جامعه بابل

كليه الهندسة المواد

قسم السيراميك

Recycling cork waste to produce lightweight concrete

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الاهداء

أرى رحلتي الجامعية قد انتهت اليوم بالفعل ، من بعد تعب ومشقة لوقت طويل، ها أنا اليوم أختم بحث تخرجي بكل ما لدي من همة،

وبداخلي كل التقدير و الأمتنان لكل شخص كان له الفضل في مسيرتي ، وقدم لي المساعدة.

إلى رفيق دربي (أبي الغالي) و إلى نور عيني (والدتي العزيزة) . .

ولأستاذي (وسام الاسدي) . .

أهدي لكم بحث تخرجي و أتمنى أن ينال رضاكم، واتمنى من الله أن يطيل في أعماركم ويرزقكم

Conclusion-:

This research deals with two important matters locally and globally, the first is environmental pollution (which is a problem of the age), and the second is the great economic return as a result of recycling and reusing materials without the need for trouble and costs of raw materials. One of the industrial pollutants of the environment is cork waste. Cork is important in all aspects of practical life due to the many advantages that it enjoys, the most important of which is the ease of its compression and manufacture in a way that suits human daily needs and life. One of the negative results in the cork industry was the accumulation of large quantities of cork waste that was consumed and it was time to get rid of it.

In this research, the effect of adding industrial cork waste as a percentage of sand weight on some concrete properties such as compressive strength, sound insulation, density, and thermal insulation was studied. Three mixtures containing different proportions of cork were used. Compressive strength and sound insulation tests were conducted at (28) days of age, and the density of concrete samples was examined.

The laboratory results obtained from this study indicated that the addition of industrial cork to ordinary concrete leads to a decrease in density, a decrease in compressive strength, and an increase in sound insulation.

Chapter one

the introduction

1.1 the introduction

This research deals, albeit in a simple manner, with two important matters locally and globally, the first is environmental pollution (which is considered a problem of ageing), and the second is the great economic return as a result of recycling materials and reusing them without the need for trouble and costs of raw materials, and one of the most important environmental pollutants is cork waste. Cork is important in all aspects of practical life due to the many advantages that it enjoys, the most important of which is the ease of its compression and manufacture in a way that suits the daily and life needs of man. Most cork does not decompose quickly, as its waste has contributed significantly to environmental pollution. The researchers were unable to destroy this material, so these industrial wastes accumulated and began threatening human health and all elements of the environment. It was found that some of these wastes can be controlled by the recycling process, and some types of cork may be reconfigured to produce new commodities used to supplement practical and daily life.

Lightweight concrete

Since ancient times, man has shown interest in building materials that are light in weight and good for heat insulation. For example, in Iraq, wood and plant aggregates were used in various forms, such as rice husks and figs mixed with clay, as a binder to reduce dead weights in ceilings (2), which attracted the attention of researchers to solve problems arising from dead weights. For tall buildings, in various ways, including adding cheap industrial cork. The use of cork has become very common, especially in tall and service buildings (i.e. building offices), as it is used to separate rooms and offices, and this directly gives a great profit in the live weight of the building studied, as well as for ribbed tiles. The most important benefits of cork concrete in the construction sector can be summarized as follows (3)

1- Reducing the dead weights in the structural parts and what follows from reducing the cost of the foundations or determining the dimensions of the structural parts and reducing the vertical or lateral pressure of the casting molds.

2 -Providing better thermal insulation and sound absorption compared to regular concrete.

1.3Increasing the burning resistance (for flammable inorganic species), thus reducing the risks and damages resulting from fire.

4 -Increasing the damping coefficient, thus reducing the damage caused by earthquakes, storms, or other dynamic effects.

5 -Ease of perforating, drilling, cutting, or any process that facilitates fixing nails or passing electrical wires.

Previous studies-:

There is not much research on this type of concrete. Although artificial cork granules have been known since the fifties, the high cost of cork at that time did not encourage its widespread use. The physical properties of cork concrete have been studied by, who have noticed that the properties of concrete such as compressive strength, sound insulation and thermal insulation depend on the cork to sand ratios mainly (both concluded that the compressive strength is directly proportional to the density and notes a decrease in these properties when the Density The ratio of water to cement plays the most important role in determining the strength of this type of concrete.

Cork has been added

As a percentage of sand weight, the effect of this addition on the mechanical properties and density of the produced concrete was studied. This addition had a negative effect on compressive strength and a decrease in density. Adding cork to concrete in an attempt to

produce lightweight concrete. The laboratory results obtained from this study indicated that the addition of artificial cork to ordinary concrete led to a decrease in density, a decrease in compressive strength, and an increase in sound insulation and thermal insulation.

