YIDDISH Vol 10 Issue 01,March 2020
ISSN NO: 0364-4308

The Use of Jujube Seed Ash as a Possible Substitute for Portland Cement

RAMESH BABU[1], R.KARTHIKEYAN[2], G.VENKATARAGHU[3], SYEDA MISBAH SYED AMEER BASHA[4]

[1]Assistant professor, Dept of Civil Engineering, KSRMCE, Kadapa, AP, India.
[2]Assistant professor, Dept of Civil Engineering, KSRMCE, Kadapa, AP, India.
[3,4]Student, Dept of Civil Engineering, KSRMCE, Kadapa, AP, India.

ABSTRACT- Concrete is a composite material composed of cement, water, fine aggregate and Coarse Aggregate, bonded together that hardness over time. It is extensively used around the globe as an important construction material. India being one of the largest agricultural economy, produces a quantitative volume of agro waste that is being dumped which could be used in concrete such as fruit seeds. Plain concrete has low tensile strength and is susceptible to cracks. These can be reduced by addition of fibers such as steel in the concrete toimprove properties such as toughness, compressive strength, resistances to fatigue etc.The present investigation is comparative study on the use of jujube seeds, also known as (Ziziphus Mauritiana) on replacement of fineaggregate with jujube seed powder and cement with jujube seed ash. Fine aggregate is partially replaced with Jujube Seed Powder at an interval of 10%, i.e. 0%, 10%, 20%, 30%, and 40% and the cement is partially replaced with Jujube Seed Ash at an interval of 5%, i.e. 0%, 5%, 10%, 15%, and 20%. Steel fibres are added at constant proportion of 1% by vol. of concrete. Various tests are done on cement, FA & CA. Cubes and cylinders are casted and workability, compressive strength and split tensile strength is determined at the age of 7days and 28days.

I. INTRODUCTION

Concrete is most widely used man made construction material in the world and is second on to water as by mixing concrete materials, and sometimes admixtures, in required proportions. The mixture when placed in forms and allowed to cure hardens into a rock likes mass known as concrete. The hardening is caused by reaction between water and cement it continues for a long time consequently the concrete may also be considered as an artificial mix in addition to filling the voids offine aggregates, coats the surface of fine aggregate and binds them together as it cures, there by cementing particles of fine aggregates together in a compact mass.The strength, durability and other characteristics of concrete depend upon the properties of ingredients, on proportions of mix, the method of compaction and other control during placing, compacting, and curing. The popularity of the concrete is due to the fact that from the common ingredients it is possible to tailor the properties of concrete to meet the demands of any particular situations. The mold ability of concrete in variety of architectural norms cam be at ease. The advances in concrete technology have paved the way to make the best use of locally available materials by judicious mix proportions and proper workmanship, so as to produce concrete satisfying performance requirements. But now a days the natural sand (fine aggregates) is going to decreasein day by day and that too farming river erosion this is major problem now a days and the fine aggregate cost is also increasing. In this view the present work is focus on replacing fine aggregate with Jujube Seed Powder and Ash, it wastes material produced from the waste Jujube Seed Powder.The jujube, also known as Ziziphus Mauritiana or ber is grown and cultivated in India, Russia southern Europe, China and the Middle East. The fruit has been used in Chinese medicine for over 4,000 years. In India, the jujube is grown for just a few niche markets. Jujube contains potassium, phosphorus, manganese and calcium as the major minerals.

ADVANTAGES OF JUJUBE SEED ASH

1. Jujube Ash has the potential workability to be used as partial replacement of cement to produce durable concrete.
2. It uses as partial replacement of cement will help in alleviating the potential problem of dwindling natural resources.
3. It uses will also help in protecting the environment surroundings.
4. Jujube Ash as a waste product from jujube fruit available in India, Russia southern Europe, China and the Middle East could be used as a partialreplacement of cement in concrete. Its use in concrete could be used be used save as a much as 10% of cement as a binding material, while providing the same strength.
5. The jujube Ash has a black color, which could beaesthetically more pleasant.
6. In mass concrete, use of jujube Ash as a partial replacement of cement would reduce the heat of hydration, which could help to control the development of secondary stresses in the structures.

7. Using of a jujube Ash as a partial replacement of cement in the cement concrete the voids are reduced. Therefore, increase in compressivestrength with optimum dosage of jujube Ash.
8. Jujube Ash concrete could be produced withsatisfactory setting times with nearly the same water cementing material ratio as in normal concrete without mineral.

