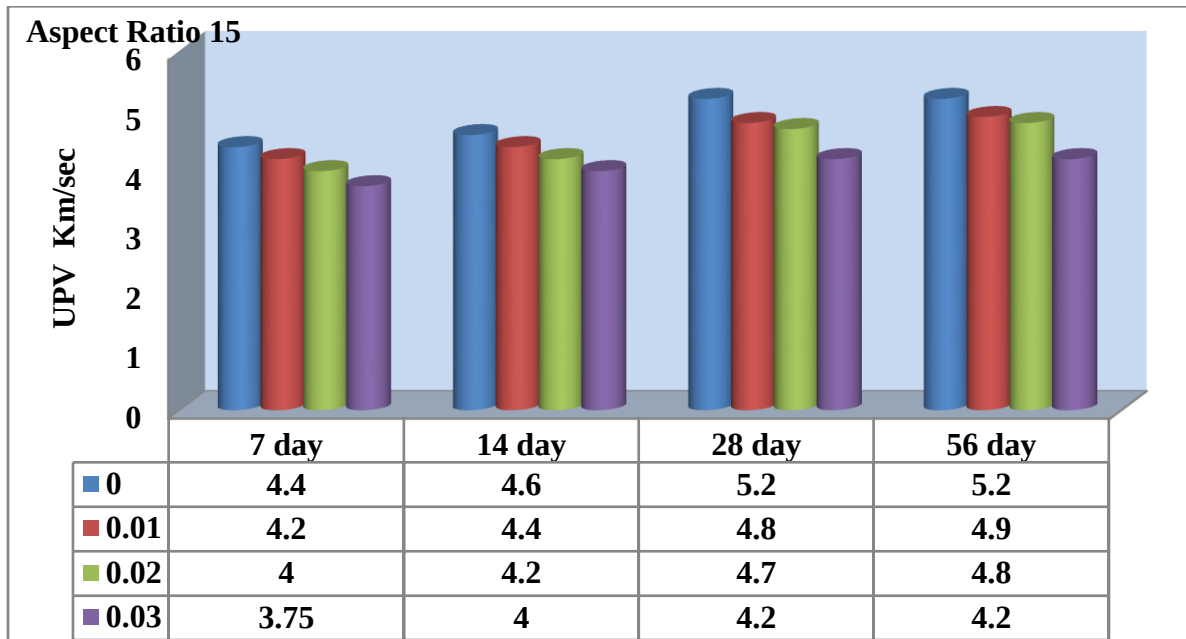
Figure 11. shows the tensile strength of concrete containing different percentages of waste fiber (1, 2 and 3%) with two aspect ratios (10 and 15).

3.4. UPV pulse velocity

The UPV test is a non-destructive test. Figure 12 shows the ultrasonic pulse velocity results for concrete samples at ages 7, 14, 28, and 56 days containing 1, 2, 3% plastic fibers. Figure 12A shows the UPV at an aspect ratio of 10, classifying the concrete as excellent. The UPV recorded 5.2 km/s for the reference mix and maintained this classification at ages 28 and 56 with an addition ratio reached 0.01. It was 4.5 km/s at age 7 with a ratio of 0.03, classified as doubtful. Velocities were good for the remaining ages and addition ratios [33,34]. Concrete classification ranged between excellent to good for ages 7, 14, 28, and 56, for addition ratios of 1%, 2%, and 3%, despite variations in readings as shown in Figure 12B. In general, the decrease in UPV was affected by the material density, moisture content, and elasticity [35]. The aspect ratio of 15 showed better results than the aspect ratio of 10 when measuring pulse velocity. These differences may be due to the fact that one 30 mm fiber was compared to three 10 mm fibers. The mixture contains the same weight of fibers but differed in number, shape, and distribution. This difference in readings gave an advantage to concrete containing fibers with an aspect ratio of 15 over that with an aspect ratio of 10.



(A): The Pules Velocity with aspect ratio 10



(B): The Pules Velocity with aspect ratio 15

Figure 12. shows the pules velocity with three different percentages of plastic waste of concrete (0.01, 0.02, 0.03) and different ages of concrete (7, 14, 28 and 56 days). (A) aspect ratio 5. (B) aspect ratio 15.

