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Study the effect of source of Portland cement in compressive strength (COPERESION STUDY)

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Abstract: As it is known, ordinary Portland cement is the basic material in the concrete industry, and the quality of cement is very important in producing concrete according to the required specifications, given the desire among citizens and companies to use certain types of cement in addition to the discrepancy in prices, and this indicates doubts about the quality and specifications of some types of manufactured cement Locally or imported, and in order to give confidence to the consumer, we had to conduct a comparative study between cement manufactured locally in the factories of (Al-Ittihad Al-Arabi - Souk Alkhamis - Almargab) and imported from (Turkey-Tunisia), as these types are the most consumed, especially in the western region of the country. The aim of this The study is to verify the extent of the effect of cement production sources on the compressive strength property of concrete, which is the most important property, whereby a concrete mixture was designed to achieve pressure resistance (25Mpa) and the use of the same proportions for the components of the concrete mixture (coarse aggregate - sand, water) from the same source and the only variable for each mixture is Cement has been tested for slump and (6 cubes) for each mixture are prepared. (3 cubes) are tested to determine the compressive strength after (7 days), and (3 cubes) to determine the compressive strength after 28 days. It turns out that the variation in the pressure resistance after (28 days) is simple. Between each of the cements of the Arab Union, Souk Al-Khamis, Turkish Falcon and Tunisian Kairouan Cement, while Al-Margab Cement and Tunisian Central Mountain Cement did not achieve the target of the mixture.

Introduction

The civilizational development that the world is witnessing, which includes the development of construction works of various kinds, and Libya is among the countries that have witnessed urban development at various levels for decades, and it consumes very large quantities of cement and the construction of many factories in various regions of the country. However, very large quantities are imported from countries Many of them, including Tunisia, Egypt, Turkey, and others. Whereas, concrete is the basic material used in most constructions, and cement is the material that possesses cohesive properties (cohesive) and adhesion (adhesive) in the presence of water, which makes it able to bind the components of concrete to each other and its cohesion with reinforcing steel and turn it into a complete unit Cement has the property of setting and hardening due to chemical reactions in the presence of water, so it is known as hydraulic cement[1]. The raw materials used in the Portland cement industry consist mainly of limestone (Cao), silica (Sio2) and alumina AL2O3) and iron oxide (Fe2O3). These compounds interact inside the furnace until a chemical equilibrium state is reached. This reaction results in clinker. The clinker contains four main compounds, namely: **1.** Tri-calcium silicate C3S **2**. Di-calcium silicate ((C2S) **3**. Tri-calcium aluminate (C3A) **4.** Calcium iron aluminate (C4AF) [2] Due to the different proportions of oxides in raw materials according to the composition and environmental conditions surrounding these materials, and since factories use raw materials The raw material is from different sources according to its location. Therefore, the quality and specifications of this important material depend on the quality of the raw materials.

practical program:

To achieve the objective of this study, a practical program was prepared that included the preparation of a standardized concrete mix design according to the proportions mentioned in Table (3). Six cubes were prepared from each mixture, i.e. for each type Cement to determine the strength of concrete was tested after a 7 days and after 28 days, and the results were as shown in Table (4) and we measure the slump for each mix and the results shown in the table (5).

Materials used:

Cement:

Considering the aim of the study is to compare the compressive strength of concrete using different sources of, Portland cement type (42.5) was chosen according to Libyan Standard Specifications No. (340/2009) from the following sources:

Tabel.1: Sources 0f cement

[No	Sources of cement	Name of cement
1	Zlitn	Union Arab company (Cement borag factory)
2	SOUK ALKAMES	Souk alkames
3	KOMES	Almirgab (Cement almirgab factory)
4	TURKY	Falcon cement
5	TUNIS	Kairouan
6	TUNIS	Jabal oust

Coarse and fine aggregate:

Coarse aggregate from a quarry in Bani Walid and fine aggregate from Zliten quarries were used. The granular gradient test of coarse and fine aggregate was carried out using the laboratory equipment of the Bani Walid College of Engineering. The results were as shown in Figure No. (1) and (2) according to American specifications [3] .

