The International Journal of Engineering and Information Technology

journal homepage:www.ijeit.misuratau.edu.ly

Effect of Locally Manufactured Mosaico Tiles Waste on Concrete Strength

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Abstract—**this study investigates the strength of concrete production from the waste of local mosico tiles, where included the use of two types of coarse aggregate, the first one was natural aggregate used for the reference concrete mix, and the other was imported from local tile factory in Zliten. The tile waste was crushed by manual means. The natural aggregate in concrete mix was replaced by the mosico tiles waste with percentages 0%, 50% and 100%. Several laboratory tests were carried out on coarse aggregate, fine aggregate and tile waste such as sieve analysis test, water absorption test, and conducting tests on fresh concrete represented by operational testing, as well as hardened concrete to know its resistance. The results showed that the higher the percentage of adding residues, the higher the operational degree, and the decrease in concrete was recorded 9, 10.5 and 11 cm according to replacement ratios, respectively. While the results of concrete resistance showed that the decrease in pressure resistance the higher the percentage of adding residues at the time of 7 days, and recorded 28, 16.77 and 14.84 Mpa, in the above mentioned ratios, respectively. From a period of 7 to 28 days the concrete resistance increased with an increase in the percentage of adding residues. It was recorded as 32.63, 21.01 and 18.26 Mpa, where the strength of the concrete with adding of mosico tile residues is poor compared the reference sample.**

Index Terms: **coarse aggregate, mosico tile waste, concrete resistance, laboratory tests, slump test.**

I. INTRODUCTION

The remnants of mosico tiles spread especially those of local production which is usually disposed of in landfills. They need large areas to accommodate these large quantities which cause an ethical and environmental problem. Hence, this study suggests possibility of use of this waste to produce concrete with good resistance, in addition to maintain clean environment and aesthetic appearance. The use of two types of coarse aggregate - which is one of the main material of concrete composition- is included. As a result of different construction processes, it led to the development of concrete in all fields, where the aggregate constitutes are the largest part in concrete, about 75 % of the concrete volume [1,2]. In order to reduce the pollution processes in production of aggregates, it is possible to benefit from mosico tiles waste in concrete [3].

In India, Mohd. et al [4], studied the crushed tiles waste used to replace the coarse aggregate. The composition of tiles waste was replaced in place of coarse aggregate by 0%, 10%, 20%, 30%, 40%, and 50% without changing of the mix design.

The results showed that the compressive strength test increases when the percentage of replacement increases. Another study was conducted by Mohd. Aadil and D.L.Budhlani [3], where they added mosico and granite waste and replaced it by fine and jagged aggregate respectively, at ratios of 0%, 10%, 20%, 30%, 40% and 50%. The obtained results for the strength of concrete were good.

Also, Ganaw et al [5], used crushed floor tiles waste to substitute natural coarse aggregate. The results showed that the strength of concrete was weak compared to the reference sample. In this paper, the findings of Ganaw were confirmed.

II. MATERIAL AND METHODS

The materials were used namely cement, water, coarse aggregate, fine aggregate, and mosico waste to prepare required samples. All used material were collected from Zliten area.

A. Cement

The cement was obtained from a local factory (Al-borj for cement – Zliten).

B. Water

The water source throughout mixing of concrete was the man-made- river water.

C. Coarse aggregate

The aggregate was supplied from Majer region, Zliten area. Several tests were done on aggregate. “Figure. 1,” shows the grading curve of coarse aggregate to ensure that it has good grading according to specifications, BS

Received 11 July, 2022; revised 17 Aug, 2022; accepted 30 Sep, 2022.

Available online 1 Dec , 2022.

812:1992 [6]. Also the physical properties of aggregate such as aggregate specific gravity test, Los Angeles abrasion test, and water absorption, were performed at Al-Asmarya University Engineering Laboratory, and shown in table (1), according to ASTM C33, C131[7,8], [9], was used as coarse aggregate as shown in "Figure. 2,".

