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Effect of Saw Dust Ash as a Partial Replacement of Cement on Fresh and Hardened Properties of Concrete

[1]Muhammad Habib Ur Rehman, [2]Dr. Fareed Ahmed Memon, [3]Samar Hussain Rizvi, [4]Nisar Ahmed Gabol

[1,4]Student, M.E structural engineering, Civil Engg., Mehran UET, Jamshoro, Pakistan
[2]Professor, Civil Engg., Mehran UET, Jamshoro, Pakistan
[3]Assistant Professor, Civil Engg., Mehran UET, Jamshoro, Pakistan

***Abstract* - In this research work, the Saw Dust Ash (SDA) was used as a partial cement replacement material in concrete to reduce the use of cement in concrete manufacturing and to reduce the effect of CO2 in the atmosphere which creates environmental problems. The main objectives of this research study were to determine the fresh (workability) and hardened properties (compressive and splitting tensile) of concrete by using SDA at various percentages of 0%, 5%, 10%, 15% and 20% by the weight of cement. Total 75 concrete specimens (45 cubes and 30 cylinders) were cast for the targeted strength of 25 N/mm2. Cube specimens (100 x 100 x 100mm) were tested for the compressive strength at 7, 28 and 90 days, cylindrical specimens (200 x 100mm) were used for determining splitting tensile strength at 7, 28 and 90 days curing period. It was obtained that the compressive strength and tensile strength were increased with up to 10% replacement of SDA. The workability of fresh concrete was decreased with an increase in the percentages of SDA content. SDA was used in concrete to increase the strength of concrete.**

Keywords: OPC, SDA, Cubes, Cylinders, Workability, Compressive strength and Tensile strength.

I. INTRODUCTION

Since many years, concrete is one of the most used materials in the construction. The ingredients used in concrete are cement, fine aggregate, coarse aggregate and water. Cement is one the most useful binding agent used in concrete which is totally unfriendly environmentally material. By the production of port land cement more amount of carbon dioxide CO2 is released and some other types of greenhouse gasses which could be harmful to our environment. It is perceived that up to 50% of CO2 will be released from the production of port land cement by the year 2020 (Ambrutha Sebstian, 2016). So many researchers decided to replace cement by some other amount of materials which should be friendly environment and efficient construction material (Pontip Stephen Nimyat, 2013).

Many efforts are made to reduce the quantity of cement throughout the world for the global warming. Numerous waste materials are used as a replacement of cement by many researchers (A.A.Raheem, 2012). Materials can give various advantages to the resulting concrete and can also be used by more amount as a replacement by cement, if they contain some pozzolanic and cementitious properties (B.Gobinath, 2013).

Sawdust is a side-effect of cutting, crushing or some other material with a saw or other device; it is made out of fine particles of wood (C.Marthong, 2012). It is likewise the side-effect of specific creatures which live in wood. The cutting of wood is the daily process, which gives us the more waste of wood. The saw dust contains some pozzolanic properties and also some cementitious properties.

The saw dust ash was replaced by cement to make cement concrete mix cost effective and environment friendly disposal of the product. It was noticed that with some percentages replacement of cement with wood ash satisfied all the strength requirements. Hence saw dust ash is made pozzolanic material due to presence of much finer particles. With this pozzolanic material, strength also increases with age (Ambika Nahak, 2015).

II. LITERATURE REVIEW

Lakshmi & Chandran (2010), they investigate the compressive strength of concrete by using waste material in concrete eg: Saw Dust Ash, glass powder and rubber tires. It was observed that by adding 4% Saw Dust Ash in concrete the compressive strength was increased. The increase in compressive strength was due to pozzolanic reaction of SDA and cementitious products formed in hydration of cement.

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Barathan & gobinath (2013), in this research, it was reported that Saw Dust Ash contains some great amount of pozzolanic properties. So with the increase of Saw Dust Ash water requirements also increases. At 20% replacement of cement by Saw Dust Ash, it gives more compressive strength and degree of hydration than that of 100% OPC. So it was decided that 20% Saw Dust Ash could be used for construction works.

The slump cone and compacting factor results showed that the usefulness of the saw dust ash (SDA) concrete declines as the SDA amount builds (Raheem et al, 2012). From these outcomes, it was seen that concrete accomplished less workability as the level of SDA increments because of higher water request and more water is to be added than the planned amount to achieve great workability. Because of the existences of rich silica content makes increment in the use of more water to build up a homogenous blend. To finish the hydration procedure, pozzolanic substances like silica and lime requires water at high amount to create required quality after hardened stage and easeness working during fresh stage (Folorunso, 2012).

Naik (2000), made research on generation of controlled low-quality material (CLSM) with ash gathered from burning of Saw Dust as a key constituent. Saw Dust Ash(SDA) is taken from three unique sources to get ready 31 blend extents are determined with SDA, OPC, water as real constituents for assembling of CLSM and tried following 28 days restoring period and accomplished the strength qualities in the middle of (0.34 – 1.0) Mpa. They directed tests with reference to benchmarks to break down the conduct of CLSM blend arranged with Saw Dust Ash as added substance in hardened and fresh stage. In view of the rheological properties, they watched the reaction of Saw Dust Ash concrete concerning attributes like specific weight, intemperate water substance and liquidation.

