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Evaluation of relationship generated between concrete fiber properties and permeability

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Abstract**—** *The research aims to Evaluation of a relationship generated between concrete fiber properties and permeability. All concrete samples were examined in Baghdad, Iraq, where 8 samples for beams were collected distributed on cutting and flexural tests, and 16 samples were collected for the cylinder distributed on compression and tensile strength tests.*

The study found that fibrous concrete reduces permeability and thus reduces water bleeding, as some types of fibers produce greater impact and resistance to abrasion and fracture in concrete. In general, fibers do not increase the flexural strength of concrete, so they cannot replace structural or resistive rebar, some fibers reduce the strength of concrete.

This can be explained from the general concept of the mechanism of action of the fibers inside the manufactured concrete, which, when exposed to stresses, works to form connecting bridges through the internal cracks in the concrete, which may contribute to creating additional resistance after the cracks occur.

Keywords**— Fibers, Permeability, beams, flexural, tension.**

I. INTRODUCTION

The fibers have the ability to improve concrete's resistance to shear, tensile, bending, impact and shrinkage It also works to reduce the widening of cracks and redistribute them, but the fibers do not greatly affect the pressure resistance, and the most important function of the fibers is that it increases the value of the durability criterion of the material to a very large extent [1,2].

Thus, it transforms the fracture mechanics of concrete from Dangerous Failure Sudden to Failure Ductile The significant and effective effect of the fibers in resisting shear forces and increasing the parameters of Toughness is evident. Fiber concrete is widely used in roads and airports [3].

Fiber concrete is a type of concrete that is used during manufacturing to improve cracking and cracking resistance in which fibers with refractive behavior are added, preferably steel, glass or plastic fibers [4,5,6].

The fibers are incorporated into the cement stone or with concrete, and it increases the tensile strength as Concrete mainly determines the bearing behavior of concrete [7,8].

Concrete in its hardened state appears as a rocky material with high pressure resistance

It has the property of plasticity, which allows it to be formed in any required architectural form Concrete with steel is the most common and widely used construction material in our modern age, due to its ease, presence and the relative cheapness of its constituent materials, as well as the ease and licenses of its manufacture Concrete in combination with other materials to form Sections Composite [9,10,11].

It is also used in crust ceilings and the connection areas between the beam and the column in tires and fibers are also used in concrete pipes and precast companies and in concrete elements subjected to shear and impact forces in spite of fibers increase the resistance to tensile strength [12,13].

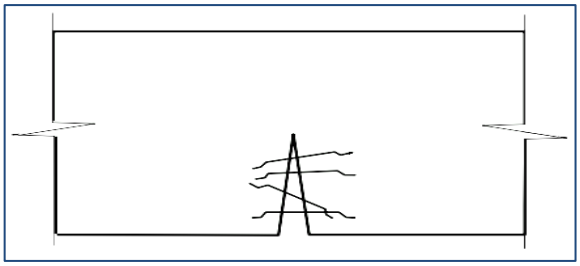


Fig.1- Role of fiber in reducing widening of cracks

The fibers are commonly used in concrete to control plastic shrinkage cracking and to dry out shrinkage cracking. They also reduce the permeability of concrete and thus reduce water bleeding some types of fibers produce a greater impact and resistance to abrasion and fracture in concrete In general, fibers do not increase the bending strength of concrete, so they cannot replace resistant or structural steel [14,15].

Some fibers reduce the strength of concrete as the amount of fibers added to the concrete mix is measured as a percentage of the total volume of the compound (concrete and fibers) called part volume. Fragment size usually ranges from 0.1 to 3% and the aspect ratio is calculated by dividing the length of the fiber by its diameter [16].

II. METHODOLOGY

Samples were collected from private laboratories in Iraq, Baghdad, for the case of beams, four types were made (80 cm x 17 cm x 17 cm) where the first type consisted of concrete beams Simple, as for the second type, it consists of pieces with a mixture of concrete and reinforcing Polymer fibers (carbon) by 900 grams per cubic meter of concrete, as for the third type

The beam was composed of concrete and the proportion of steel reinforcement was entirely dependent on the load that was being applied.