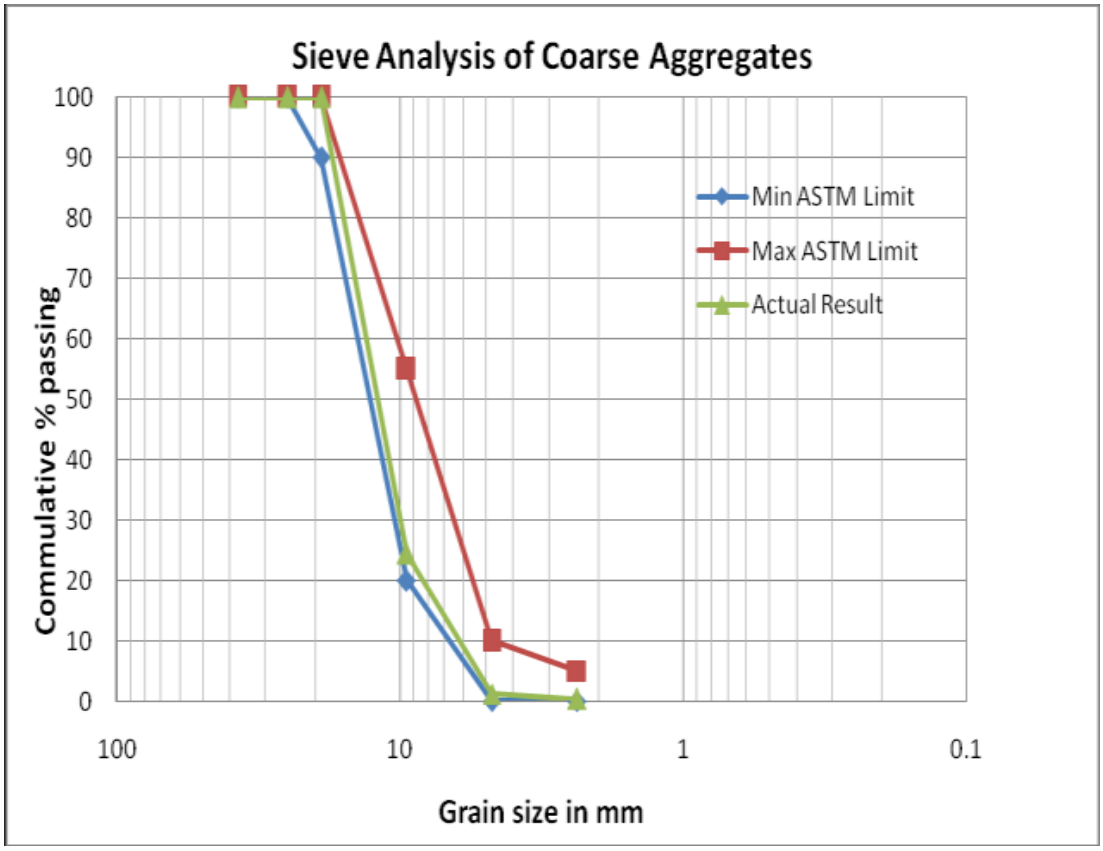


Figure.1: the granular gradient of coarse aggregate

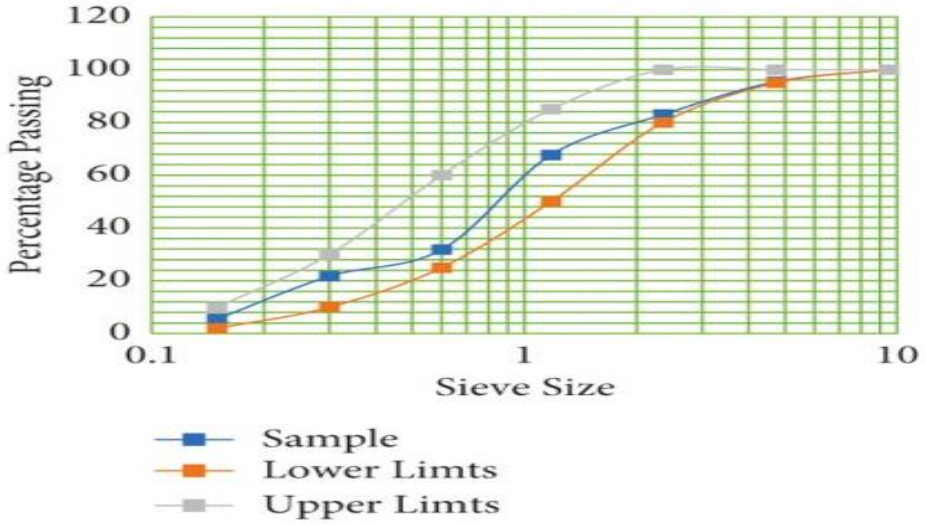


Figure.2: the granular gradient of fine aggregate

water:

