Preparation of Fine Aggregate by Using Thermal Power Plant Waste by Pelletisation Technique

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***Abstract*— Light weight concrete is booming in recent times due to scarcity of natural aggregates like sand. Over extraction of sand from the rivers and streams has affected the water holding capacity of the earth which is in turn affecting the groundwater recharge. Thus, this is an curbing issue for the sustainable management of the environment. On the other hand, rapid urbanization, increased economy constraints etc. are affecting the developmental activities, thus, necessitating the research for alternate resources. Fly ash which is the by product of thermal power plant (TPP) is generally land filled due to its un productivity after its use in the TPP. Thus, in the present study, an attempt has been made to use the fly ash for the manufacture of fine aggregates with small portion of cement using Pelletisation technique with varying proportions like 85:15, 90:10 and 95:05 of fly ash: cement respectively After preparation of FAFA with different proportion has listed above were tested for basic values like density and water absorption. After analyzing the results of all proportions 85:15 proportion FAFA were light weight and less water absorption when compare to other two proportions. FAFA were prepared with a proportion of 85:15 and checked for the physical properties like, sieve analysis, water absorption capacity, specific gravity, bulk density etc... and physical properties were maintained as per the Indian standards.**

***Key words:* FAFA- fly ash fine aggregates, TPP - Thermal power plant, physical properties.**

I. INTRODUCTION

With the advent of urbanization, the demand for concrete is growing exponentially. Thus a stress has been created on the natural resources like sand and coarse aggregates. The availability of natural sand due to increased and ever increasing demand necessitates the above research. However, precautions have to be taken regarding the strength parameters. Light weight concrete is the one in which the weight of concrete is less as compared to the conventional concrete. In order to obtain this, there is a need of material that can be used as an alternative. If the alternative material is a byproduct of some other process i.e. a waste material, the utilization of this product will also help in sustainable management of the Earth's natural resources.

In the present study, fly ash is used in the production of fine aggregate. As flyash is a waste material and also the outcome of it is very huge in thermal power plant, part of flyash obtained is used in cement industries and remaining of it is simply land filled or dumped. As it contains silica content, it can be effectively consumed in the preparation of aggregates along with a binder solution like water. In this study fly ash is mixed with sufficient quantity of water in the preparation of flyash fine aggregate.

Pelletisation technique: Process of comprising or molding a material into the shape of pellets.

II. LITERARTURE REVIEW

Harikrishnan et. al., [2004]: Has manufactured, aggregates by Pelletisation technique. The authors report that the technique of preparing aggregate depends upon the size and distribution of particles used for aggregate making and also the amount of moisture absorption. He also studied that the formation of aggregates also depends on the some important factors based on the instrument used for manufacturing like Pelletizer and the operational activities and the amount of moisture or water content added to aggregate. Operational activities like turning speed, rotational angle or revolution and the amount of water content added during manufacture also greatly influences the strength and size growth.

Ramamurthy et. al., [2004]: has prepared, the light weight fly ash aggregates by Pelletisation technique. The authors used different binders for the formation of light weight aggregates and has studied the performance of these three binders in the formation of aggregates with respect to fly ash aggregates sintered.

Manikandan et.al., [2009]: fly ash aggregates is prepared by the Pelletisation technique with bentonite as a binder. In this study, the fly ash used for preparation of light weight aggregates were taken in 2 different thermal power plants with varying finesse viz. 414 m^2/kg and 257 m^2/kg respectively. Aggregates prepared were categorized for the physical properties and found that the finesse of flyash 257 m^2/kg exhibits more strength when then the finesse of flyash 414 m^2/kg.

Thus, in the present thesis, flyash fine aggregates are prepared by Pelletisation technique with varying percentage of cement: flyash like 15:85, 10:90 and 05:95. The manufactured aggregates are cured for 7 days and are characterized based on

the physical properties. The aggregates are introduced in concrete.

III. METHODOLOGY

Fly Ash Aggregates

Class F flyash from the power plant of raichuru is used for the preparation of fly ash sand is checked for properties on replacement of sand as per IS codes.

Table 1 Properties of Flyash

Properties	Values
Specific Gravity	2.2
Normal Consistency (%)	31
Fineness (%) 2.5	2.5

a) Preparation of Fly Ash Aggregates

- In different proportion ordinary Portland cement and fly ash were weighed [fly ash:cement] 85:15, 90:10 and 95:05.
- The mix of this proportion is dry mixed with the help of concrete mixer.
- For this dry mix the water is sprayed as the concrete mixer is rotated.
- The water spraying is continued until the formation of aggregates.
- After the formation of aggregates they are collected from the mixer with the help of tray as shown.
- Once the aggregate is collected, they are dry for 24hr.
- FA sand dried for a day is taken and is allowed for water curing for seven days.

Figure:1 Process of Formation of Flyash Aggregates by Pelletisation

b) Flyash Aggregates Curing

Flyash sand obtained is kept for air drying for a day and then is kept water curing.

