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Concrete Using Agro-Waste As Fine Aggregate

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***Abstract*— The most economic and environmental problems result from burial agricultural waste materials. The main objective of the present investigation is to assess the usefulness of agricultural waste in mortar admixture. These materials are expected to reduce the density of the admixture, and thus producing lightweight mortar.This study aims to study the effect of using pistachio shells as partial replacement of sand on the properties of cement mortar.**

I. INTRODUCTION

The high cost of construction materials is a major problem in the construction industry. Therefore, researchers tend to study more economic materials such as agricultural and industrial waste Materials. However, these waste materials if not charged safely it may be dangerous. The manufacture of traditional masonry materials consume a lot of thermal and electrical power and in return it turn contaminates the air, water and land.

Other benefits of using agricultural waste materials in the construction industry instead of naturalistic materials are protection of natural resources, elimination of waste materials and release of precious ground for different purposes. Pistacia vera is an individual from the Anacardiaceae or cashew family. Pistachio trees are separate sex, implying that there are isolated male and female trees. The criterion male class is “Peters”, the essential vaccinator for “Kerman”, the principle female class [1].

The pistachio is local to the Asia Minor region, from the islands of the Mediterranean in the west to India in the east. Furthermore, it is broadly found in Syria, Iraq and Iran. It presumably created in inside wilderness zones, since it demands extended, warm summersfor organic product development, is dry season and salt tolerant, in addition to that has a high winter severe prerequisite. Figure 1 explains Pistacia vera fruits. Several researchers have discussed the replacement of sand by many types of waste materials; Ganiron studied the use of recycled glass bottles as fine aggregates in concrete mixture. He concluded that the use of recycled glass bottles as an alternative fine aggregate for concrete mix decreases the unit weight of concrete, the value of modulus of elasticity and cost of concrete, he also concluded that the use of recycled bottles as an alternative of fine aggregate is not recommended for structural members such as columns, beams and suspended slabs [2].

Sada et al. investigated the use of groundnut as a replacement of fine Aggregate; they found that the use of groundnut shell in concrete reduces the concretes workability due to the high absorption of water by the groundnut shell; the densities and compressive strength of concrete decreased with the increase in groundnut shell percentage [3]. Obilade conducted experimental study on rice husk as fine aggregates in concrete; he found that the density reduces with the increase in the percentage of husk rice, he also concluded that there is a high potential for the use of rice husk as fine aggregate in the production of lightly reinforced concrete [4].

Mohammed stated that as a result of the heterogeneity of the mortar, its technique of conduct under various load impacts is subject to the properties of the constituents of the mortar. Sand has an important effect on the characteristics of the mortar because it forms the master volume of mortar; therefore the chosen of convenient aggregates in mortar is very substantial [5].

De Schutter and Poppe demonstrate an exceptionally noteworthy impact of the sand sort on the mortar properties [6]. Mortar is the material responsible for the dividing of stresses in building structures; therefore studying the properties of mortar is significant to ensure a good performance of masonry structures [7].

Lenczner stated that the main purpose of mortar is to adhesively join the individual masonry units together. It also provides defense against the permeation of air and water through the joints in a masonry assembly. Mortar also links the non-masonry elements of an assembly such as joint reinforcement and ties. Minor dimensional variations in the masonry units have also been compensated by mortar. Finally, mortar joints have important effect on architectural quality of construction through colour and shadow [8].

The Agricultural wastes used as fine aggregate in concrete are sugarcane bagasse ash, groundnut shell, oyster shell, sawdust, giant reed ash, rice husk ash, cork and tobacco waste. The

major differences of these agro-wastes are the place from where they collected and the processes to convert into a fine aggregate. It can be observed that sugarcane, giant reed, and rice husk are produced worldwide and they have a similar type of processing, those are burnt to convert into sugarcane bagasse ash, giant reed ash and rice husk ash. These are used as partial replacement of fine aggregate which provide additional pozzolanic property in concrete. Groundnut shells are crushed in mill to convert into fine aggregate prior to use in concrete. Oyster shells are the sea shells generally available in coastal areas. These are used as partial replacement of fine as well as coarse aggregate in coastal regions. Sawdust is generated from mechanical processing of raw wood from saw mill industry. These are dried by leaving in sun and sieved properly before using in concrete (Oyedepo et al., 2014). Cork and tobacco wastes are collected and processed from cork oak trees and cigarette making industries which were used as fine aggregate replacement in concrete. The shape, size and availability of mentioned agro-wastes are discussed below. The purpose of this review is to study the properties such as workability, mechanical properties, durability, thermal conductivity of agricultural wastes used as a partial replacement of fine aggregate in concrete.