The water of the Great Man-Made River was used, and the results of the chemical analysis were as shown in Table No. (2)

Table .2: The results of the chemical analysis of the water

Chemical composition	T.D.S	CL	SO4	CaCo3	PH
Result	1031 mg/L	354.53 mg/L	532 mg/L	425 mg/L	8

Mix design:

To investigate the compressive strength of concrete by using different sources of cement, a concrete mix was designed to achieve compressive strength (25Mpa) with uniform proportions. The only variable in it is cement according to Table No. (3).

Table .3: Mix design component

Mix component	Cement (kg)	Course aggregate (Kg)	Fine aggregate (Kg)	Water (litter)	Water cement ratio W/C
	323	1139	741	200	0.62

Laboratory tests:

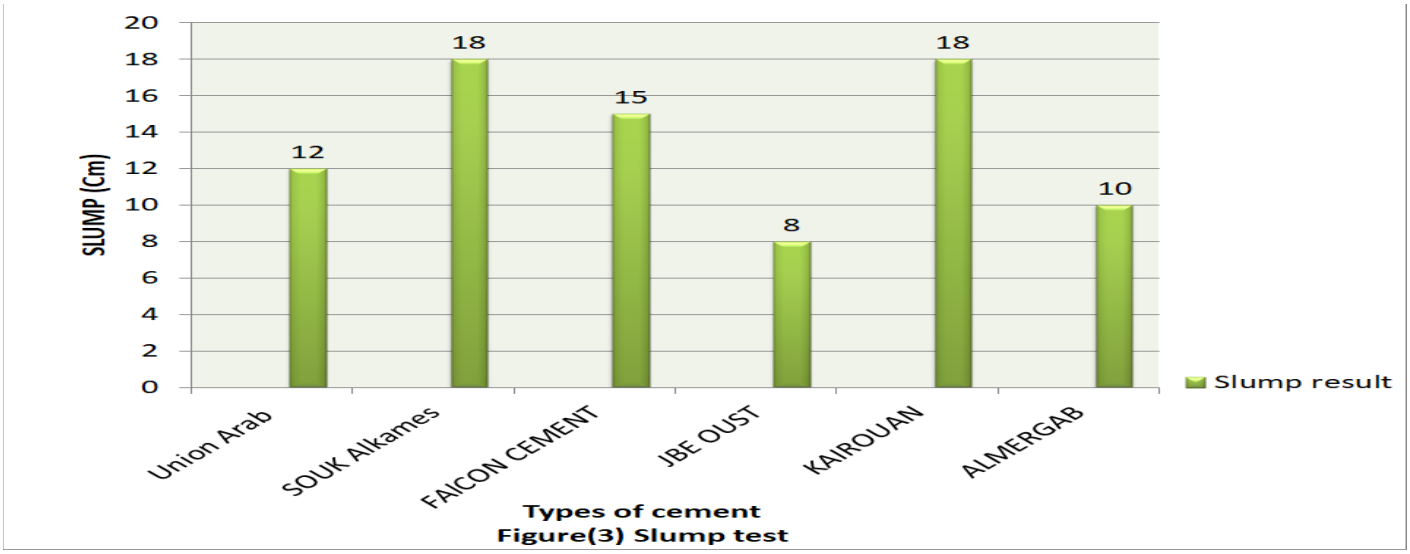
Concrete mixtures have been prepared for various cement sources, using equipment in the laboratory of the College of Engineering, Bani Walid (balance - mechanical mixer - slump test device - cubes - pressure testing machine). **6** cubes were prepared from each mixture. **3** cubes are tested after **7** days and **3** cubes After **28** days, with a total number of **36** cubes, bearing in mind that all cubes have been processed according to the specifications' recommendation, and the results were according to Table No. (4), and as Figure No(2). shows the test results after **7** days, and Figure No. (4) shows the test results after **28** days.