The fourth type was completely similar to the third type but differed in terms of adding an enhancement Fibers.

The cylinder samples are cast even in harsh conditions, and the molds used should retain their original shape and dimensions, the concrete mold should be held without any leakage, before placing the concrete mixture inside the mold, the inside of the mold should be properly lubricated to facilitate the removal of the solid cylinder.

The mixed concrete is placed in the molds in layers not less than 5 cm deep, the number of lines in each layer during compaction should not be less than 30, the pressure should reach the basic layers allowing most of the air spaces to escape, the samples are stored unobstructed in a place with A relative humidity of at least 90% at a temperature of 27° ± 2° C for 24 hours, after which time samples are taken and immersed in clean, clear water until the test age is reached.

III. RESULTS

T	Fine	Coarse
Fineness modulus	1.71	5.50
MD mm	2.36	12.5
Dry specific mass g/cm³	2.63	2.77
Apparent specific mass g/cm³	2.40	2.72
Bulk density kg/m³	1620	1470

Fig.1- aggregate characteristics

Eight samples were examined for beams at the age of 90 days, and they were divided into 2 samples for cement and 2 samples for fibres flexure.

As for tension , it was also divided into two groups, which included the steel group with cement and the cement, fibres , steel and 90-days test as shown in figure below

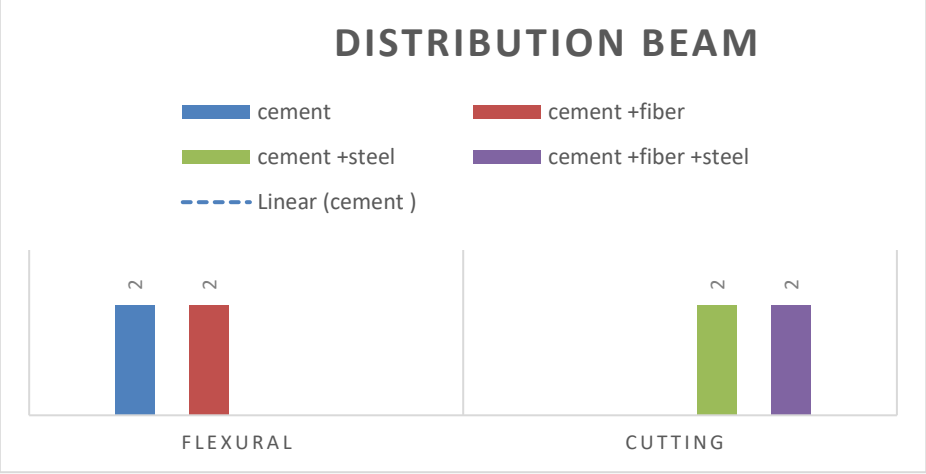


Fig.2- Distribution of sample according to beam

As for the cylinder test, it was 28 and 90 days old, and it was divided into two types, compression test and the Tension test, divided into 16 samples consisting of cement and fiber as shown in table 1

Table 1- distribution of sample in cylinder

Test cylinder				
Type of test	Compression		Tension	
Composite	Cement	Cement with fiber	Cement	Cement with fiber
28	2	2	2	2
90	2	2	2	2

Table 2- results on fresh concrete of compression and tension (cylinder)

Age and type of test	A/C	Slump (cm)		Content of air (%)	
	A/C	Cement	Cement with fiber	Cement	Cement with fiber
28 DAYS CY compression/ tension	0.79	19	7	2.4	2.3
28 CY compression/ tension	0.60	14	11	2.1	2.2
90 DAYS CY tension	0.79	18	11	2.2	2.3
90 CY tension	0.60	15	14	1.9	1.7

