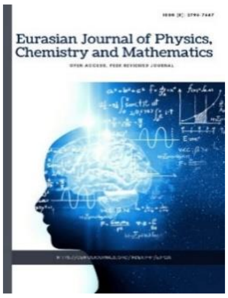

The Investigation of the Effect of Polypropylene Waste on the Compressive Strength of Iraqi Portland Cement (UM-Qasir)

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ABSTRACT

The present study includes inspecting the change of compressive strength of the Ordinary Iraqi Cement (henceforth; OIC) produced by Um- Qasir plants. The used cement was a petrified type, which was obtained by direct exposure to environmental circumstances for three months. The study was carried out by using a cubic mold of 50 mm in length for mortar and 150 mm for concrete, where the mixing ratio was: 1 cement, 1.5 sand, and 3 gravel. Polypropylene fibers waste was added in the form of square nets with a 40mm of side dimension. The added nets ratio range was (0-4), and three types of curing were used: Moisture, Water, and Air. All cement samples were measured within seven days of curing aging, while the concrete samples were measured after 28 days. Furthermore, the study incorporated the effect of changing sand particle size. Water Curing was the best curing condition for mortar samples where the compressive strength varies within a range of (10-14.12) N/mm^2. According to the curing method (Dry, Wet, and Moisture). The number of nets of polypropylene waste added is also has affected the compressive strength where a 15.42 N/mm^2 was obtained at two added nets of polypropylene at wet curing. The effect of sands was also studied by using two different particles size, which (600 micrometers and 1.2 millimeters) and the obtained results showed that the smallest particle size is the better compressive strength. Finally, a comparison between petrified and non-petrified cement of concrete was studied. The obtained results showed a rapid decrease in compressive strength: (7.11 N/mm^2) and (18.4 N/mm^2) for petrified and non-petrified cement respectively.

Keywords: *UM-Qasir, Iraqi, compressive strength, petrified, Basrah.*

Introduction:

Because of its strength, great moldability, structural stability, and low cost, concrete is one of the most often used construction materials worldwide. Rapid advancements in building materials technology have enabled civil and structural engineers to make great gains in terms of energy efficiency.The safety, economy, and usefulness of a construction designed to meet society's basic necessities [1-3].

Both cement and concrete were developed economically and environmentally, but they had significant drawbacks or limitations at the start of their usage, such as shrinkage during drying, low tensile strength, and a curing

delay, as well as sensitivity to some chemicals that induce iron corrosion [4-7]. In current building methods, the most effective way to improve the quality of concrete is to use additives. It is possible to solve any difficulty associated with generating concrete with required properties by using suitable and proper additive applications[1,3]
Furthermore, other concrete features such as high strength, low permeability, high durability, and frost resistance may be achieved by lowering the flow of cement and the number of chemical additions to 0.1-2% of cement weight and 5-20% or more of additives. Chemical additives are one of the most often used approaches because of their low cost and flexibility in managing concrete technology and controlling its qualities [8-14].
Because of its satisfying and remarkable performance in the industrial and construction area, fiber-reinforced concrete has been effectively used in a wide range of technical applications ([15-19]. The most significant advantage of utilizing fiber reinforcement is that it improves the structure's long-term serviceability. Fiber-reinforced concrete has long been regarded as a cutting-edge and cost-effective building material [20-22]. The compressive strength of OIC manufactured at Um-Qasir facilities was studied in this study as a function of polypropylene waste fiber admixture.

Experimental and procedure:

The experiment of the current research focused on the use of petrified cement (rigid). Mobilization Portland Cement bags produced in Um- Qasr plant (the Republic of Iraq), was opened and left vulnerable to the air for three months with same storage conditions of other cement, which including a higher proportion of humidity in Basra provinces the Republic of Iraq which is the research working site. During this time, cement turned into particles of petrified. The formed product had been used in mortar and concrete applications, and the compressive strength was measured to the extent of the change in the behavior of cement stored in normal conditions. After that, Polypropylene fibers wastes, which are as nets shaped, had been collected from the mobilized vegetables and fruit bags after using them in mobilization.