Figure: 2 Water Curing

c) Gradation of Flyash Aggregates (85:15)

- After curing of flyash sand, the FA sand sieved and separate is coarser finer materials according to the size of IS standards.
- After segregation the aggregates were of two types, aggregates sizes below 4.75 mm are said as as fine and size bigger than 4.75 mm as coarser.
- The fine aggregates are than graded according to the IS sieves and Fineness modulus of FAFA is determined.

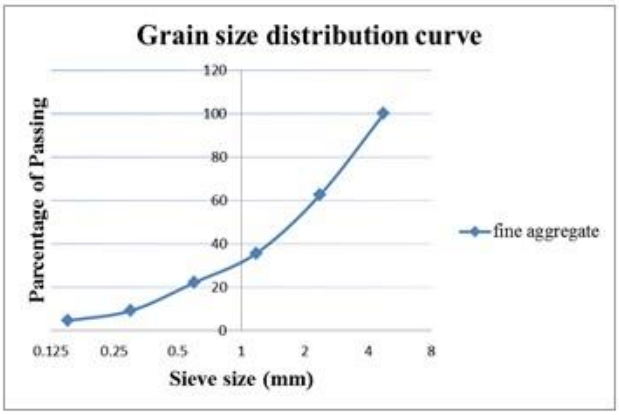

Figure 3 Grain Distribution Curve of Flyash Fine Aggregates

Fineness modulus = ∑F/100

= 366/100

= 3.66

d) Characterization of FAFA (85:15)

The graded FAFA are categorized by its physical properties. The categorized aggregates are introduced in concrete to determine its performance in it.

Figure: 3 Flyash Aggregates by Pelletisation

Table 2 Sieve Analysis of Flyash Fine Aggregates (85:15)

Sieves	**Retained weight (gms)**	**Retained % weight**	**Retained Cumulative %**	**Passing percentage**	**I zone**
4.75	-	-	-	100	90-100
2.36	375	37.5	37.5	62.5	60-95
1.18	268	26.8	64.3	35.7	30-70
600 Micro	135	13.5	77.8	22.2	15-34
300 Micro	130	13	90.8	9.2	5-20
150 Micro	46	4.6	95.4	4.6	0-10
Bottom pan	46	4.6	100	0	

Table 3 Specific Gravity Test of FAFA(85:15)

A	Empty pychnometer (w_1)	652 gms
B	Pychnometer + saturated sand (w_2)	952 gms
C	Pychnometer + sand + water (w_3)	1632.5 gms
D	Pychnometer + water (w_4)	1508 gms
E	Sp. Gravity= $((w_2-w_1)/((w_2-w_1)-(w_3-w_4)))$	1.68

Table 4 Water Absorption Test of FAFA (85:15)

A	Saturated sand (w_1)	39
B	oven dried sand (w_2)	34.36
C	Absorption (w_3) =(w_1- w_2)/ w_2	0.135
D	% absorption= w_3*100	13.5%

Table 5 Characterization of FAFA of 85:15

	85:15	**Code**
Sp. Gravity	1.68	2386 of IS (I Part):1963
Absorption	13.5%	2386 of IS (III Part):1963
Modulas of Finess	3.66	2386 of IS (III Part):1963
Bulking density	873	2386of IS (III Part):1963

IV. CONCLUSION

- Various mix proportions of flyash aggregates were manufactured in the ratio of 95:5, 90: 10 and 85: 15 respectively and were blended with concrete.
- After comparing results of all proportion ,85:15 satisfied all the criteria means it is light weight and less water absorption when compare to other two proportions.
- Fly ash fine aggregates are light weight compare to sand. So if we used this fly ash fine aggregates in concrete that concrete will become light weight compare to normal concrete.
- The thermal power plant wastes which includes fly ash and bottom ash consists of elements like calcium, iron and magnesium etc., degrades the environment when disposed. Thus utilisation of that waste helps in sustainable management of environment.

REFERENCES

[1]. Harikrishnan, “Influence of Pelletisation process on the properties of flyash aggregates”.

[2]. Ramamurthy et. al. “Influence of binders on properties of sintered flyash aggregates”, *Cement and Concrete Research*, Vol-28, 2006, PP. 33-38.

[3]. Harikrishnan KI and Ramamurthy K,“Study of parameters influencing the properties of sintered flyash aggregates”, *International Journal of Solid Waste Technology Management, (*2004), 30(3), PP. 136–42.

[4]. R. Manikandan, “Swelling Characteristic of Bentonite on Pelletization and Properties of Flyash Aggregates”.*Journal of Materials in Civil Engineering* [ASCE], October 2009.

[5]. O. Kayali, “Flyash lightweight aggregates in high performance concrete”, *Journal of Construction and Building Materials*, 22 (2008) 2393–2399.

[6]. Shanmugasundaram, S. Jayanth, R. Sundararajani,“Utilisation of flyash aggregates in concrete”,*Journal of Modern Applied Science*, May 2010 Vol. 4, No. 5