III. EXPERIMENTAL INVESTIGATION

Materials used: Many materials are used for the preparation of mix design concrete such like: cement, fine aggregates, coarse aggregates, Saw dust ash and water. The details of all the materials are given below in table 1:

TABLE 1
The details of all the materials

S.No	Material description	Material source
1	Saw Dust Ash	Timber market hyderabad
2	Cement	Lucky cement factory
3	Coarse aggregates	Nooriabad
4	Fine aggregates	Bholari sand jamshoro
5	Water	Fresh water accessible in Structural Research laboratory

Tests performed: various tests are performed on coarse and fine aggregates which are mentioned in the following table 2:

TABLE 1
Physical Properties of Fine & Coarse Aggregates

S. No	Description	Fine Aggregate	Coarse Aggregate
1	Max size	4.75mm, Zone-II	20mm
2	Specific Gravity	2.60	2.69
3	Water Absorption	1.24	2.7
4	Fineness modulus	2.75	7.20

Mix Design: DOE British mix design method was used in this study work to find out the proportions of concrete ingredients. In the light of DOE mix design from the materials properties, the Mix design was done for 28 Mpa. The ratio was found out as: 1: 1.52: 2.63 @ 0.56 w/c.

Mix Proportions: Different mixes were prepared for replacement of cement with SDA. The detail of all mixes is given in Table 3.

TABLE 3
Details of All Mixes

S.No	SDA	Cement	Fine aggregate	Coarse aggregate	W/C
1	0	100	100	100	0.56
2	5	95	100	100	0.56
3	10	90	100	100	0.56
4	15	85	100	100	0.56
5	20	80	100	100	0.56

IV. RESULTS AND DISCUSSIONS

Workability: In this the fresh properties were conducted by slump cone test method to check the workability of different percentages of mixes of Saw Dust Ash. The results of these

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are given in the following table number 4 and shown in figure 1:

TABLE 4
Result of Workability of All Mixes

OPC replaced with SDA	Slump in inches
0%	3in
5%	3in
10%	3in
15%	0
20%	0

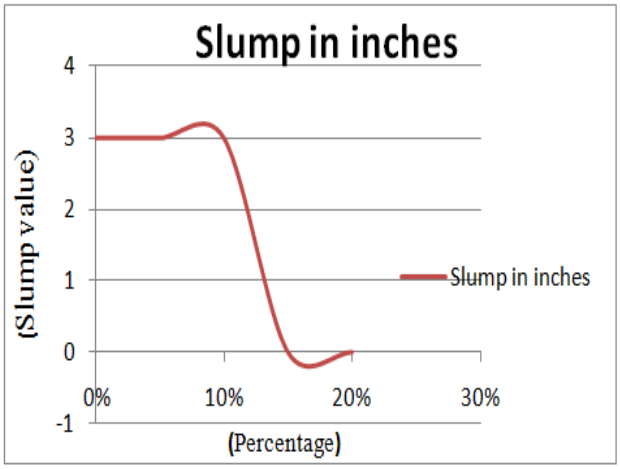

Figure 1: comparison of workability of all mixes

This graph shows that the slump and workability of concrete remains same with the 0%, 5% and 10% and its starts decreasing as we increase the percentage of replacement above the 10%.

Compressive strength: The compressive strength of all the mixes were checked after the curing of 7, 28 and 90 days in the Universal testing machine at mehran university and the results of these are described below in the table number 5 and shown in figure 2. This shows that addition of saw dust ash with the replacement of cement with 5 and 10%, the compressive strength increases.

TABLE 5
Compressive Strength of All Mixes

SawDustAsh	Compressive strength(N/mm2)		
	7 days	28 days	90 days
0%	23.5	28.37	32.45
5%	24.74	32.53	34.79
10%	24.98	32.60	34.88
15%	22.5	24.23	28.20
20%	21	21.90	25.28

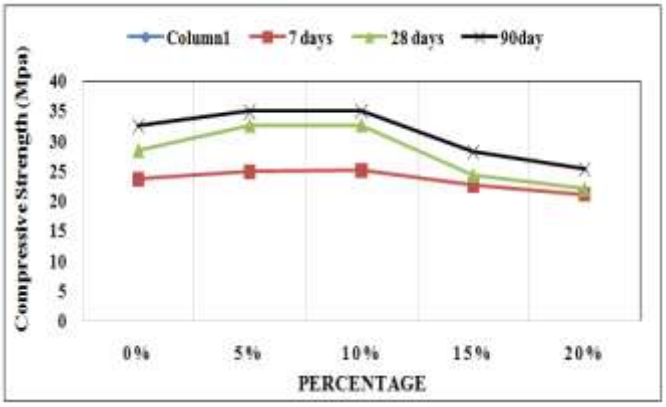

Figure 2: Comparison of compressive strength of all mixes at different intervals

Tensile strength: The tensile strength of all the mixes were checked after the curing of 7, 28 and 90 days in the Universal testing machine at mehran university and the results of these are described below in the table number 6 and shown in figure number 3 . This shows that addition of saw dust ash with the replacement of cement with 5 and 10%, the tensile strength increases.