II. LITERATURE REVIEW

Jnyanendra kumar prusty (Dec 2016), High demand of natural resources due to rapid urbanization and the disposal problem of agricultural wastes in developed countries have created opportunities for use of agro-waste in the construction industry. Many agricultural waste materials are already used in concrete as replacement alternatives for cement, fine aggregate,coarse aggregate and reinforcing materials. This paper reviews some of the agro-waste materials, which are used as a partial replacement of fineaggregate in concrete. Different properties of fresh and hardened concrete, their durability and thermal conductivity when admixed with agro-wastes are reviewed. Agro-waste used in self-compacting concrete and mortar are also reviewed and their properties are compared. It has been seen that the agro-waste concrete containing groundnut shell, oyster shell, cork, rice husk ash and tobacco waste showed better workability than their counterparts did. Agro-waste concrete containing bagasse ash, sawdust ash and oyster shell achieved their required strength by 20% of replacement as fine aggregate, which were maximum among all agro- waste type concrete. Close relations were predicted among compressive strength, flexural strength, tensile strength, ultrasonic pulse velocity and elastic modulus of agro-waste concrete. Addition ofbagasse ash as fine aggregate in mortar increased the resistance of chloride penetration whereas inclusion of cork in mortar showed better thermal resistance and improved cyclic performance. After the review, it is of considerable finding that more research is deserved on all fine aggregates replacing agro-waste materials.

Arvind Kumar, Amit Kumar Tomar (July 2016), They did experimental investigation to study the properties of concrete made with Rice husk ash. The replacement was done partially in theproportion of 0%, 20% and its effect on workability of concrete made with rice husk ash were investigated for the 20% rice husk ash replacement.The hardened properties such as compressivestrength observed were good as compared to 0 % RHA. The compressive strength test was conducted at 0 % and 20 % rice husk ash replacement and the highest compressive strength was obtained at 20 % RHA replacement as compared to 0% RHA replacement at 14 ,21 and 28 days. It is observed

that at all the bond substitution levels of Rice husk fiery debris; there is slow increment in compressive quality from 3 days to 7 days. However, there is huge expansion in compressive quality from 7 days to 28 days took after by slow increment from 28 days.

A.G. Dahake and K. S. Charkha (Jan 2016), Plain concrete is a brittle material. Under impact and dynamic loading plain concrete exhibitsextensive cracking and undergoes brittle failure. The concrete is weak in tension and hence to overcome this problem cement concrete isreinforced using steel bars and thus called as reinforced cement concrete (R.C.C.). The present work deals with the effect of different types of steel fibers on various strengths of concrete are studied. The different fibers at a constant rate of 2.5 % by the weight of cement are used for the experimental work. Various strengths considered for investigation are compressive strength and flexural strength. Results obtained are of different researchers and their experimental Comparison of results of steel fiber reinforced concrete with that ofnormal concrete showed the significantimprovements in the results of compressive strength and flexure strength of concrete with different types of steel fiber with various constant volume fractions and different aspect ratio. The mechanical properties of concrete are enhanced with the addition of steel fibers. All the properties of concrete like compressive strength and flexural strength is increased. Also, there is reduction in porosity as well as reduction in absorption capacity of the concrete as compared with normal concrete. From the results and discussion, it shows that for
2.5 % addition of steel fibers, concrete showing overall improvement. Addition of steel fiber irrespective of type and aspect ratio improves the compressive strength of concrete. Strength Comparison between same aspect ratio HK-80 and RD-80 is 54.95 MPa and 50.59 MPa respectively and HK-50, RD-50 and CR-50 is 52.30 MPa, 46.62MPa and 51.79 MPa respectively.

R. Chitra (Nov 2015), Concrete, a homogeneous mixture of cement, fine aggregate, coarse aggregate and water is widely been used in construction activities. But cement and fine aggregate are becoming consequently costlier and their demand also increases every day. Meanwhile, industrial waste from manufacturing units also increases. On behalf of utilization of industrial waste as well to minimize the construction materialcost, some materials can replace the by-product of concrete. In this study we have chosen ceramic powder and copper slag as a replacement of cement and fine aggregate. More studies were carried out replacing cement by ceramic powder and replacing fine aggregate by copper slag separately. From the literature review we can to know maximum percentage of replacement of ingredients. In this

study, different mix proportions were carried out byreplacing different percentage of ceramic powder and copper slag. From the experimental results, it was observed that compressive strength was increased about 36%, when compared to conventional concrete. Replacement of cement and fine aggregate by ceramic powder for 20% and Copper slag for 40% is effective and can be used inthe construction activities.