Table .4: Compressive strength of concrete

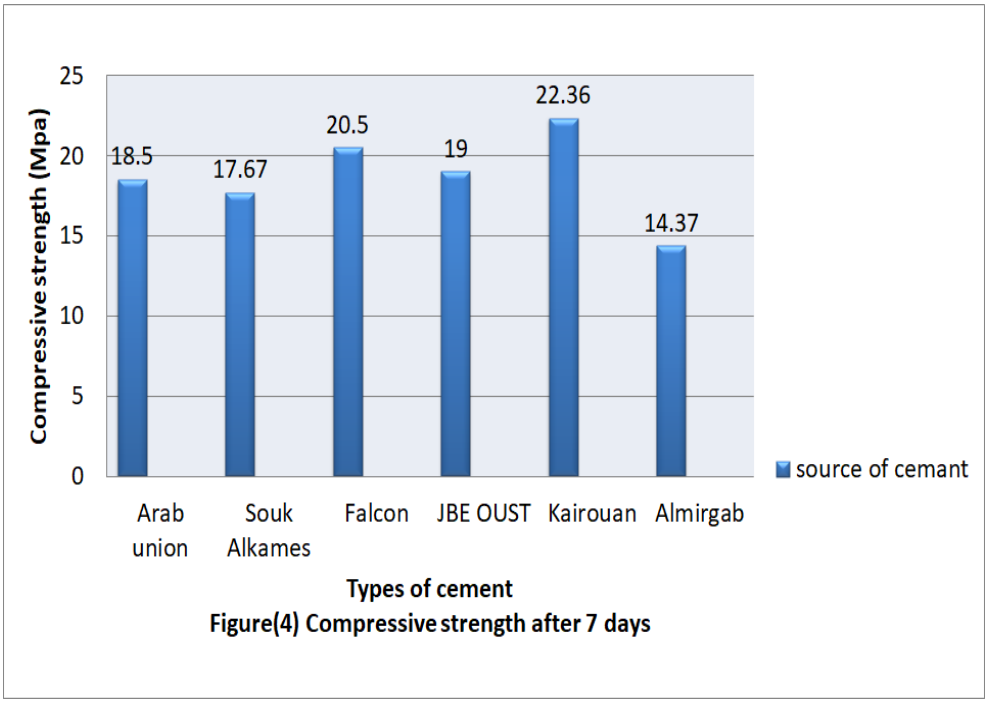
No	Name of cement	Compressive strength after (7 days) (Mpa)	Compressive strength after(28 days) (Mpa)
1	Union Arab company	18.5	27.93
2	SOUK ALKAMES	17.67	28
3	ALMERGAB	14.27	21.7
4	FALCON CEMENT	20.5	29.36
5	KAIROUAN	22.36	27.4
6	JBEl OUST	19	24.63

