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Research paper

Study the Possibility of Recycling Damaged Thermostone in Thermostone Najaf Plant

[1]Ammar Razzaq Hasan, [2]Khaldoon Hussein Hamzah

[1]University of Kufa/College of Engineering ,Department Of Materials Engineering
[2]Assistant Lecturer, Khaldoon Hussein Hamzah, University of Al-Qadisiyah
/College of Engineering/Department Of Materials Engineering
**Corresponding author E-mail: ammarr.alshemary@uokufa.edu.iq*

Abstract

Research include the possibility of benefiting from a damaged thermostone and output from several sources, including manufacturing and damaged operations during transportation and the user to measure the durability other from other sources as substitutes for Raw Materials involved in thermostone industry while maintaining the quality of the product and its properties and thus reducing the raw materials consumed in production processes where it was noted that the compensation of 15% of each of sand and cement. Thermostone mix give the results of the power of good bear while maintaining on its properties and that the compensation cement results were better than the compensation sand and therefore can benefit from a damaged Thermostone in recycling.

Key words: *Thermostone, Damaged, Cement, Sand, Benefiting, Recycling.*

1.Introduction

The real concrete (Thermostone) or sometimes called porous concrete, the alternative construction materials Characterized by lightly in weight and thermal in solution and acoustic good moreover suitability to the circumstances and the nature of climate and other economic and aesthetic features which is famous for these materials, which were used to enhance the urban and industrial wealth in the world federation [1]. Thermostone is a construction material, which is commonly used in Iraq as a filling material in blocks, panels, ceiling panels, pre-cast exterior walls, void filling, roof insulation, thermal insulations, sound insulation, floors and low cost housing [2]. It dose essentially consist of cement, sand and lime, which are mixed in a different propositions [3].

Thermostone is a concrete which by one means or another has been made lighter than conventional concrete. Using concrete with a lower density can, therefore, result in significant benefits in terms of load bearing elements of smaller cross-section and a corresponding reduction in the size of foundations. Furthermore, with lighter concrete, the formwork needs to withstand lower pressure than would be the case with normal weight concrete, and also the total mass of material to be handled is reduced with a consequent increase in productivity [4].

Concrete which has a lower density also gives better thermal insulation than ordinary concrete and possesses good fire and frost resistance [5].

The growing importance of sustainable development on a global scales for several reasons, including that many of the earth's resources non-renewable. Many countries adjust in the world from the negative effects of the accumulation of industrial waste and the demolition of buildings and causing environmental and health problems [6], This requires the development of practical solutions to reduce these excess materials by recycling as an alternative to some of the most common building materials (such as cement, sand and gravel) in mixtures of concrete or asphalt [7].

Iraq is one of the Gulf countries with hot climates, most consistent dry summer and winter cold and wet, with average summer temperatures of more than 50 °C (external temperature) and relative humidity less than 10%. Rarely used lightweight concrete construction in Iraq, Moreover, the small amount used has been imported in most cases from abroad. This has led to several studies on the possibility of producing light debris from local materials or natural or recycling of construction waste and use partial or total coal or fine aggregate substitute in concrete materials [8].

2.Aim of the Research

Benefit from thermostone damaged substitutes for raw materials warbler in thermostone industry while maintaining the quality of the product and thus reduce the raw materials consumed in the manufacturing processes.

3.Experimental work

3.1. Materials used

Sand, Cement, Lime, Aluminum powder, Water, Damaged Thermostone

Table (1) represents the weights of the raw materials used in Thermostone Najaf plant.

Table (1) the weights of the raw materials used in laboratory mold in Thermostone Najaf plant

Raw materials	Sand	Cement	Lime	Al
Mix standard (gm)	550	150	100	0.25

4.Devices and equipment used

4.1.Device of measuring strength (Durability) for Thermostone

The durability of the Thermostone cubes prepared in vitro is tested using a robustness test of Thermostone cubes at the Thermostone laboratory in Najaf plant, shown in Figure (1).

Figure (1) measuring of strength for Thermostone (Durability)

4.2.Device of measure weight for Thermostone

The density of the Thermostone cubes prepared by laboratory is calculated by calculating the weight of these cubes using a thermometer measuring device for the purpose of calculating the density of the Thermostone in the laboratory of the Thermostone Najaf plant, shown in Figure (2).