The measurement of the physical properties of ordinary Iraqi cement (OIC), used in the research has been measured according to standard: B. S. 4450: Part 3:1978 also had been chemically analyzed used cement at Chemical Construction Laboratory of the Department of Chemical Engineering /College of Engineering / University of Basrah according to standard: B. S. 4450: Part 2:1972. The source of the used sand was the Al-Zubair Quarries area in Basra province, the Republic of Iraq, with the adoption sand size of 600 μ with a mixture of (cement, sand, and gravel) using manual mixing to obtain a homogeneous mixture, but not empty from bubbles. Four percentages of Polypropylene fibers waste have been used in the used templates. Polypropylene fibers waste has been added as nets shape with square dimensions (40 × 40) mm and for mortar, dimensions were (140 × 140) mm concrete with added ratios ranged between one to four nets. In sample one, mortar the mixture is cast in cubes of dimensions (50× 50× 50) mm which is used to measure mechanical properties of cement (mortar) and concrete cubic models with terminal length 150 mm which were manufactured locally. The water ratio used in the research is (31 %) from the weight used cement and (41%) from the weight of cement in concrete cubes. After that, the mixture was poured and affixed with polypropylene fibers, then prepared samples were processed for addressed during different rigidity conditions, then filed at casting template after 24hr, and then left in the air. Water and humidity during period curing were seven days for mortar and 28 days for concrete until measurement time and the average data obtained was from three measurements. Compressive strength measured according to standard B. S. 1881:part 116:1983 on cubic models which were preceded by pouring paint the surface procedure templates thin layer of engine oil. After that, the mixture was poured into the mold of a cube in batches. Each layer should be addressed by using a bar of steel at a rate of 35 a blow, after the completion of the casting process, evens out the surface after 24 hours of open cube molds and then curing process for cubes were achieved as was mentioned earlier. Compressive universal testing was by Maruto testing machine Co. type 744 N. K.

Results and Discussions

Measurements of the study are including the compressive strength of cubic cement molds (mortar) as a function of three variables. The obtained results attained to study resistance to compression of the reference mixture (without any additives) that the best ways of curing are the water and change this resistance within range (10-14.12) N/mm^2 moving from dry curing via moisture reversing addressing water mortar stereotyped conceptions for seven days. Figure No.1 shows the change in compressive strength.

An effect of additives on compressive strength had been noted with the dry curing and this reflecting the positive impact on compressive strength when the curing process was dry, which is contrary to the behavior of resisting change and compressive strength at wet curing where compressive strength reaches to 7.3 N/ mm^2 with reduced percentage ratio rate up to 40% in comparison with the reference mortar. It observed that the ratio of added two of polypropylene nets was the best descent as it achieved the highest resistance to compression up to 15.42 N/ mm^2 while suffered compression resistance decreased when other ratio used. On the other hand, it was noted that with increasing water compression, resistance was decreased, and this happened in moisture and water curing also, opposites to dried curing. An exposure of cement bags, when opening them to the air, was affected via an interaction between particles of cement and water, which led clearly to this increasing behavior in compression resistance for dry curing.

Figure No. 2, illustrates the change in compressive strength as a function of additive ratio, which was calculated by the difference between compression resistance of pure and impure divided by the compression resistance of a pure sample. Figure No. 3, displays the effect of the third variable, which is the size of the sand used in the mixture, where the size of the used sand was 1200 μm and 600 μm. The results showed that there is a decrease in resistance to compression when the extent of the polypropylene nets added is (1-3). In contrast, the trend of decreasing when added 4 nets increased to 14.766 N/ mm^2, which demonstrated that the small size of particles has a positive effect on the compression resistance, which conforms with the above interpretation that the cement particles because of its exposure to the air conditions.