Aim of the study *1.2

The study aims to achieve two goals: The first is to study the effect of adding industrial cork waste, which is present as industrial waste harmful to the environment, on some mechanical properties of concrete such as compressive strength, fracture criteria and density.

a friend of the environment.

The second chapter

is the theoretical part

Concrete2.1

It is a mixture of raw materials consisting of sand and gravel. (breaking stones)

and cement with the addition of water to them. When mixed well, the cohesion process takes place between them.

Raw materials for concrete

1-cement

2-the sand

3-gravel

4-water

5-synthetic cork.

Cement 2.2.1

As in Figure No. (2.2) (adhesive) and adhesion (Cohesive), which is the material that has cohesive properties

In the presence of water, which makes it able to bind the components of the concrete to each other and its cohesion with the reinforcing steel and turn it into a complete interconnected unit so that the cement is manufactured by breaking and grinding the ecclesiastical stone and lime

(which materials contain oxides of calcium, silicon, aluminum and iron),

Then the mixture is heated to a temperature of about (1500) degrees Celsius in special ovens and a substance called clinker is obtained. After obtaining the clinker, the materials included in its composition cannot be recovered, and this process is considered irreversible.

The most well-known form of cement is Portland cement, but there are other different types of cement with various characteristics, and it forms about 5% and up to 20% of the total volume of concrete from cement. About 95% of the cement manufactured in the world is used for the manufacture of concrete. It is mainly used to stabilize soil and adjust the acidity of the reaction waste.

The basic cement compounds are four:

1- dicalcium silicate(C2S).
2- Tricalcium silicate(C3S).
3- Omina triglycerides(C3A).
4- Tetracalcium lumina(C4A).

Figure No. (2.2) Cement

Sand2.2.2

It is an aggregate that consists of small granules so that it can pass through the standard sieve 4.75, either natural sand, crushed stone sand, or crushed gravel. As in Figure 2.3

Figure No. (2.3) Sand

2.2.3 Gravel

Large aggregates whose grain size ranges from 4.75 to 150 mm, such as unbroken or partially broken gravel taken from rivers and streams, or broken rocks such as clay, iron slag, etc., as in Figure 2.4.

Figure No. (2.4) pebbles

Water 2.4

It must be clean and free from harmful substances. Water is life for the concrete mix and it is very necessary to mix the components together, and to obtain a cement paste suitable for work.

It is the basis of the chemical reaction that takes place between its components, so it is absorbed by the cement and gravel granules, and it provides the concrete with ductility and makes it capable of forming and pouring.

Water is added in certain proportions, and after pouring and shaping the concrete, the water gives the concrete a double volume of 15%, and the remaining part is lost by evaporation. One of the important things is to water the

concrete with water after it has been poured and completely dried to increase its strength.

synthetic cork.2.2.5

Industrial cork (Styropore) was used from fruit preservation residues after cleaning and crushing them. as in Figure 2.5.

Figure 2.5.

*Confusion

It must be ensured that the sand and gravel are clean, and therefore they must be cleaned of any organic materials attached to them, and that is passed through a sieve and washed with water before using them, because the presence of large proportions of clay, organic materials, salts, or phosphates in the concrete due to corrosion and resonance of the iron present in it.

Strength of Concrete 2.3

The strength of concrete is one of its most important other properties such as durability and impermeability, as it gives a comprehensive picture of the quality of concrete and a good guide to most of its other properties.

The strength of concrete results from:

1- Mortar resistance
2- 2- The strength of adhesion between the mortar and the coarse aggregate.

3- Resistance of coarse aggregate granules to applied stresses.

2.4Factors Affecting Resistance:

1 - Water/cement ratio

It is assumed that the strength of concrete at a given age and cure at a specific temperature depends primarily on cementing only two factors: the water/cement ratio and the degree of compaction. When the concrete is fully compacted, its strength is taken to be inversely proportional to the water/cement ratio. The water/cement ratio determines the porosity of the hardened cement paste at any stage of hydration. Thus, the water/cement ratio and the degree of compaction both affect the size of the voids in the concrete.

The relationship between water/cement ratio and concrete strength is shown in Figure 2

It can be seen that a lower water/cement ratio can be used when vibrating concrete to achieve higher strength while a relatively higher water/cement ratio is required when compacting concrete by hand. In both cases, when the water/cement ratio is less than the scientific limit, the strength of the concrete falls rapidly due to the introduction of air voids.