3.5. Unit Weight.

The unit weight was calculated as the weight of a solid concrete cube model with dimensions of $150 \times 150 \times 150$ mm. The UW of the reference mixture at ages (7, 14, 28, and 56) reached (2589, 2586, 2592, and 2592, respectively) kg/m^3 with an average of 2590 kg/m^3 . The percentage decrease in unit weight of concrete after adding plastic fibers at ratios of 1%, 2%, and 3% for the aspect ratios of 10 and 15 is shown in (Table 5). The weight of concrete containing plastic waste was reduced compared to the unit weight of concrete without plastic fibers. Related studies reported that the weight loss was related to the low density of the plastic waste compared to the high density of the aggregate, as the plastic waste took up volume within the mixture and replaces the aggregate [36, 37].

Table 5 illustrates at an addition rate of 1%, the decrease in density was almost equal at aspect ratio 10 and 15, which was 4.73%, and 4.55, respectively on day 7. At a rate of 2%, the decreases were 6.69% and 6.56%, and at rate of 3%, the decrease was 7.8% and 7.95%. The decrease was similar in all ages. The decrease rate from an addition rate of 1% is about 4.5%. At an addition rate of 2%, it was 6.7%, and at 3%, it is 7.8%. Changes in aspect ratios did not affect the density at similar addition ratios, at 28 days and added fiber percentages 1%, 2% and 3% (Figure 13).

Table 5. explains weight loss with different the Percentages of plastic waste and aspect ratio 10 and 15.

Age(day)	Percentage of plastic waste (Aspect ratio 10)			Percentage of plastic waste (Aspect ratio 15)		
	1%	2%	3%	1%	2%	3%
7	4.73	6.69	7.8	4.55	6.56	7.95
14	4.62	6.85	7.61	4.51	6.52	7.76
28	4.43	6.84	7.58	4.51	6.67	7.86
56	4.52	6.92	7.46	4.47	6.67	7.86

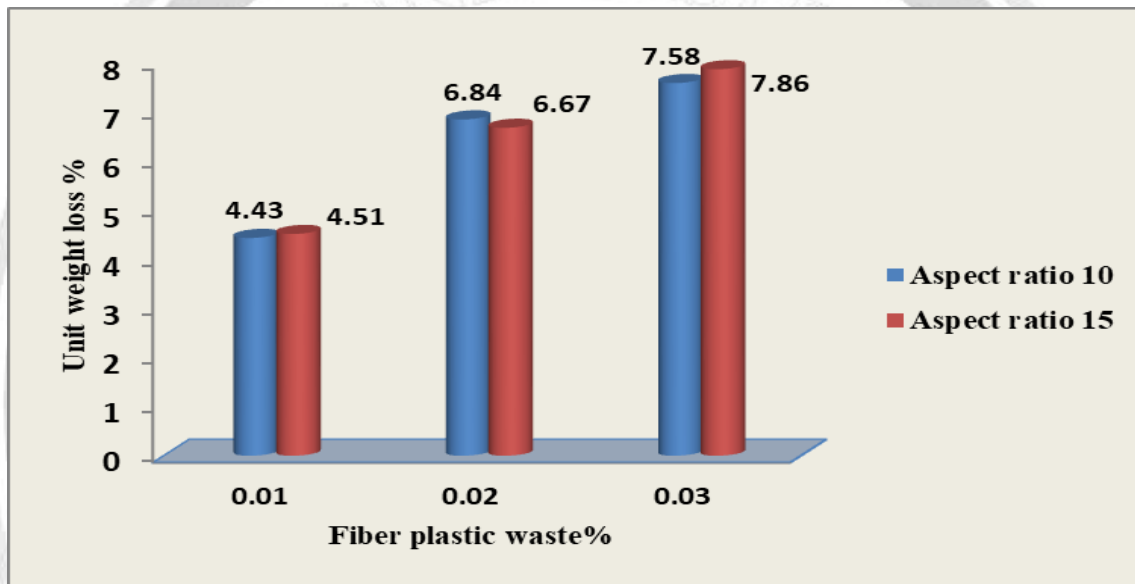


Figure 13. Unit weight loss at 28 days for different aspect ratios.