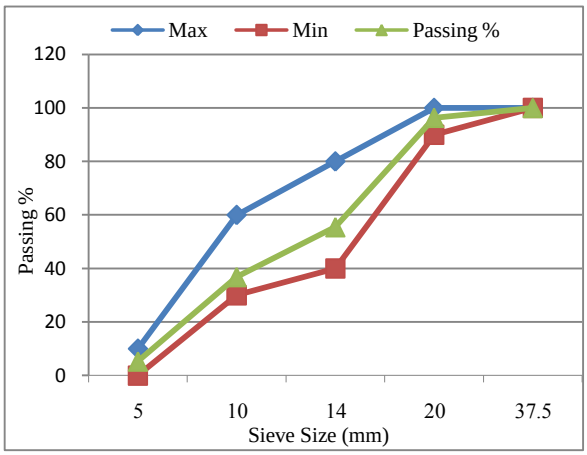

Figure 1. Grading curve of coarse aggregate.

Table 1. Properties of aggregate observed in laboratory test

Description	**Test Result**	**standard**	**No Reference**
Specific gravity test	2.62	2.6-2.7	[7]
Los Angeles test	26.93 %	≥ 40 %	[8]
Water Absorption	0.32 %	(3-5)%	[9]

Figure 2. Natural coarse aggregate.

D. Mosico tile waste

The sample of mosico tiles waste was collected and tiles waste were crushed into sample constituents manually. The physical properties of mosico waste such as aggregate specific gravity test, Los Angeles abrasion test according to ASTM C33, C131[7,8], and water absorption according to BS 4131 [10], were performed at Al-Asmarya University Engineering laboratory are shown in table (2). "Figure. 3," shows the grading curve for coarse aggregate to ensure that they gave good grading according to specifications BS 812:1992 [6], and "Figure. 4," shows the used mosico waste.

Table 2. Pysical properties of mosico tile waste

Description	Test Result	standard	No Reference
Specific gravity test	2.35	2.6-2.7	[7]
Los Angeles test	29.23 %	≥ 40 %	[8]
Water Absorption	0.46 %	≥ 8 %	[10]

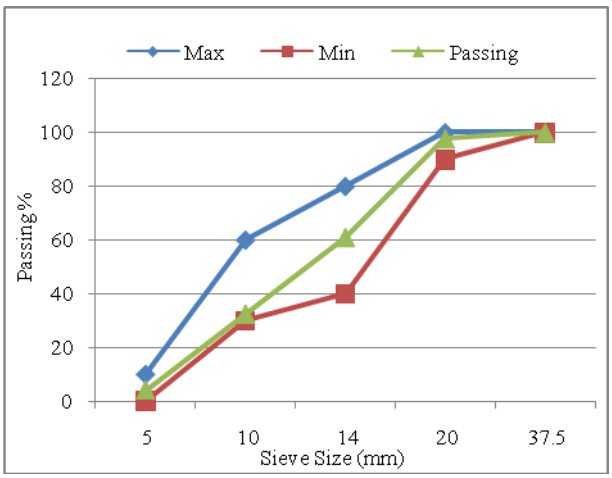

Figure 3. Grading curve of mosico tile waste.

Figure 4. Mosico tile waste.

E. Fine aggregate

The fine aggregate was tested for its physical requirements such as specific gravity in accordance with ASTM C128[11], as shown in table (3). "Figure. 5," shows the grading curve of fine aggregate to ensure that they have good grading according to specifications BS 882: 1992 [6].