Table .5: Slump test

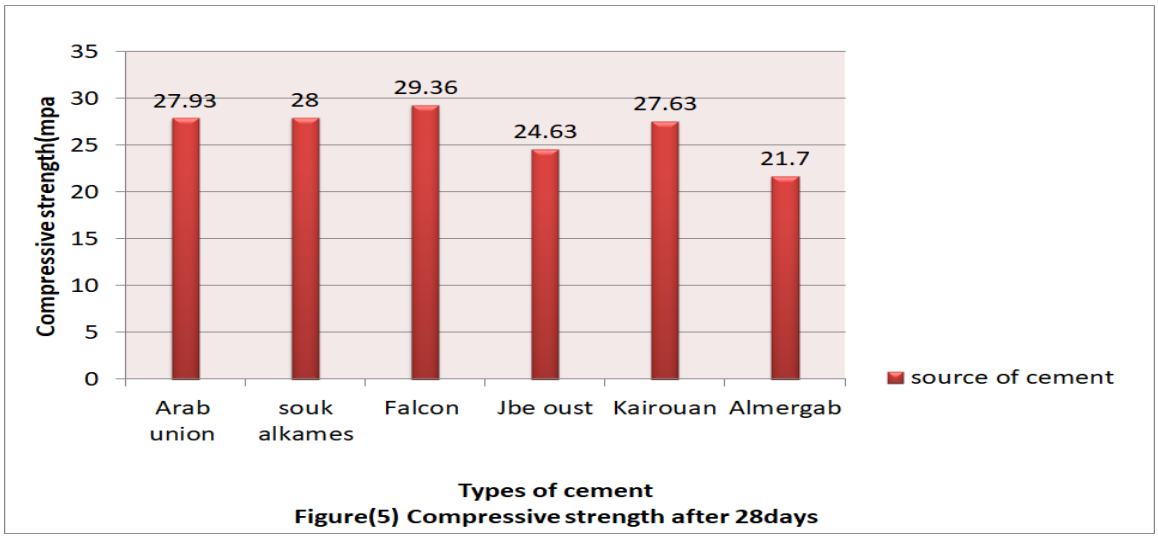
No	Name of cement	Slump(cm)
1	Union Arab company	12
2	SOUK ALKAMES	18
3	ALMERGAB	10
4	FALCON CEMENT	15
5	KAIROUAN	20
6	JBE OUST	8



Figure(3) Slump test



Figure(4) Compressive strength after 7 days



Figure(5) Compressive strength after 28days

Analysis of the results:

By looking at Table No. (5) and Figure No. (3), which show the slump test values for the various mixtures, where it was found that the highest slump value for the mixtures was the cement of Souk Al-Khamis and Al-Qairouan, and this indicates that these two types of cement show high operational performance of concrete, while Jabal Al-Wasat cement showed the lowest slump value This indicates that the performance of the concrete is low. As for Al-Ittihad Al-Arabi cement, Souq Al-Khamis and Falcon cement showed a moderate decline, this indicates that the performance of using these two types of cement is good.

By looking at the table of tests for pressure resistance No. (4) and Figure No. (4) which shows the average results of the cube test after 7 days, it is clear that the slight discrepancy between each of the cements (Al-Ittihad Al-Arabi - Kairouan and - Souk Al-Khamis and Jabal Al-Wasat - and Falcon) in achieving a rate of 70% from designed value in this age of mixture, and this indicates that the cement specifications are good, while Al-Margab cement showed pressure resistance of 57%only from designed value in this age of mixture.

By looking at the test table No. (4) for pressure resistance and Figure No. (5) which shows the results of the tests after 28 days, it is clear that the slight discrepancy between each of the cements (Arab Union - Suq Al-Khamis - Falcon Cement - Kairouan Cement) where the value of the compressive strength exceeded the design value and this It also indicates the quality and specifications of these types and their conformity with the Libyan specifications, while Al-Margab cement and Jabal Al-Wasat showed a value less than the design pressure resistance value.

Conclusion and recommendations:

Referring to the laboratory results that were reached in this research to test the pressure resistance of the manufactured concrete from the mentioned sources, we can draw the following conclusions:

1. The Tunisian Jabal oust Cement showed a low workability.

2. Souk El Khamis Cement and Tunisian Kairouan Cement showed high workability.

3. Union Arab Cement, Souq Al-Khamis, and Turkish Falcon Cement showed good workability.

4. According to the results obtained from the pressure resistance tests after 28 days, it was found that the cements of (Al Ittihad Al Arabi - Souk Al Khamis - Turkish Falcon Cement - Tunisian Kairouan Cement) exceeded the design value of the pressure resistance, and this indicates the quality of these sources and their conformity with the Libyan standard specifications.

5. According to the results obtained from the pressure resistance tests after 28 days, it was found that the cements of (Al-Margab and the Tunisian Central Mountain Cement) did not achieve the design value for the pressure resistance.

6. Recommends the need for periodic control by the competent authorities on the specifications of raw materials and on all materials used in the cement industry, in addition to the necessity of periodic inspection of the factory and ensuring the calibration of devices and machines for locally manufactured cement.

7. The need to comply with the approved Libyan specifications for all types of cement supplied from abroad, with inspection of these factories prior to supply.

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