4.5. Absorption.

The absorption results for the reference mixture free of plastic waste were 5% at 28 days. Table 6 shows the absorption results for concrete cube samples according to ASTM 642-21[38] at aspect ratios of 10 and 15. The results revealed that adding plastic waste fibers to concrete reduced water absorption. In this case, the decrease in the absorption was due to the presence of fibers in the concrete mix. This led to fewer cracks. Moreover, the tensile strength of the plastic waste fibers prevents these cracks [39,40]. The absorption percentage decreased at both aspect ratios, gradually according to the addition ratios 1,2,3 % as shown in Table 6. The optimal results (4.4, 4.42) were at an aspect ratio of 15 with an addition of 3,4 %. This could be related to the overlap length at an aspect ratio 15 is greater than at aspect ratio 10. Fiber length directly affects the overlap length as well as the tensile strength of the fibers and their quantity in the concrete mix. All of these reasons led to a reduction in the number and length of cracks in each sample.

The samples containing fibers with an aspect ratio of 15 were characterised by lower water absorption than those with an aspect ratio of 10.

Table 6. Water absorption of harden concrete with three Percentage of plastic waste for each aspect ratio.

Age (days)	% Plastic Waste (Aspect ratio 10)			% Plastic Waste (Aspect ratio 15)		
	1%	2%	3%	1%	2%	3%
28	4.85	4.73	4.56	4.63	4.42	4.40

Conclusion

In this study, the effect of adding fibers from recycled plastic from plastic water bottles to the concrete was determined. The aspect ratios were 10 and 15, with dimensions of (20 x 2) and (30 x 2) mm in concrete mixture. Moreover, the compressive strength was 37.14 MPa, at a ratio of 1%, 2%, and 3% by weight of concrete. The improvement of the behavior of concrete containing plastic waste as a fiber depends on the dimensions, length, and width. As the aspect ratio increases, the behavior improves to some extent. The workability of concrete improved at both aspect ratios but was better at 15. The increase in tensile strength supports the mixture containing PET at the aspect ratio of 15, which increased (13, 10.4, 5.5) % when adding 1%, 2% and 3% respectively. A mixture containing waste at an aspect ratio of 15 was better than 10. The higher the aspect ratio of added waste, the better the concrete properties in compressive strength. Relatively, when the aspect ratio was reduced by one-third, the compressive strength was reduced by half. Changing the aspect ratios did not affect the density at similar addition ratios. Adding fibers at an aspect ratio of 15 significantly improved the properties of concrete in terms of reducing water absorption. Future studies should investigate the microstructural bonding between PET fibers and cement paste using SEM and consider hybrid fiber systems.

Acknowledgment: I would like to thank University of Mosul.

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تأثير النسبة الباعية لشرائح البلاستيك المعاد تدويرها على الخصائص الميكانيكية للخرسانة بأعمار مختلفة.

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الخلاصة

البحث الحالي دراسة تأثير إضافة المخلفات البلاستيكية إلى الخرسانة على شكل ألياف بنسبة باعية (الطول / العرض) 15 و 10، وينسب معينة من وزن الخرسانة 1 و 2 و 3% على التوالي وبأعمار 7، 14، 28 و 56. تم فحص ثمانية وتسعون مكعب بأبعاد (150 × 150 × 150) ملم للأعمار 7، 14، 28 و 56 يوماً، كما تم فحص 21 نموذجاً أسطوانياً (300 × 150) ملم لعمر 28 يوماً. كانت الدراسة تتمحور على قياس قابلية تشغيل الخرسانة الطازجة. وقياس مقاومة الانضغاط، ومقاومة الشد، وسرعة النبض بالموجات فوق الصوتية و امتصاص الخرسانة للماء ونسبة فقدان بالوزن للخرسانة المتصلبة ذلك الجزء العملي من الدراسة. وأظهرت النتائج أن الهطول انخفض مع زيادة النسبة المضافة من الألياف 30,40 ملم على التوالي، وأن مقاومة الانضغاط أعطت نتائج أفضل عند النسبة الباعية 15 عند نسب 1% و 2% و 3% مقارنة مع النسبة الباعية 10، بينما زادت مقاومة الشد لجميع نسب الإضافة للنسبة الباعية 15 وانخفضت قابلية الامتصاص، أظهرت النتائج فقداناً تدريجياً ولكن طفيفاً في الوزن. وبشكل عام فإن سلوك الخرسانة كان أفضل عند النسبة الباعية 15.

الكلمات الدالة : الامتصاص، النسبة الباعية، سرعة النبضة، شرائح مخلفات البلاستيك، مقاومة الشد، مقاومة الضغط.