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# Effect of Particle Size of Datepalm Seed Ash (DPSA) on Concrete Properties

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**ABSTRACT:** The effect of particle size of date palm seed ash (DPSA) on concrete Properties was explored through the use of different fineness of date palm Seed ash (600um, 300um, 150um and 75um) at 2.5% replacement of cement With date palm seed ash and analyzed for compressive strength at 7, 21, 28 and 56 days curing duration. The constant and setting times of cement-DPSA Paste was also prepared to determine the amount of water needed to prepare hydraulic cement paste for testing. The date palm seed ash used was made by controlled burning of date palm seed in a kiln in two states: Firstly, it was burned for eight hours at a max temperature of 590°C, and was cooled afterwards for two days. Secondly, it was further burned for three Hours at a max temperature of 630°C and was again cooled for three Days. It was then sieved through 75um sieve and its oxide composition analyzed using X-ray fluorescence (XRF) process. DoE method of mix Design was used to obtain concrete ingredients for grade 30N/mm<sup>2</sup> giving a water- cement ratio of 0.53.

**KEYWORDS:** Cement, Concrete, Compressive strength, Date palm seed ash, Partial replacement

## I. INTRODUCTION

Concrete is prepared by mixing the right proportion of cement, fine combination, coarse aggregate, water and sometimes admixtures added to modify certain of its belongings both in the fresh and hardened forms.

Concrete is of three types as: heavy weight, normal weight and light weight concrete. Concrete is a reliable material that is applied in many kinds of construction developments given its many desirable properties like compressive strength and more durable. As we know concrete is made up of the combination or mixture of cement, sand and aggregates, DPSA is also a different type of material which will include in our concrete. DPSA will be added into the concrete as the partial replacement of cement. Date Palm Seed is obtained from date palm, tree of the palm family which can be found in Canary Islands, Northern and Western Africa, the Middle East, Pakistan, India, and the U.S. State of California. Mainly dates were cultivated highly for humans and animals but now a day human research and technology has been gone far ahead in terms of creativity and new inventions.

## II. MATERIALS

### 1.1 Date Palm Seed Ash(DPSA)

Date Palm Seed is an agricultural produce from date palm, tree of the palm family which can be found mainly in Canary Islands, Northern and Western Africa, the Middle East, Pakistan, India, and the U.S. State of California. Date is highly produced for animals and human utilizations. So now we will know that seed are the wastes for us, so we will burn it in the kiln to make it ash. Firstly, the DPS was burnt for duration of eight hours at a temperature of about 590°C. Secondly, after allowing it to cool for two days, it was further burnt for three hours at a temperature of 630°C and was again allowed to cool for another three days. The ash obtained from the burning was then sieved through 75µm sieve before it was used for concrete production.

### 1.2 Cement

The cement used was Ordinary Portland cement; it is available in 50kg bag.

### 1.3 Fine Aggregates

The fine aggregate used was clean river sand.

### 1.4 Coarse Aggregates

The coarse aggregate used was clean, crushed granite.

## 2. Concrete Mix Design

We will go to make a concrete grade of 30N/mm<sup>2</sup> for this research work, and this method gave a mix design of

1.0:1.850:2.625 (cement: fine aggregate: coarse aggregate) and water-cement ratio of 0.53. Maximum 20mm size of aggregates is used.

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## IV. COMPRESSIVE STRENGTH

Compressive Strength of DPSA Concrete Compressive strength of DPSA concrete was carried out after curing for 7, 21, 28 and 56 days. 75µm healthy DPSA was used to replace cement at 0, 2.5, 5, 7.5, 10, 15, and 20%. Cube mold of sizes 100mm×100mm×100mm was used to cast a total of 84 cubes for compressive strength test. The compressive strength behavior is shown in Figure 3.

## V. RESULTS AND DISCUSSIONS

### 2.3 Steadiness and Setting Times of Cement-DPSA Paste

The steadiness and setting times of cement-DPSA paste for cement replacement with DPSA as shown in Figures 1 increased with increase in DPSA content.

The stability increased because of particle interference effect, and so a large amount of water is required to properly wet higher percentage of DPSA in the mix to produce cement gel as the cement is more mixable/soluble than the DPSA, and this led to the increase in the steadiness of the DPSA concrete. The increase in settlement times of DPSA concrete means that DPSA can be used as a set slower in concrete to be transported over a long distance.