Table 3- results on fresh concrete of beam

Age and type of test	A/C	Slump (cm)		Content of air (%)	
	A/C	Cement	Cement with fiber	Cement	Cement with fiber
90 DAYS flexural	0.79	15	9	1.9	2.1
	0.60	12	11	2	2.4
90 cutting	0.79	18	11	2.5	2.5
	0.60	17	14	2.1	2.2

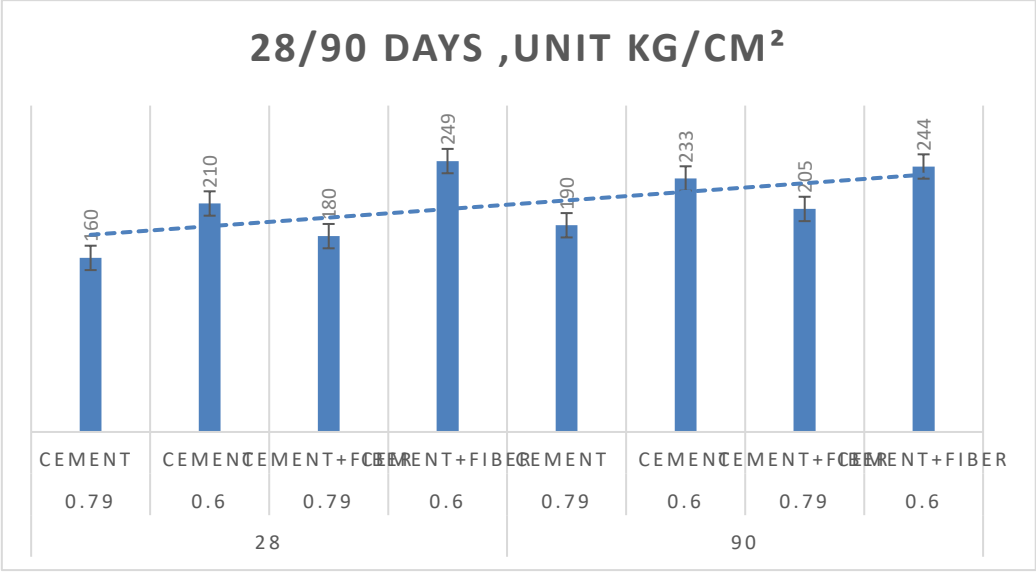


Fig.3- Results of compression in 28 days and 90 days

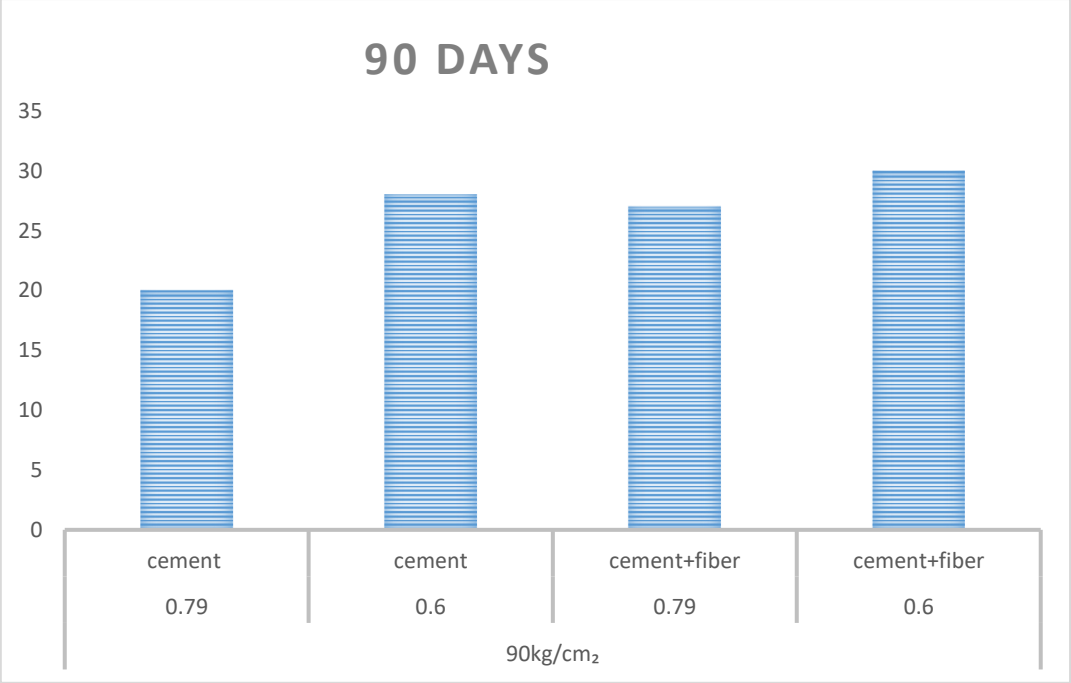


Fig.4- Result of flexural in beam

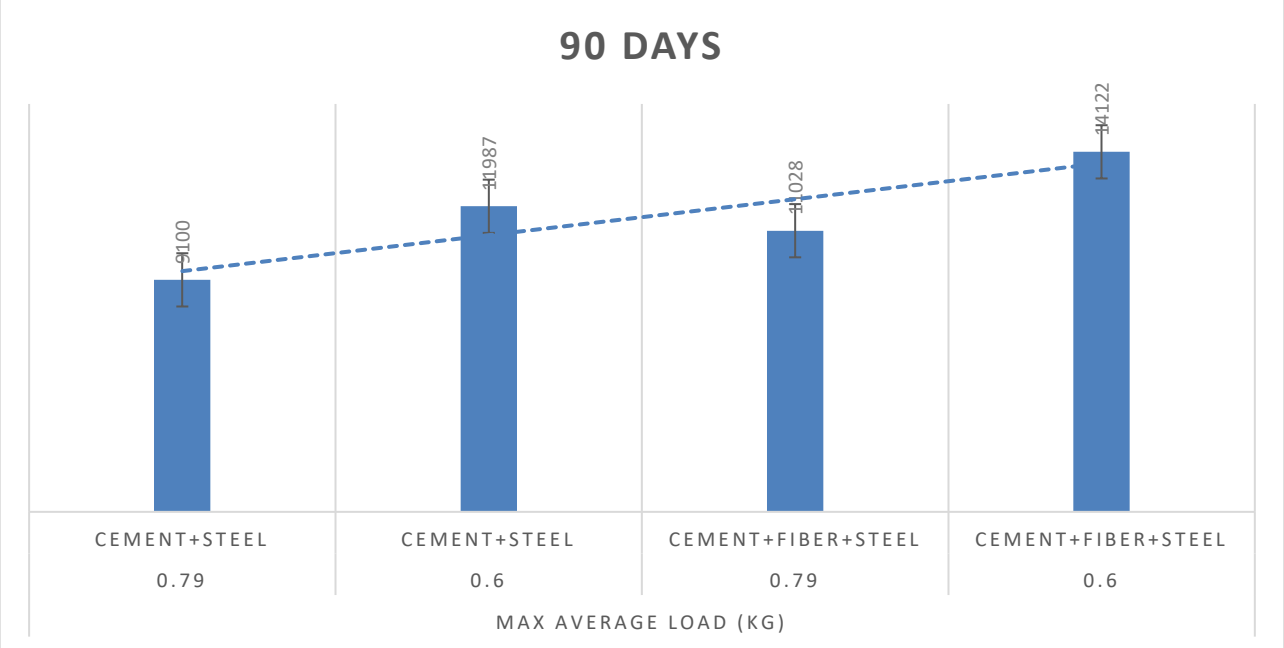
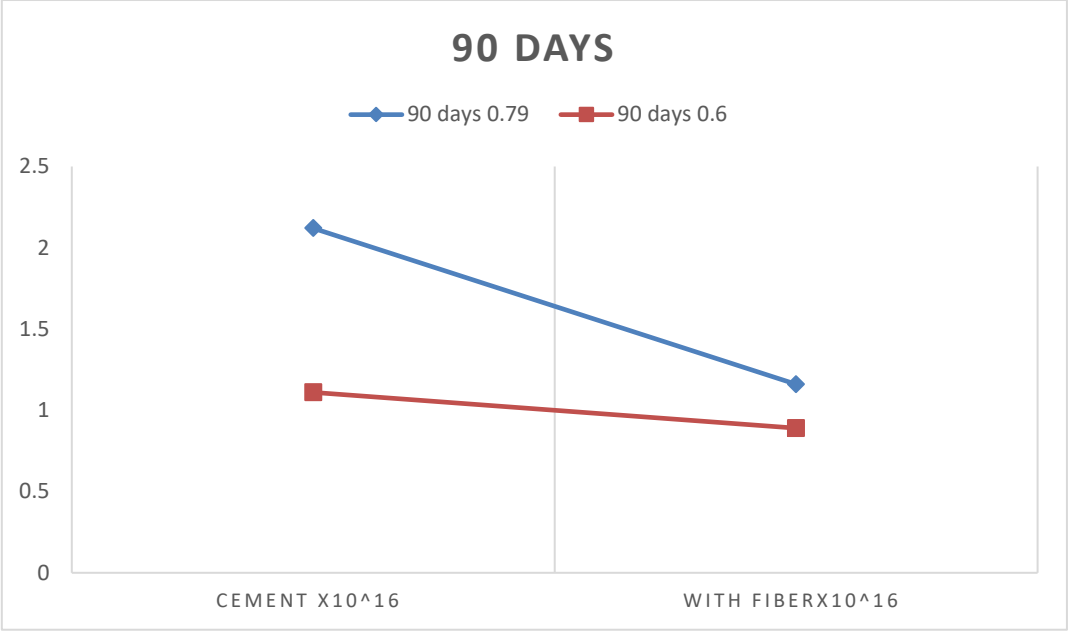