III. CEMENT WITH JUJUBE SEED ASH

In the construction industry the widely used material is concrete. Fine aggregate and cement are the main important constituents in it. Indian jujube is a multi-purpose tree mainly grown for its fruits. It starts bearing fruits 6-8 years after planting, and yield increases until the tree is 15-20 year. The fruit is edible and can be eaten fresh, dried like dates, candied, salted or pickled. It can beprocessed into flour meal, paste, juice, syrup or an alcoholic beverage. It is a good source of carotene, vitamins A and C, and fatty oils. Young leaves are edible and are cooked as a vegetable in Indonesia. Fruits and bark are used to make dye and medicinalpreparations. Indian jujube wood is reddish, fine- textured, hard and durable. It can be used in rural house construction, posts and tool manufacturing. Itmakes excellent firewood. The Indian jujube tree hosts lac insects and is also fodder for the tsarsilkworm that makes high-prized silk in India. It isa minor source of pollen for bees. A potential agroforestry species, this thorny tree can grow to provide windbreaks and living fences. It is browsed by livestock and its leaves are nutritious fodder for sheep and goats. Jujube originated from CentralAsia and then spread to North Africa and Indiathrough Afghanistan, South China, Malaysia and Australia. It was in use around 1000 BCE and is now widely naturalized in the tropics (Africa, Central and South America, and the West Indies), in the Pacific Islands and in the Mediterranean region. It is only commercially important in India and China. In South-East Asia, it is mostly found inThailand. It is becoming increasingly important for its wide adaptation, easy management, early fruit bearing, value as a food and feed, and multipleuses. Chinese jujube and Indian jujube are widely cultivated with a total growing area of over 2 million hectares with an annual production of over
6 million t of fruit. Approximately 30 million farmers rely on jujube production for their livelihood. Jujube can be grown in semi-arid and arid regions as it thrives under very dry conditions. In the Sahelian zone, Indian jujube is one of the most persistent trees, like Acacia raddiana and, remaining available for browsing from July to March. Jujube is found from sea level up to an altitude of 1600 m in India, though it is mostly cultivated under 1000 m. It grows where annual
rainfall ranges from 150 mm to 4000 mm. Fruits need hot, sunny and dry conditions but moisture is necessary to support growth and flowering. During hot summers, with temperatures up to 49-50°C, the tree may shed its leaves and stop growing. New shoots can grow with onset of the rains. In Burkina Faso, Indian jujube remains green later in the season than acacia species. Indian jujube does well on a wide range of soils but prefers well-drained, deep sandy, neutral or even slightly acidic or alkaline loams. It can withstand some salinity.

Fig.1. Jujube Seed Ash

The present investigation is comparative study on the use of jujube Seeds, also known as (Ziziphus Mauritiana) on replacement of fineaggregate with jujube Seed Powder. Fine aggregateis replaced in proportions of 0%, 10%, 20%, 30%,
& 40% & cement in proportion of 0%, 5%, 10%, 15% & 20%. Steel fibres are added at constantproportion of 1% by vol. of concrete. Various tests are done on cement, FA & CA. Cubes and cylinders are casted and workability, compressive strength and split tensile strength is determined at the age of 7days and 28days.

Tests on Jujube Seed Ash

The following tests are done on the Jujube SeedAsh

a. Fineness test

b. Specific gravity testa.) Fineness test

% Weight of residue = Weight of sample retainedon sieve /Total weight of sample

Table:1 Observations of Fineness of Jujube SeedAsh

Trail No.	1	2
Weight of Jujube seed ash in grams	100	100
Weight of residue on sieve in grams	3	3
Amount retained in grams	3	3

Fineness of Jujube Seed Ash = 3%.

b.) Specific gravity Test

Specific gravity of Jujube Seed Ash = weight ofJujube Seed Ash/weight of equal volume of water

Table:2 Observations of Specific gravity ofJujube Seed Ash

S. No.	Description	Trail
1	Weight of cement used (W) grams	64
2	Initial reading of flask (V_1) ml	0
3	Final reading of flask (V_2) ml	22.5
4	Volume of cement particle (V_2-V_1) ml	22.5

Weight of equal volume of water = (V2-V1) ×specific gravity of water
= 22.5 × 1 = 22.5
Specific gravity of Jujube Seed Ash = 6422.5 =2.84
The specific gravity of Jujube Seed Ash obtained is2.84.