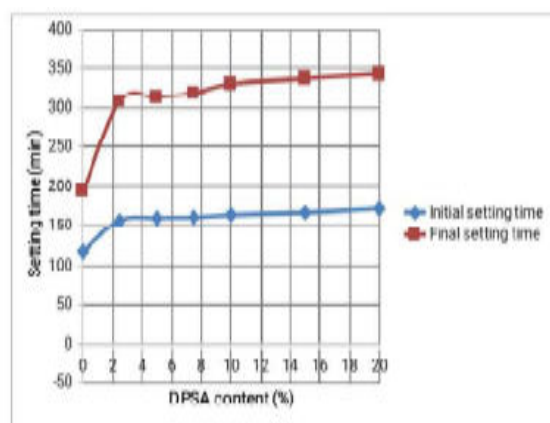


Figure 1: Setting times of cement-DPSA paste for cement replacing

### 2.4 Slump of DPSA Concrete

The slump of DPSA concrete as shown in Figure 2 decreased with increased content of DPSA and this may be due to particle interference effects, This makes DPSA concrete up to 10% replacement of cement good for lightly reinforced concrete section without vibrations and heavily reinforced sections with vibrations.

DPSA concrete higher than 10% replacement of cement with low workability can also be used for mass concrete projects.

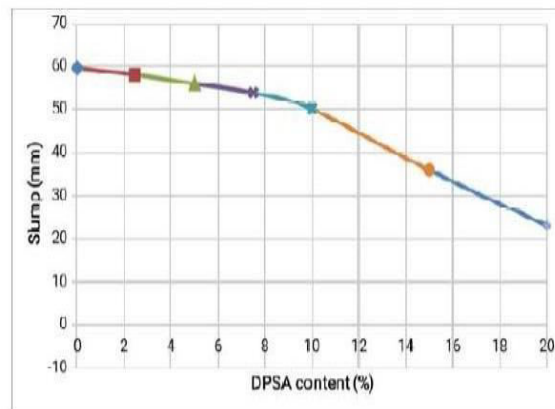


Figure 2: Slump of DPSA Concrete

### 2.5 Compressive Strength of DPSA Concrete

The compressive strength of DPSA concrete will be optimum at 2.5% replacement of cement and that is  $33\text{N/mm}^2$ . The 2.5% optimum strength may be due to the hydration of cement and DPSA. Hydration of cement goes decelerates by the 10% replacement of cement. Due to this hydration, calcium hydroxide generates more at later curing ages to react with the active silica and aluminates phases of the DPSA to produce secondary calcium alum inosilicate hydrates, enhancing strength performance. Further increase in DPSA content showed a loss in compressive strength when compared with the normal concrete. The reduction in compressive strength with 15% and 20% replacement of cement with DPSA may be due to the saturation of the cement mix with  $\text{K}_2\text{O}$  in DPSA which forms composite that hinder the formation of calcium silicate hydrates from cement. Since we know DPSA concrete will gain more strength after the long period of curing ages of 28 days.

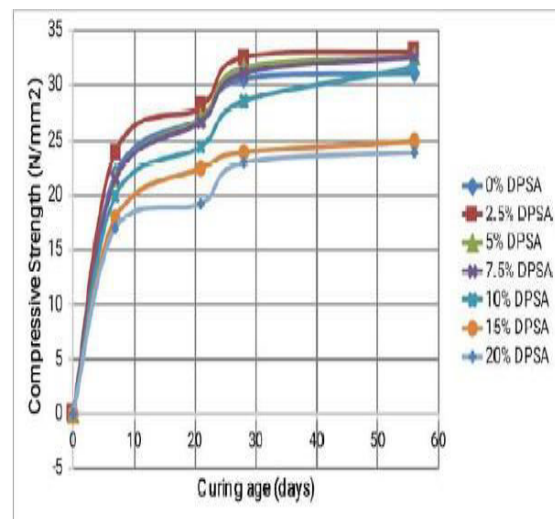


Figure 3: Compressive strength of DPSA concrete

### 2.6 Water Absorption of DPSA Concrete

Water absorption will reduce as increase in DPSA content in DPSA concrete. This is due to the paste formation from cement-DPSA reaction coats the collection and larger micro voids better than that resulting from cement, since we know that process of water absorption depends on pastes pore, capillarity, surface energy, surface tension and concrete absorptivity. This type of concrete will help in construction where waterlogged environment.



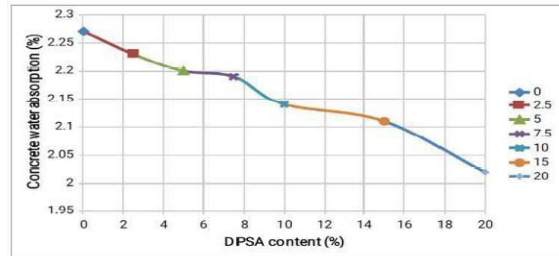


Figure-4: Water absorption of DPSA concrete

## VI. CONCLUSION

The results of DPSA concrete are the consistency and setting time increases as increase in DPSA content. The slump and water absorption decrease as increase in DPSA content. And ultimately compressive strength of DPSA concrete is maximum at 2.5% replacement of cement.

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