Table 3.Properties of fine aggregate observed in laboratory test

Description	**Test Result**	**ASTM C128**
specific gravity test	2.6	2.5 – 2.75

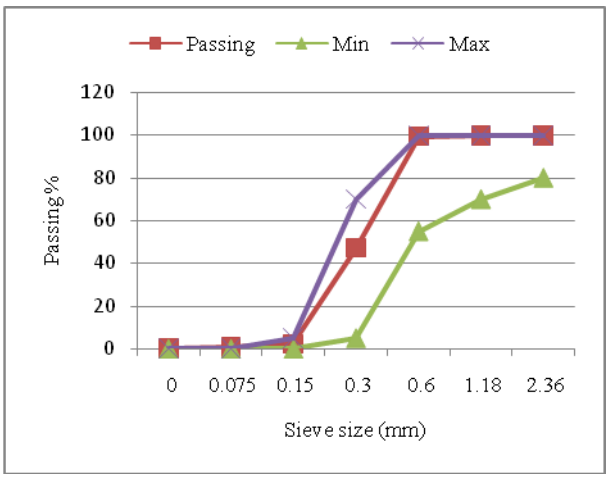

Figure 5. Grading curve of fine aggregate

III. MIX DESIGN

The process of mixing and preparing materials is an important matter in concrete mixture. In order to obtain good concrete resistance, quantities of concrete materials used for the all concrete mixtures are shown in table (4). Three types of concrete mixes were prepared. All the concrete mixes were produced by keeping proportion of 1:4:2.61:0.6 (cement: coarse aggregate: fine aggregate: water).

Table 4. Weights of materials used to implement concrete Mixes

Mix Design	Cement Kg/m^3	Corse aggregate Kg/m^3	Mosico waste Kg/m^3	Fine aggregate Kg/m^3	Water L/m^3
M_1	300	1200	0	785	180
M_2	300	600	600	785	180
M_3	300	0	1200	785	180

Where,
M_1 is a reference sample consisting of aggregate only.
M_2 is a sample consisting of 50% ordinary aggregate and 50% mosico waste .
M_3 is a sample made up of 100% mosico waste only.

IV. RESULTS AND CONCLUSION

A. *Slump test*

Water plays a major role in concrete in its ability to be poured into the mold and its resistance hardening. Table (5) shows the workability of concrete measured by slump test. The following concrete were prepared with indicated partial replacements.

1- Reference concrete without any additives.
2- Concrete with partial replacement of aggregate by 50% of mosico tile waste.
3- Concrete with partial replacement of aggregate by 100% of mosico tile waste.

Table 5. Slump test

Mix. No	Workability (Cm)
M_1	9
M_2	10.5
M_3	11

The results show that,
1- Medium to high workability for mixes.
2- Slump value ranged from 80 – 120 mm according to BS8500 [12], which is suitable for simple strip footings and cast in-situ hard-standing slabs or trench-filled foundations.
3- The workability increases when the percentage of replacement increases. It is clear that the reference mix shows more decrease slump than mixes of mosico tile waste.

B. *Concrete Compressive Strength*

At the end of the curing, the cubes were removed and wiped to remove surface moisture in readiness for compression test in accordance to BS EN 12390-3[13]. The cubes were then placed with the cast faces in contact with the platens of the testing machine. The load was applied at a constant rate of stress of to failure. The obtained results are shown in "Figure. 6," and they are consistent with Ganaw results [2].

The results show that:
1- The compressive strength of concretes decreases as the percentage of substituted aggregate increases by up to 50% within 7, 28 days. This decrease could be due to a large percentage of the mixing water or the lack of quality of the locally made mosico tiles.
2- These results show that partial and total substitution of mosico waste decreases the average compressive strength.

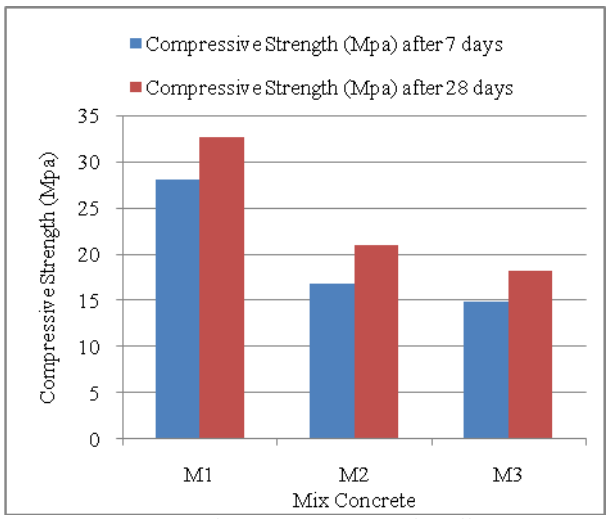

Figure 6. Comparison of compressive strength for different mixes.

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