

Strength Assessment of Cement Concrete by Supplementing the Palm Oil Fuel Ash Partial Replacement for Fine Aggregate at Different Dosages

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ABSTRACT:

Concrete is the most generally utilized restricting material in all development works. Because of its significant expense and warmth freedom property, endeavors have been made to supplant concrete in substantial utilizing horticultural or mechanical waste. This examination includes fractional substitution of concrete in concrete by palm oil fuel debris (POFA) which is an agro-squander produced in palm oil industry. POFA is a pozzolonic material which enjoys conservative and specialized benefit when utilized in concrete. In the current examination compressive strength, split Tensile strength test & Ultra sonic pulse velocity was led on solidified cement by supplanting concrete with 3 %, 6%, 9 % ,12% & 15% of POFA and contrasted the outcomes and control blend. The grade of concrete is M-30. It has been seen that substantial with 9% TO 12 % replacement of POFA gave the most noteworthy strength.

Key words: POFA, emission, M-30 Grade, split-tensile Strength.

I. INTRODUCTION

Concrete is a manmade material and it is the most widely used building material in construction industry. There has been so much demand on construction materials in many countries around the world. Therefore, the discovery of alternative conventional building material that is cheaper and accessible becomes a highly critical issue. Nowadays, the use of waste material as concrete ingredient is gaining popularity. One such material is palm oil fuel ash (POFA). POFA is an agro-waste generated in palm

oil industry. It is obtained from the combustion of palm fruit residues of oil palm tree. Generally, the wastage of palm oil from palm oil industry was increasing eventually. It is become a major problem to palm oil power plants because this waste is not reused and recycled in any works. Therefore, POFA whose chemical composition contains a large amount of silica, can be used in cement replacement.

In general, the ingredients of concrete consist of coarse aggregate, water, sand and cement. However, some researcher found that another material that can be added to the concrete mixes which is called admixture. The admixture is selected based on the concrete requirements. The admixtures are used to modify concrete properties to achieve the requirement or performance. Mostly, the requirements and performances needed are to control setting and early hardening, workability, increase in strength, reduction in water demand, improved durability, and permeability and to control the heat of hydration. For this paper, Palm oil fuel ash (POFA) will be discussed. Pozzolanic properties due to its chemical composition which is high in silica. Mehta defined pozzolan as "siliceous or siliceous and aluminous materials which on themselves possess little or no cementitious value but will in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compound possessing cementitious properties" Due to the environmental issue, researchers take POFA as a sample for laboratory work since POFA is abundant waste material which is useless. The idea to use POFA and other waste material to add into the concrete mixes are due to this problem. Various

researchers reported that POFA has pozzolanic properties and highly reactive when the fineness is high and can be used as a unique cement replacement for building construction materials

MATERIALS USED: Materials used for this study includes

1. Palm oil fuel ash (POFA),
2. Ordinary Portland cement of grade 53
3. Coarse aggregate,
4. Fine aggregate,
5. superplasticizer Master Glenium SKY8233
6. Water.

PALM OIL FUEL ASH (POFA):

Palm oil fuel ash is produced (POFA) is produced by burning of fibre, shell and empty fruit bunch of palm oil tree as a fuel to heat steam for electricity and palm oil extraction process. It is disposed in landfills that the amount of ashes increases every

year and now becomes a burden. It is estimated that more than 1000 tons of POFA is produced every year in India. The sustainable amount of silica and the fineness of POFA makes it suitable to be used as a substitute for cement also. The following properties of concrete are altered with the addition of rice husk ash:

- The heat of hydration is reduced. This itself help in drying shrinkage and facilitate durability of the concrete mix.
- The reduction in permeability of concrete structures. This will help in penetration of chloride ions, thus avoid the disintegration of the concrete structures.
- There is a higher increase in sulphate and chloride attack.
- Good workability which helps in better placing and compaction.

S.No	Chemical Composition	% OF POFA
1	Silicon dioxide	53.82
2	Aluminium oxide	5.66
3	Ferric oxide	4.54
4	Calcium oxide	4.24
5	Magnesium oxide	3.1
6	Sodium oxide	0.1
7	Potassium oxide	4.47
8	Sulphur oxide	2.25
9	Phosphorus oxide	3.01

TABLE: 8 PROPERTIES OF POFA

Thesis organization Cycle



MIX DESIGN

MIX DESIGN IS FOLLOWED BY USING INDIAN STANDARD - CODE BOOK – [10262-2009]

Amount of cement, sand, aggregate and water in different grades of concrete				
Mix	Ratio	Cement in Kgs	Sand in Kgs	Water in Litres
M5	1:5:10	141	785	70.50
M7.5	1:4:8	174	773	87
M10	1:3:6	226	753.60	113
M15	1:2:4	322	717.80	161.00
M20	1:1.5:3	403.20	672	201.60
M25	1:1:2	565	565	282.50
M30	1:1:3	452	452	226

The Above Values Are Approximate Values And May Change According To The Presence Of Moisture Content In The Constituents.