Table:3 Test results on Jujube Seed Ash

S. No.	Test name	Test results
1	Fineness of Jujube Seed Ash	3%
2	Specific gravity of Jujube Seed Ash	2.84

IV. RESULTS

The following section presents the results of experimental study. The workability in terms of slump values for different percentages of Jujube Seed Ash as a partial replacement of cement respectively are given below.

Table:4 Replacement of cement with jujubeSeed Ash

S. No.	% Jujube Seed Ash	% Steel Fibers	Slump Value (cm)	Compaction Factor
1	0	0	12.0	0.92
2	0	1	11.5	0.9
3	5	1	10	0.88
4	10	1	9.4	0.875
5	15	1	7.8	0.87
6	20	1	7.2	0.86

REPLACEMENT OF CEMENT WITHJUJUBE SEED ASH

Table:5 Compressive strength at 7 days curing of cubes of partial replacement of cement with jujube Seed Ash

S. No.	% PRC JSA	% Addition of Steel Fibers	No. of Days	Average Weight of 3 Cubes (kg)		Average Compressive Load of 3 Cubes (KN)	Average Compressive Strength of 3 Cubes (MPa)
				Dry Weight	Wet Weight		
1	0	0	7	8.42	8.53	920	40.88
2	0	1	7	8.45	8.59	1000	44.44
3	5	1	7	8.41	8.51	720	32.0
4	10	1	7	8.27	8.35	780	34.66
5	15	1	7	8.13	8.20	660	29.33
6	20	1	7	8.11	8.18	590	26.22

Table:6 Compressive strength at 28 days curing of cubes of partial replacement of cement with jujube Seed Ash

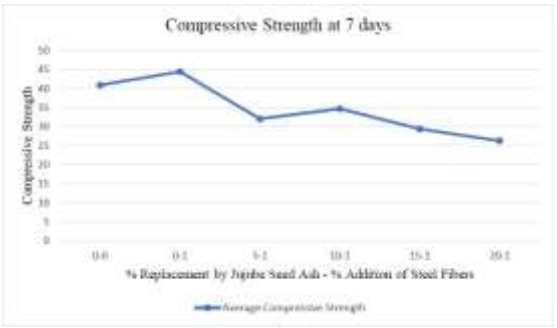
S. No.	% PRC JSA	% Addition of Steel Fibers	No. of Days	Average Weight of 3 Cubes (kg)		Average Compressive Load of 3 Cubes (KN)	Average Compressive Strength of 3 Cubes (MPa)
				Dry Weight	Wet Weight		
1	0	0	28	8.43	8.52	1370	60.88
2	0	1	28	8.47	8.59	1500	66.66
3	5	1	28	8.40	8.48	1120	49.77
4	10	1	28	8.28	8.37	1210	53.77
5	15	1	28	8.15	8.24	950	42.22
6	20	1	28	8.12	8.19	845	37.55

Table:7 Tensile strength at 7 days curing of cylinders of partial replacement of cement with jujube Seed Ash

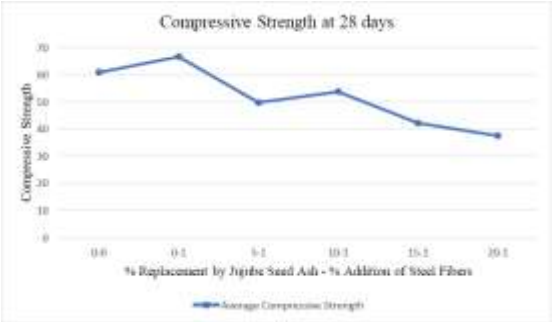
S. No.	% PRC JSA	% Addition of Steel Fibers	No. of Days	Average Weight of 3 Cubes (kg)		Average Tensile Load of 3 Cubes (KN)	Average Tensile Strength of 3 Cubes (MPa)
				Dry Weight	Wet Weight		
1	0	0	7	12.81	12.95	280	3.96
2	0	1	7	12.96	13.09	320	4.52
3	5	1	7	12.75	12.86	220	3.11
4	10	1	7	12.66	12.74	250	3.53
5	15	1	7	12.55	12.64	160	2.26
6	20	1	7	12.24	12.35	140	1.98

Table:8 Tensile strength at 28 days curing ofcylinders of partial replacement of cement with jujube Seed Ash