2-Jelly / space ratio

The strength can be more related to the hard products of cement hydration with the surface area available to form this product. Figure 3 illustrates the relationship between the gel/void ratio and the strength of concrete, and showed that the strength increases with the increase of the gel/void ratio.

3-Active water in the mixture

Active water is water that takes up space outside the aggregate particles when the aggregate volume of concrete has settled.

4-Coarse aggregate swell

It has been found that the use of larger aggregates leads to a decrease in strength due to

* Larger aggregates with maximum size give a reduced surface area for the development of gel bonds which are responsible for the lower strength of concrete.

* Larger aggregate size leads to more heterogeneity in the concrete which prevents uniform distribution of load at stress.

* When using oversized aggregates, due to internal bleeding, the transition zone will become much weaker due to the development of micro-cracks which result in lower compressive strength.

5- The influence of cement content

For a given workability strength increases with cement content and the increase depends on the type of aggregate used, although the increase in strength is for a given increase.

6 -Water quality

To always be on the safe side, proper cold drinking water is used for concrete. Water contaminated with chlorides and sulfates is harmful to concrete and sulfates are harmful to concrete and directly affects its strength.

7 - Concrete age

Concrete under normal curing conditions, the strength will increase with age.

8 -temperature

The higher the temperature, the faster the concrete hardens, otherwise it is slow. At (-5) degrees, the concrete pouring works must stop if you want to continue pouring the concrete then appropriate measures must be taken.

The main uses of recycled concrete:

Recycled concrete is used today in the construction of infrastructures, both public and private, with a huge boom in recent years. In some European cities, 50% of the concrete used in new buildings is already recycled concrete. Another great use of concrete is in partitions, They can be used both in the base layer and as spacers (for expansion of concrete.

The third chapter

Preparation steps 3.1

1- pieces of cement were 3kgweighed.

2- pieces of sand were 6kg weighed. As shown in Figure (3.1)

3- pebbles were 12kg weighed. As in Figure (3.2)

4- Add water 1500 ml to the mixture.

*Note that the mixing ratio is 1:2:4

Figure (3.1) Weight of sand

Figure (3.2) The weight of the grain

3.2Mixing steps

Mix all the ingredients. Both sand, cement, gravel and water and make a homogeneous mixture.

*Concrete mixing steps:

-The mechanical mixing. as in figure (3.3)

Figure (3.3) The mechanical mixing

The casting3.3 The mold and casting

The casting process is one of the most important processes that concrete undergoes.

The mold :- cube shape dimensions (15*15) made of iron, the mold is cleaned well in order to remove the old impurities and the oil is used, the mold is increased. As in the following figure (3.4)

Model (3.4) model (15 * 15)

After mixing the ingredients, each of the sand, gravel, cement and water without any addition, after sieving the sand, turning these materials into a homogeneous mixture to become a strong material, after that he puts the mixture in the mold by making three layers, pounding each layer with the metal rod with (35) accuracy and stacking it well, After that, the remains are removed for the purpose of leveling the surface, to obtain homogeneity and hardness of the mold.

as shown in the following figure. (3.5)

The figure before casting (a) Figure (3.5)

After casting (b) Figure (3.5)

Three (7) day old cubes and (28) day old cubes are made. After (24) hours, it is removed from the mold and placed in water (ripening tank) at a temperature of (27-21) until the day of the test and after 28 days in water. as in figure (3.6)