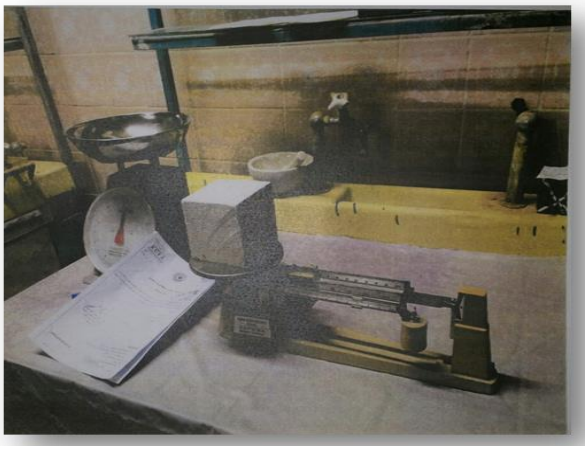

Figure (2) device of measure weight for Thermostone

4.3.Mix materials

Processing of raw materials (sand , cement , and lime powder aluminum) from Thermostone Najaf plant, Mixing the raw materials situation dry, a laboratory for the specification and measurement carried out on raw materials in the laboratory. Regular use of drinking water and soap solution as chemical foam. The real concrete industry by mixing raw materials (sand, lime, cement) mixing proportions determined by the required specifications. Aluminum powder and soaps as added, these materials are produced by the spherical cells as a result of liberalization of hydrogen gas "H_2" and the interaction after pouring the mixture in a laboratory mold then undergoes a final hardening of the steam inside the oven at a temperature of 200 C and under pressure equivalent to 1600 KN/M2 for a period of 16 hours.

4.4.Preparation of laboratory mold

Preparation of laboratory sheet of aluminum mold Dimensions (10 x 10 x 10) cm^3 for the purpose of the study laboratory so that we can conduct examination durability of cubes prepared or templates laboratory to laboratory Thermostone Najaf plant Create the template with oil before casting process, shown in Figure (3),(4).

Figure (3) the process of casting raw material in the mold to product the required shape

Figure (4) the dimension of the sample

4.5.Calculate the amount of water used

Water user account is quantity by 75% of the raw materials; the quantity can be calculated from the following equation:

$$0.75 * (550 + 150 + 100) = 600 \text{ mm}$$

4.6.Calculate the density

The density of Thermostone cubes prepared by laboratory is calculated by knowing the weights of these cubes and using the following equation:

$$\text{Density} = \frac{\text{The weight}}{\text{The size}} \quad g/cm^3$$

4.7.Compensation for the percentage of the sand in Damaged Thermostone:

Compensation for different percentage of sand in Damaged with Thermostone maintain an amount of fixed and other materials. Note mixed results with standard work every time for the purpose of comparison.

The proportions and quantities used in casting these mixtures as shown in table (2).

Table (2) Compensation for a percentage of sand in Damaged Thermostone

Raw materials	Mix standard (gm)	Compensation for a percentage of sand in Damaged Thermostone (gm)				
		5%	10%	15%	20%	25%
Sand	550	522.5	495	467.5	440	412.5
Cement	150	150	150	150	150	150
Lime	100	100	100	100	100	100
Al	0.25	0.25	0.25	0.25	0.25	0.25
Water	600	600	600	600	600	600
Damaged Thermostone	--	27.5	55	82.5	110	137.5

4.8.Compensation for the proportion of cement in damaged Thermostone:

The compensation for different ratios of cement in Damaged Thermostone maintains an amount fixed and other materials. Note mixed results with standard work every time for the purpose of comparison.
The proportions and quantities used in the molding of these mixtures as shown in table (3).

Table (3) Compensation for cement in Damaged Thermostone percentage

Raw materials	Mix standard (gm)	Compensation for cement in Damaged Thermostone percentage (gm)				
		5%	10%	15%	20%	25%
Sand	550	550	550	550	550	550
Cement	150	142.3	135	127.5	120	112.5
Lime	100	100	100	100	100	100
Al	0.25	0.25	0.25	0.25	0.25	0.25
Water	600	600	600	600	600	600
Damaged Thermostone	--	7.5	15	22.5	30	37.5

After casting mold have been entered into the furnaces Thermostone Najaf plant, and in the same condition used in the production of laboratory Thermostone.

5.Results and Discussion

5.1.Results of density tests for Compensation for a percentage of sand in Damaged Thermostone:

Density (calculate an average of three models for each mixed) table (4):-

Table (4) Results of Density for Compensation for a percentage of sand in Damaged Thermostone

Mix type	Density g/cm^3
Mixed standard	571
Mixed compensated for 5% of the sand	385
Mixed compensated for 10% of the sand	420
Mixed compensated for 15% of the sand	550
Mixed compensated for 20% of the sand	620
Mixed compensated for 25% of the sand	715

Mixtures of any density closer to the mixed standard.