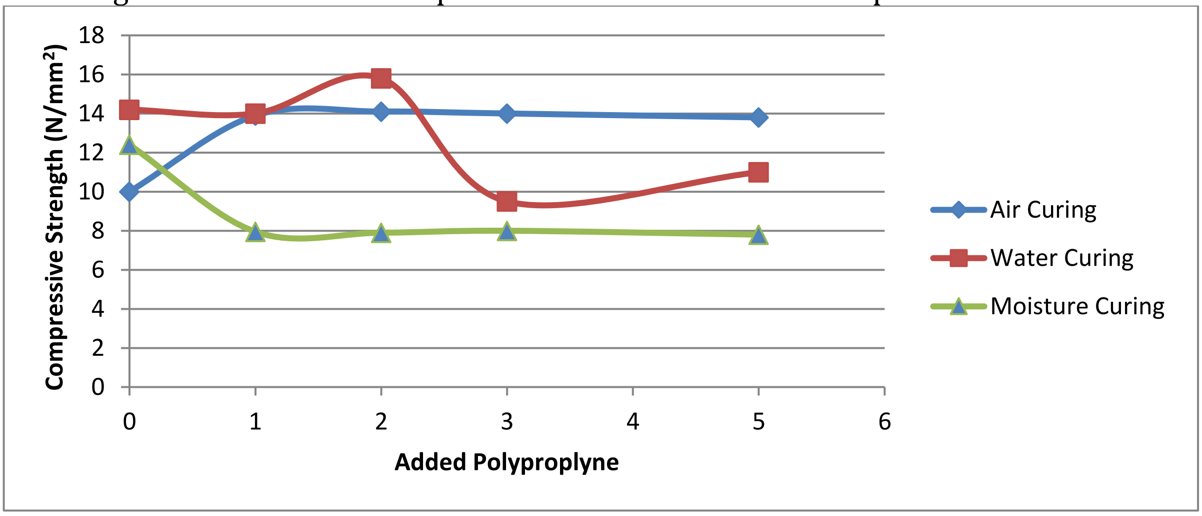

Fig. (1) The compressive Strength as A function of Added Polypropylene nets

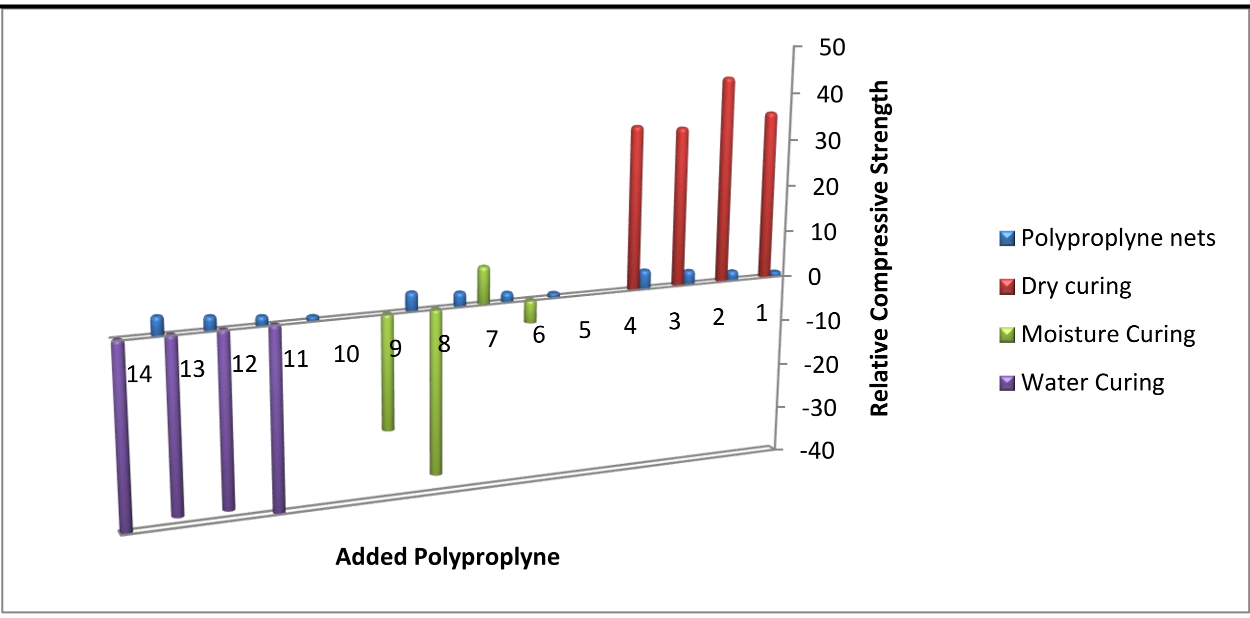

Fig. (2) The Relative compressive Strength as A function of Added Polypropylene nets.