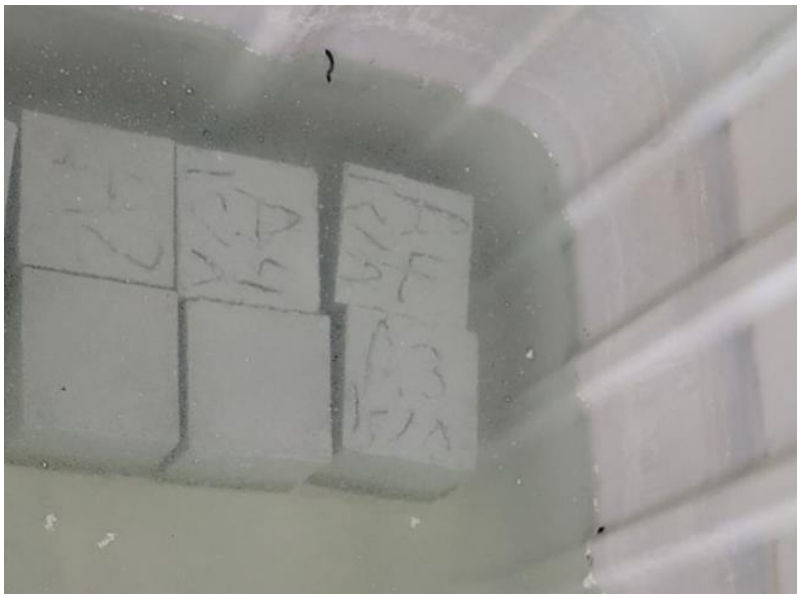

Figure (3.6) The concrete in the water

A new mixture is made with the same proportions and a 0.25% 0.50% sand cork is added to it. The cubes are poured at the age of 7 days and at the age of 28 days. Cover them with water and then the cubes are removed at the age of 28 days.Below the table (3.1) shows the mixing ratio:

	mixing rate	**weight of cement (kg)**	**weight of sand (kg)**	**weight of gravel (kg)**	**Polystyrene (g)**	**water (Ml)**
1	control	3	6	12	0	1500
2	0.25%	3	5.985	12	15	1500
3	0.50%	3	5.97	12	30	1500

Table (3.1) Mixing ratio

Chapter Four

1- Check the compressive strength

2- Examination of sound insulation

The examination 4.1 The examination

After taking out the cubes from the ripening tub and placing them in the compression device for the purpose of testing the compressive stusing a compressionCompression device in the figure below: device.rength to obtain the results, the average is taken.

Figure (3.7) Compression device

Sound insulation check 4.2

The method is conducted to measure the speed of ultrasonic waves in concrete using the device as in the figure below (3.8).

Figure (8.3) Sound insulation test device

discussion and results

Five different mixtures shown in Tables 1, 3, 5, 7, and 9 were done. Compressive strength in (KN) for cubes (12) and thermal insulation in (MPA) for (16) were measured. The results were as shown in Tables (1, 2, 3, 4, and 5).

It is clear from figures (2) (3) (4) (5) that the higher the percentage of polystyrene, the lower the density of concrete. Therefore, it is recommended to use polystyrene in concrete mixtures for places where low-density concrete is needed (real weight and does not need high compressive strength .

It is clear from figures (2) (3) (4) (5) that the higher the percentage of polystyrene, the greater the sound insulation.

*** All this work is used to benefit from it in:**

(1) Reducing pollution rates, i.e. disposing of cork waste and preparing sites for using the waste.

(2) It reduces the consumption of raw materials such as sand.

(3) In addition to getting rid of the city's pollution as well, and providing all kinds of energy consumed in the manufacture of building materials.

(4) Reducing the cost of producing new or used construction, and preserving the raw natural materials used for the production of building materials.

(5) Creating new job opportunities.

The results were as in the following table:

Table 1

Standar concrete	The weight Of sample	The examination Compressive strength	Sound insulation
Sample 1	8.032kg	29.62 KN	50.037 MPA
Sample2	8.194kg	28.53 KN	47.836 MPA
Sample3	8.354kg	30.13 KN	46.759 MPA

Table 2

0.025 polystyreen in concrete	The weight Of sample	The examination Compressive strength	Sound insulation
Sample 1	7.77 kg	20.61 MPA	38.241 MPA
Sample 2	7.87 kg	20.51	38.281 MPA

Table 3

0.05 polystyreen in concrete	The weight Of sample	The examination Compressive strength	Sound insulation
Sample 1	7.087 Kg	19.23 MPA	31.11 MPA
Sample 2	7.032 kg	18.61 MPA	26.813 MPA

Table 4

0.25 polystyreen in concrete	The weight Of sample	The examination Compressive strength	Sound insulation
Sample 1	6.831 Kg	0.622 KN	19.142 MPA
Sample 2	6.873 kg	0..751 MPA	19.052 MPA

Table 5

0.5 polystyreen in concrete	The weight Of sample	The examination Compressive strength	Sound insulation
Sample 1	6.584 Kg	0..245 KN	6 MPA
Sample 2	6.785 kg	0.362 KN	5.969 MPA

Conclusion

* According to the results drawn from Table 2

We take the added percentage of cork (0.025) as sample number one, because it has good sound insulation (38.241Mpa).

And the resistance (20.61Mpa) is relatively good.

*

1- The addition of polystyrene leads to a decrease in resistance

2- Polystyrene can be used in areas that do not need high compressive strength, such as structural partitions that are not loaded with weights.

3- The direct relationship between polystyrene and density.

4_ The direct relationship between polystyrene and sound insulation.

5- The possibility of using harmful industrial waste from industrial cork after recycling it in useful areas.

* reviewer

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