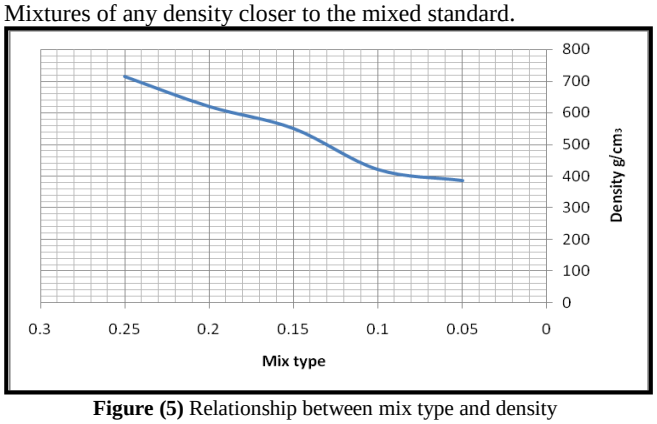

Figure (5) Relationship between mix type and density

5.2.Results of Durability tests for Compensation for a percentage of sand in Damaged Thermostone:

Durability (calculate an average of three models for each mixed) table (5):-

Table (5) Results of Durability for Compensation for a percentage of sand in Damaged Thermostone

Mix type	Durability kg/cm^2
Mixed standard	34
Mixed compensate for 5% of the sand	24
Mixed compensate for 10% of the sand	26
Mixed compensate for 15% of the sand	30
Mixed compensate for 20% of the sand	25
Mixed compensate for 25% of the sand	20

Mixture of any durability closer to the mixed standard.

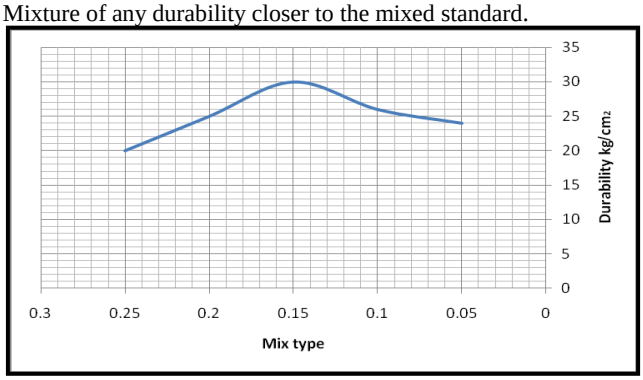

Figure (6) between mix type and durability

5.3.Discuss mixture substitutes for sand in Damaged Thermostone:

From the results of density in the table (4) and figure (5), we find that the nearest density to the density of the standard mixture is the mixture compensated for 15% of the sand in Damaged Thermostone and the results of stress strength in the table (5) Figure (6), we find that the highest durability and is the closest to bear the standard mixture strength is the mix compensated for 15% sand corrupted Thermostone and whenever increase sand ratio substitutes in Damaged Thermostone the less durability.

5.4.Results of density tests for Compensation for a percentage of cement in Damaged Thermostone:

Density (calculate an average of three models for each mixed) table (6):-

Table (6) Results of Density for Compensation for a percentage of cement in Damaged Thermostone

Mix type	Density g/cm^3
Mixed standard	571
Mixed compensated for 5% of the cement	495
Mixed compensated for 10% of the cement	535
Mixed compensated for 15% of the cement	570
Mixed compensated for 20% of the cement	580
Mixed compensated for 25% of the cement	605

Mixtures of any density closer to the mixed standard.

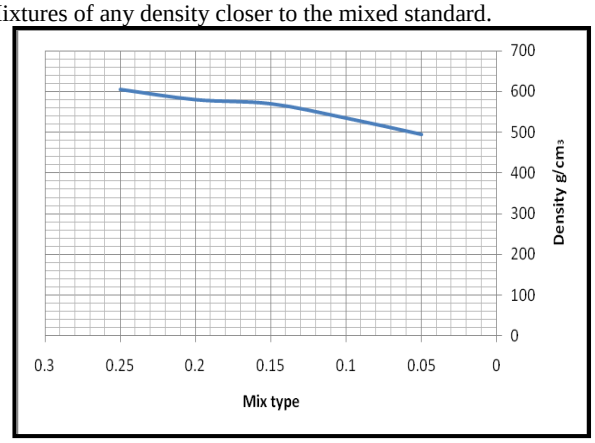

Figure (7) between mix type and the density

5.5.Results of Durability tests for Compensation for a percentage of sand in Damaged Thermostone:

Durability (calculate an average of three models for each mixed) table (7):-

Table (7) Results of Durability for Compensation for a percentage of cement in Damaged Thermostone

Mix type	Durability g/cm^3
Mixed standard	34
Mixed compensate for 5% of the cement	28
Mixed compensate for 10% of the cement	31
Mixed compensate for 15% of the cement	35
Mixed compensate for 20% of the cement	30
Mixed compensate for 25% of the cement	29

Mixture of any durability closer to the mixed standard.