Fig.5-Results of the shear resistance test in beams.

Table 4. Permeability test results.



A/C= 0.79, 0.60

IV. DISCUSSION

The research aims to Evaluation of concrete generated between fiber properties and permeability Through Table 2, which shows the results of fresh concrete from comperission and tension, we find that the slump level at 0.79 was higher than 0.6 at 28 days and 90 days for cement , but when adding fibers, we notice the clear effect it adds to the samples, as the process becomes inverted from In terms of influence, the slump level becomes higher at 0.6

Precipitation test is widely used in the workplace and all over the world, and this test does not measure the workability of concrete, but it is very useful in detecting changes in the materials involved in the formation of concrete from time to time, for example, the increase in moisture content in the aggregate or Changing the gradation of the aggregate, such as a decrease in the amount of sand in the mixture, leads to an increase in precipitation. The high or low precipitation gives a direct warning to the person supervising the mixing process and enables him to correct the mixing ratios immediately.

In the examination of compression at the age of 28 and 90 days, realistic results were found and achieved to the purpose.

The sample consisting of cement with fiber at A/C 0.6 was 249 at the age of 28 days.

As for the samples at the age of 90 days, the highest value was found in the sample of cement with Fiber is also 244 kg/cm²

Analysis of the test results Air permeability The decrease in permeability in the presence of fibers was evident. The samples that have a ratio of 0.79A / C decreased 50% of the permeability coefficient of 0.60, the decrease of 0.79 A / C can be attributed to the least amount of cementitious materials that facilitate the formation of empty spaces.

V. CONCLUSION

The ability of the fibers to reduce the formation of capillary bleeding within the concrete mixture, and also for the reasons that reduced the porosity with the presence of fibers in the concrete. It was also found by comparing the results with each other that the samples produced from concrete with smaller pressure resistance recorded lower values of permeability than their counterpart with higher resistance similar to what happened in the results of porosity and water absorption.

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