II. MATERIALS

Ordinary Portland Cement (OPC) according to ASTM C150 Type 1 [10] commercially accessible in Kufa cement plant. Test results indicated that the embraced cement adjusts to Iraqi specifications IQS No. 5/1984 [11].

The fine aggregate utilized throughout this work are brought from river snd. Tests have been completed to decide the gradation, fineness modulus, and sulfate content.

The pistachio shells were acquired from Hila city as a waste from shops which sell pistachio. The shells shown in Fig. 2 were washed, sun dried for 7 days (Sun drying was important to simplicity expulsion of the meat from the inward shells of the pistachio pieces), afterward the Pistachio shells were squashed utilizing electric power grinder machine shown in Fig. 3 to diminish it to sizes similar to fine aggregate as determined in IQS No. 45/1984 [12].

III. EXPERIMENTAL RESULTS

The results of compressive strength, density and absorption are shown in Table 7. Figures 5 and 6 show change of compressive strength with age and with variable of replacement ratios, respectively. Figure 7 shows variable of density with age at different replacement ratios. Figure 8 explains absorption at different replacement ratios.

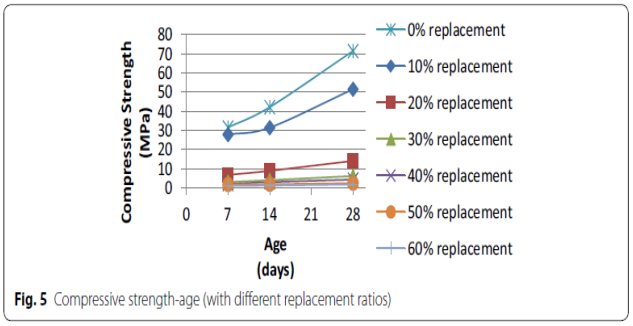

Fig. 5 Compressive strength-age (with different replacement ratios)

Compression Strength – age
(with different replacement ratios)

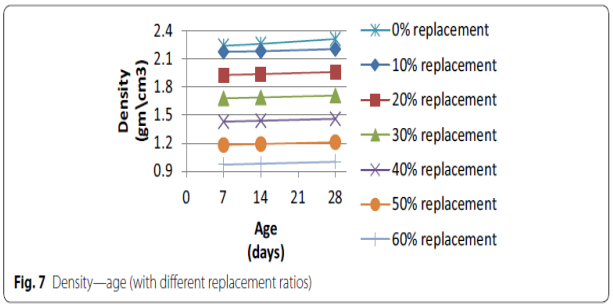

Fig. 7 Density—age (with different replacement ratios)

Density –age (with different replacment ratios)

The reduction in compressive strength with the increase in replacement levels might be attributed to the low workability of the mixture resulted from the absorption of water by the pistachio shells during mixing. Furthermore, the low density of pistachio shells as compared with that of fine aggregate may also contribute in the reduction of the compressive strength as shown in Fig. 10 and Table 7, which show that the density decreases with the increment in replacement ratio. This also coincides with the observations of Obilade who studied the influence of replacing fine aggregates by husk rice on the concrete properties [4]. Also, it was clear that mortar with 30% replacement and above could be used for non-load bearing purposes, and mortar with 20% replacement and below could be used for loading bearing purposes according to the requirements of ASTM C270, 2014 [9].

CONCLUSIONS

1. The compressive strength decreases with the increment in replacement level of pistachio shells and increases with age.

2. Density decreases with the increment in replacement level of pistachio shells due to the low density of pistachio shells as compared with that of used fine aggregate.

3. Density increases with age that was because of hydration of cement and closes the pores and makes the mortar denser.

4. Absorption increases with the increment in replacement level of pistachio shells might be due to the porous texture of pistachio shells.

5. The compressive strength decreases with increasing absorption.

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