S. No.	% PRC JSA	% Addition of Steel Fibers	No. of Days	Average Weight of 3 Cubes (kg)		Average Tensile Load of 3 Cubes (KN)	Average Tensile Strength of 3 Cubes (MPa)
				Dry Weight	Wet Weight		
1	0	0	28	12.81	12.95	410	5.8
2	0	1	28	12.96	13.09	465	6.57
3	5	1	28	12.64	12.72	310	4.38
4	10	1	28	12.55	12.61	375	5.30
5	15	1	28	12.39	12.43	230	3.25
6	20	1	28	12.06	12.19	200	2.82

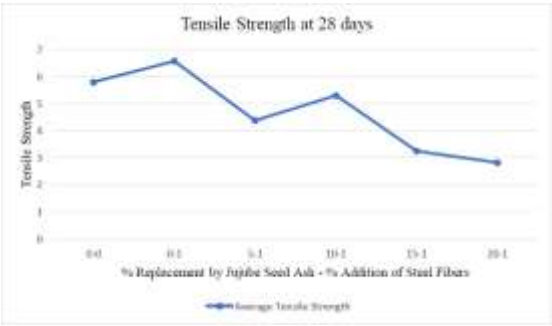


Graph:1 Average Compressive Strength at 7 days in partial replacement of Cement with Jujube Seed Ash



Graph:2 Average Compressive Strength at 28days in partial replacement of Cement with Jujube Seed Ash

Graph:3 Average Tensile Strength at 7 days inpartial replacement of Cement with Jujube Seed Ash



Graph:4 Average Tensile Strength at 28 days inpartial replacement of Cement with Jujube Seed Ash

V. CONCLUSION

The addition of steel fibers gave maximum strength to the cubes and cylinders. The slump value decreased as the % of replacement increased and it gave a true slump. The compaction factor obtained is in the range of 0.8 – 0.95. It was found that jujube seed powder has more water absorption property, so the binding was not quite satisfactory. The compressive and tensile strength decreased as the % of replacement increased. It can be concluded that jujube seed powder is not aneffective replacement to fine aggregate. Jujube seed ash is found to be a good binding material having similar properties to that of cement. The compressive and tensile strength increased as the %of replacement increased and reached an optimum point of 10% replacement, which gave maximum strength. After 10%, the strength decreased as the % of replacement increased. The compressive strength at 10% increased by 8.31% when compared with 5% for 7 days and 8.03% for 28 days. The tensile strength at 10% increased by 3.5% when compared with 5% for 7 days and 21.0% for 28 days. It can be concluded that jujube seed ash is an effective replacement to cement. It is found that jujube seed powder cannot be a good replacement to fine aggregate as it gave less strength, whereas, jujube seed ash is found to be an excellent replacement to cement as it gave high strength when replaced in concrete.

REFERENCES

1) Lakshmi Narayani P and Ramya G (Oct 2014), Experimental Study on Concrete Using Copper Slag as Replacement Material of Fine Aggregate, omicsonline.org, DOI: 10.4172/2165-784X.1000156.
2) K. Muthusamy, N. Nordin, G. Vesuvapateran,
M. Ali (Feb 2014), Exploratory Study of Rubber Seed Shell as Partial Coarse Aggregate Replacement in Concrete, researchgate.net, researchgate.net, DOI: 10.19026/rjaset.7.380.
3) **Muhammad Hassan Nensok (Jan 2013),** Exploratory study of date seed as coarse aggregate in concrete production, researchgate.net, ISSN2222-1719 (Paper) ISSN 2222-2863 (Online), Vol 3, No.1, 2013.
4) Abdulkadir, T.S., Oyejobi, D.O. and Lawal,
A.A. (2014), Experimental Study on Partial Replacement of Cement by Neem Seed Husk Ash in Concrete. iaeme.com, Volume 9, Issue 11, November 2018, pp. 2739–2744, Article ID: IJCIET_09_11_274.
5) **Ndefo, ED. (2013),** Properties of cement- groundnut shell ash concrete. International Journal of Innovative Research in Engineering & Science. 8(2): 16-23.
6) **Vikrant S. Vairagade et al., "**Introduction to Steel Fiber Reinforced Concrete on Engineering Performance of Concrete", International Journal of Scientific & Technology Research Volume 1, Issue4, May 2012
7) **Al-Jabri KS, Hisada M, Al-Saidy AH,Al- Oraimi SK (2009),** Performance of High Strength Concrete made with Copper Slag as a FineAggregate. Construction and Building Materials 23: 2132-2140.
8) **Sunil Pareek,** Nutritional composition of jujube fruit,researchgate.net,DOI:10.9755/ejfa.v25i3.1082 8.