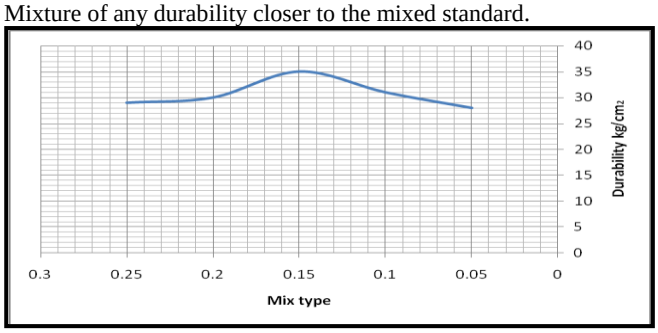

Figure (8) between mix type and durability

5.6.Discuss mixture substitutes for cement in Damaged Thermostone:

Results of density in the table (6) and figure (7), we find that the density of the nearest standard mix mixture is compensated for 15% of cement in Damaged Thermostone One result of durability in the table (7) and figure (8), we find that the highest durability of the mixture is compensated for 15% of the cement in Damaged Thermostone and are also higher durability than the standard mix, and the greater the proportion of cement to compensate for the less durability.

6.Results

When comparing mixtures substitutes for sand and cement, we find that compensation for cement gives better results than in the case of compensation for sand and all ratios and this What we're saying is clear by comparing the results of density and durability set forth in the table and this shows get stronger correlation between the damaged and other components in the case of compensation for cement to familiarize themselves with all the sand is a high percentage of the damaged content and thus gain concrete preprocessing and durability because it affects a large extent on the crystal structure and gives the block concrete resistance to external power and maintain the properties of heat and moisture and freezing.

7.Conclusion

1) Possibility of benefiting from a damaged thermostone and compensation instead of sand and cement.
2) Compensation to 15% of cement gave the best of all the results of compensation of sand while maintaining the characteristics and specifications approved and most important of which more durability as shown in the tables (4), (5), (6) and (7).
3) Cement compensation gives better results than in the case of compensation with sand and all ratios, as shown in the tables (4), (5), (6) and (7).
4) Not to increase the rate of compensation for 15% of compensation in the case of cement or sand where the increase lead to weakness in the Thermostone producing properties and durability.
5) Compensation 15% of the cement gave the results of the standard approach of the sample in terms of density and durability as shown in the tables (6) and (7).

8.Recommendations

1. We recommend the application of laboratory experiments to practical application in Najaf Thermostone plant.
2. Due to the ease of thermostone industry and provide raw materials can be used to make any experiments that will lead to the production improvement.

9.Feasibility

1) That compensation in Damaged Thermostone 15% of cement in the laboratory the size of a template (10x10x10) is a good percentage compared to the size of the mold plant where the proportion of cement used in the mixture mold plant 750 kg and that the compensation for 15% of this figure constitutes a 100 kg per mixture mold plant. Thermostone Najaf plant produces up to (2000) mixture mold plant per day and thus become the quantity (200000) kg per day of cement, provider for a period of one month will be the percentage limits (600000) kg per month, providing any ability (7200,000) kg per year.

2) Produces Thermostone Najaf plant amounts estimated at tens of tons annually of thermostone damaged as a result of several operations in the case of exploitation in compensation for any raw material gave good results.
3) To get rid of corrupted thermostone which represents a burden on the environment and recycling in order to preserve the environment, which is one of the most important problems of the present time.

Reference

[1] Thermostone Najaf plant – Group studies and research – General Organization for construction industries.
[2] Samir H. Awad, Elham Abd Al-Majeed, Mohammed Al-Issawi, 2015, (Glazing and Coloring of Cellular Concrete Blocks), Journal of Babylon University/Engineering Sciences/ No.(3)/ Vol.(23).
[3] McNeil, M., and Kang, T.H.K., 2013, (recycled concrete aggregate: A review), International journal of concrete structures and materials, 7(1): 61-69.
[4] Rami Joseph Aghajan Sldozian, 2014, (Effect of Waste Thermostone as an Aggregate in Concrete Containing Nano-SiO2), International Journal of Scientific & Engineering Research, Volume 5, Issue
[5] Ali A. Hussain abdulameer, 2012, "Types of failure in cellular concrete Blocks (Thermostone)", Kufa Journal of Engineering, Vol.3.no.2pp.101-114.
[6] Tumadhir Merawi Borhan, 2015, (Effect of Using Recycled Lightweight Aggregate on the Properties of Concrete), Journal of Babylon University/Engineering Sciences/ No.(2)/ Vol.(23).
[7] Rao, A., Jha,K.N., and Misra, S., 2007, (Use of aggregates from recycled construction and demolition waste in concrete), Resources, (conservation and Recycling), Elsevier B.V, Heliyon Partner Journal, vol. 50(1):71-81.
[8] Abed, M. F., 2009, (Preparing Lightweight Aggregate for Production of Lightweight Insulating Concrete), Tikrit Journal of Pure Science, 14(3):194-200.