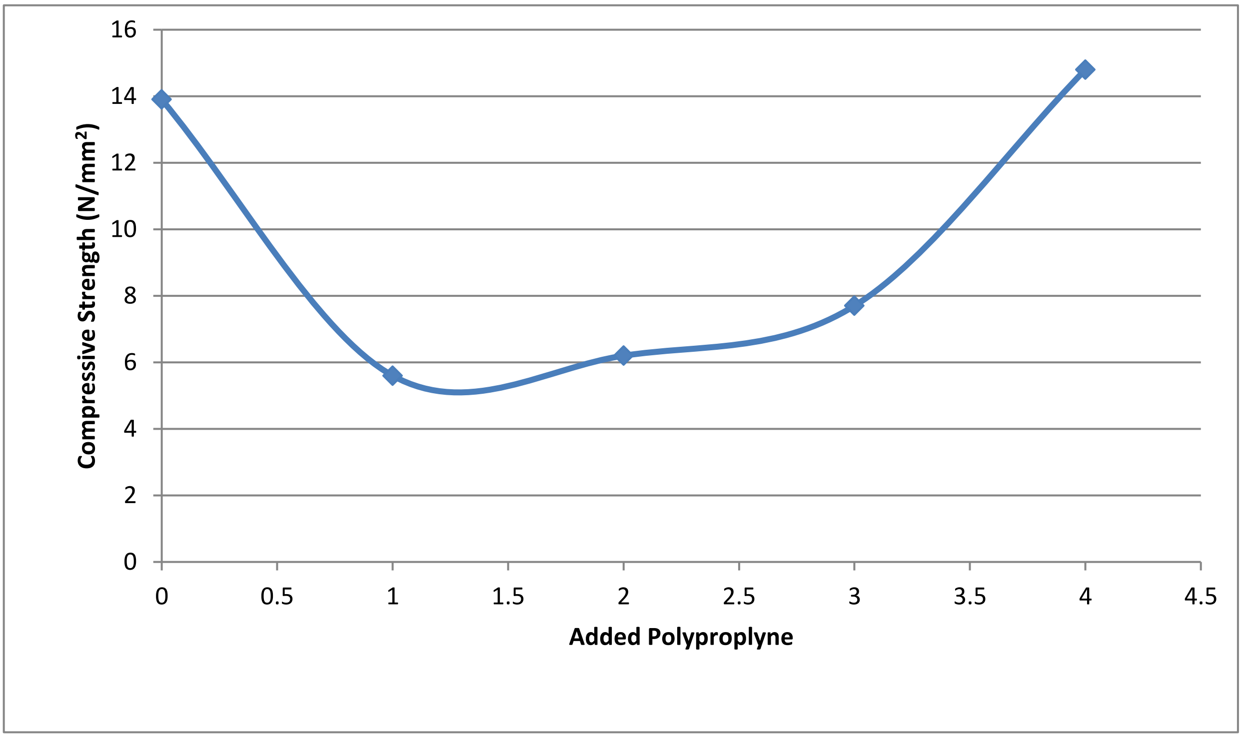

Fig. (3) The Effect of Sand particles Size on compressive Strength.

Throughout the three months greatly affected the interactions that happened with sand particles are smaller the size of the putting sand, the spread between these particles by cement is better. The study was extended to include a comparison with the type of cement (Um- Qasr) casual and fossilized (store, process conditions, appropriate packing bags closed and did not proceed to refill more than three months) as shown in Figure (4).

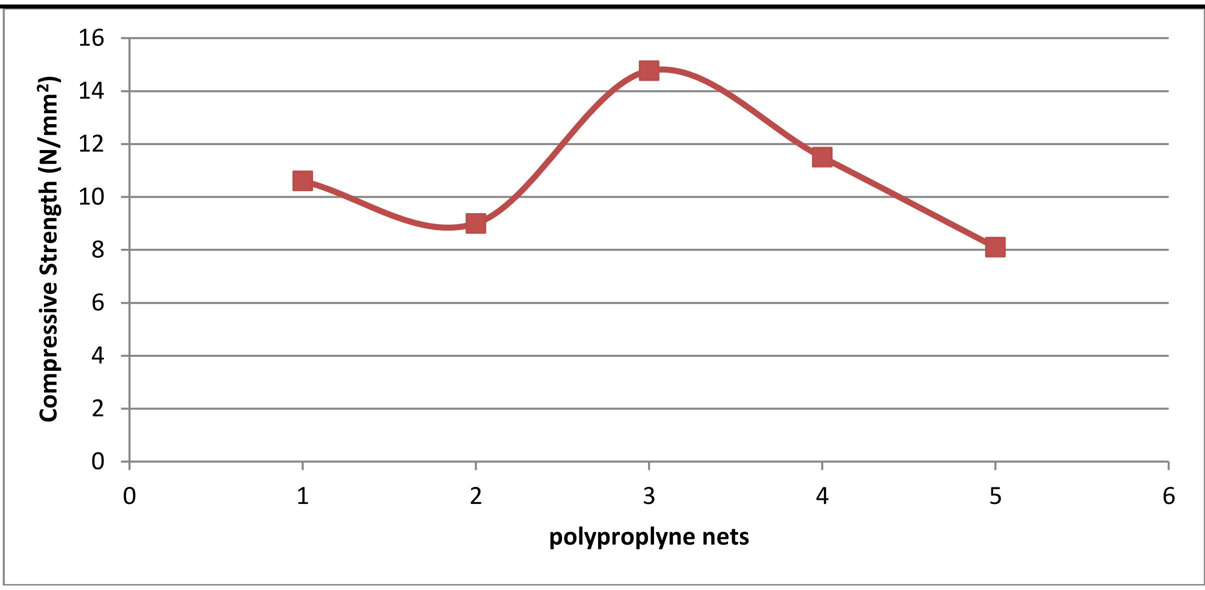

Fig. (4) The Compressive Strength of Ordinary Cement (Non-Petrified) Um-Qasir as a Function of Added Polypropylene Nets

Conclusion:

The present study has arrived at the following conclusions, The best result was when added two nets of polypropylene waste, and polypropylene added has no significant effect on the compressive strength of petrified cement. This behavior was also seen in both flexural and splitting tensile of petrified cement.The better curing method was a dry one due to the less water need to cure petrified cement with the high moisture in Basrah environment. The use of petrified cement in concrete shows a rapid decrease in mechanical properties with less bonding between materials that consist of the concrete matrix. Thus, seeing the effect of the small size of a sand particle was more than that of bigger sand particles.

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