TEST REPORTS: COMPRESSIVE STRENGTH

S.No	Type Of Mix	POR	Cube Id	28 days N/mm ²	56 days N/mm ²
1	NORMAL MIX	0	NM-X	38.24	43.3
2	POFA MIX	3	POFA-3A	38.01	38.26
3	POFA MIX	6	POFA-6A	38.28	39.07
4	POFA MIX	9	POFA-9A	40.01	41.14
5	POFA MIX	12	POFA-12A	43.30	45.16
6	POFA MIX	15	POFA-15A	45.13	45.18



COMPRESSIVE STRENGTH BY USING ACCELERATED CURING TANK

Accelerated Curing Method is used to get early high compressive strength in concrete. This method is also used to find out 28 days compressive strength of concrete in 28 hours. (As per IS 9013-1978-Method of making, curing and determining compressive strength of accelerated

cured concrete test specimens). Accelerated curing is useful in the prefabrication industry wherein high early age strength enables the removal of the formwork within 24 hours thereby reducing the cycle time resulting in cost saving benefits. The most commonly adopted curing techniques are steam curing at atmospheric pressure, warm water curing, boiling water curing and autoclaving.

S.No	Type Of Mix	POR	Cube Id	28 days N/mm ²
1	NORMAL MIX	0	NM-X	35.24
2	POFA MIX	3	POFA-3A	35.89
3	POFA MIX	6	POFA-6A	35.92
4	POFA MIX	9	POFA-9A	35.92
5	POFA MIX	12	POFA-12A	36.42
6	POFA MIX	15	POFA-15A	36.54



A).SPLIT -TENSILE STRENGTH OF CONCRETE:

S.No	Type Of Mix	POR	Beam Id	28 days N/mm ²	56 days N/mm ²
1	NORMAL MIX	0	NM-X	1.225	1.456
2	POFA MIX	3	POFA-3A	1.761	1.875
3	POFA MIX	6	POFA-6A	2.121	2.435
4	POFA MIX	9	POFA-9A	2.128	2.436
5	POFA MIX	12	POFA-12A	2.438	2.531
6	POFA MIX	15	POFA-15A	2.561	2.643



B) ULTRA SONIC PULSE VELOCITY TEST:

S.No	Type Of Mix	POH	Cube Id	Pulse velocity(km/second)	Quality of CC tube
1	NORMAL MIX	0	NM-X	3.90	GOOD
2	POFA MIX	3	POFA-3A	4.1	GOOD
3	POFA MIX	6	POFA-6A	4.21	GOOD
4	POFA MIX	9	POFA-9A	4.24	GOOD
5	POFA MIX	12	POFA-12A	4.24	GOOD
6	POFA MIX	15	POFA-15A	4.38	GOOD

References Range:

1. Pulse velocity in KM/S- above 4.5 –**excellent**
2. Pulse velocity in KM/S- between 3.5-4.5 –**Good**
3. Pulse velocity in KM/S- between 3.0-4.5 – **Medium**
4. Pulse velocity in KM/S- below 3.0 – **Doubtful**

II. CONCLUSIONS

- Based on the tests conducted on cement concrete cubes & cylinders the following conclusions are drawn up to my knowledge
- In this concrete materials Era the replacements developments are in fine manner and improved versatility of material characteristics are good, in other hand I used POFA Which is similar to cement material and 60 % more similar properties to cement. total 36 cubes and 12 beams are casted results purpose
- The following percentages are used in concrete mix 3%-15 %
- In compressive strength overall 36 cubes are passed at constant rate of loading the cubes at 9 % ,12%,15% are responded with increased percentage at constant rate at percentage
- 40.01 N/mm2 - 45.13 N/mm2 at 28 days
- 41.14 N/mm2 -45.18 N/mm2 at 56 days
- The cubes are placed in Rapid curing tank the results achieved was satisfactory & increased percentages of replacements from 9-15 % 35.92 N/mm2 -36.54 N/mm2 at 28 days
- In split- tensile strength overall 12 beams are casted the tensile strength is not in a satisfactory manner.
- Based on UPV results all cubes attains 3.8 km/second -4.5 km/second with quality of concrete tag GOOD

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