TABLE 6
Tensile Strength of All Mixes

SawDustAsh	Tensile strength(N/mm2)		
	7 days	28 days	90 days
0%	2.85mpa	2.9mpa	3.34mpa
5%	2.97mpa	3.5mpa	3.78mpa
10%	2.96mpa	3.89mpa	4.1mpa
15%	2.31mpa	2.61mpa	2.9mpa
20%	2.25mpa	2.32mpa	2.72mpa

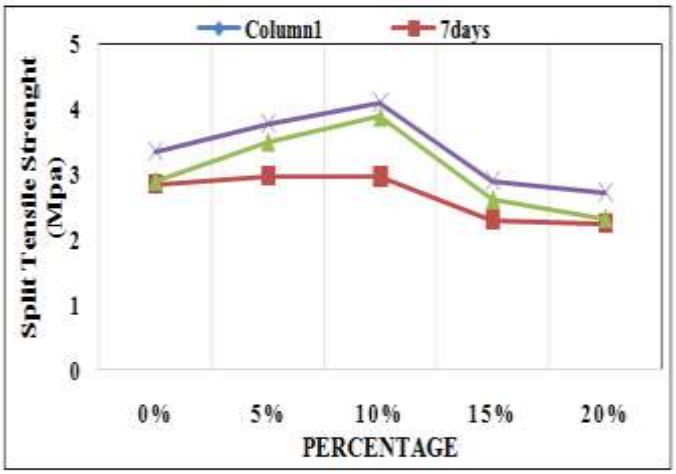

Figure 3: Comparison of tensile strength of all mixes at different intervals

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V. CONCLUSION

- The SDA concrete having 5% and 10% Saw Dust Ash is more workable and has good slump as compare to the normal concrete. This shows that as the percentage of saw dust ash increases the slump decreases.
- As the percentage of Saw Dust Ash increases, the compressive strength of concrete tends to increase up to the percentage of 5 and 10% and then start's decreasing as the saw dust ash is increased from 15 to 20%.
- The splitting tensile strength of Saw Dust Ash concrete increases up to the percentage of 5% and 10% and then it starts decreasing as the percentage of SDA increases.
- The strength of 5% and 10% Saw Dust Ash concrete is more than normal concrete. This shows that till 10% Saw Dust Ash concrete can be used in the replacement of cement.
- This increase in strength in Saw Dust Ash concrete is due to presence of Silica and pozzolanic reactions in Saw Dust Ash.

REFERENCES

[1] Amrutha Sebastian, Anju Sambath Manapurath, Devika Balachandran, Dona Maria Sebastian and Dona Philip "Partial Replacement of cement with wood ash", *International Journal of Science Technology & Engineering*, May 2016.

[2] A.A.Raheem, B.S.Olasunkanmi and C.S.Folorunso, "Saw Dust Ash as a Partial Replacement For Cement in Concrete" Department of Civil Engineering, *Ladoke Akintola University of Technology Ogbomoso, Oyo State, Nigeria*, March 2012

[3] ABDULLAHI, M. (2006). Characteristics of Wood ASH/OPC Concrete. *Leonardo Electron J Pract Technol* Vol. 8, pp. 9 – 16.

[4] ABHISHEK, D. S, KUMBAR, P. K. (2017). An experimental study on durability aspects of concrete with partial replacement of cement by sawdust ash. *International Journal of Scientific Research Organization* Vol. 1, No. 5, pp. 36 – 41.

[5] Ambika Nahak, M.S.D. (March 2015) "A Study on Strength of concrete with Partial Replacement of Cement with Saw Dust Ash and Steel Fibre"- *International Journal of Engineering Research and Technoogy (IJERT)*, 4(3), 134-137.

[6] Bidyut Mazumdar and Abhisheak Agrawal, "Saw Dust Ash as a Partial Replacement of Cement in Concrete" *International Journal For Scientific Research and Development*, 2015.

[7] BERRA, M, MANGIALARDI, T, PAOLINI, A. E., Reuse of woody biomass fly ash in cement-based materials. Construction and Building Materials, Vol. 76, pp. 286–296, 2015.

[8] C.MARTHONG, "Saw dust Ash as a Partial Replacement of Cement", *International Journal of Engineering Research & Applications*, August 2012.

[9] Cheah, C.B., and Ramali, M. (2011). The implementation of wood waste ash as a partial cement replacement material in the production of structural grade concrete and mortar: An overview Resources, *Conservation and Recycling*, 55(7), 669-685.doi: http://dx.doi.org/10.1016/j.resconrec.2011.02.002.

[10] CHOWDHURY, S, MANIAR, A, SUGANYA, O. M., Strength Development in Concrete with Wood Ash Blended Cement and Use of Soft Computing Models to Predict Strength Parameters". *Journal of Advanced Research*, Vol. 6, pp. 907–913, 2015.

[11] Corinaldesi.V, Study on light weight mortars made of wood waste materials, *Advanced material research*, 548, 34-41, 2012.

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