

Study on The Properties Of Polyester Resin Mortar Using River Sand

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Abstract— The purpose of this study is to investigate the properties of polyester resin using the river sand and fly ash and GGBS as micro filler. River sand is taken as fine aggregate passing through 4.75mm sieve. The various properties such as fineness modulus, specific gravity, void content and void ratio of river sand, fly ash and GGBS is found out. The mix design of the mortar was worked out to find the various proportions of each material for the purpose of casting the cubes of size 70.6 x 70.6 x 70.6 mm . The strength of the polyester resin mortar using fly ash and GGBS as micro filler is then found out by casting cubes with different percentage of resin, filler and river sand. The study showed that maximum strength was found for a workable mix with a resin percentage of 14 in case of river sand and fly ash resin mortar and 15% in case of river sand and GGBS resin mortar.

Index Terms— Compressive strength, fly ash, material properties, polyester resin, River sand.

I. INTRODUCTION

The most widely used resin system is polyester resin. Resin is a sticky flammable organic substance which is insoluble in water, discharged or exuded by trees and some plants. Polyester resins are unsaturated synthetics resins. They are thermosetting. Polyester resin when used in mortar with river sand and various micro fillers, a suitable strength can be obtained by altering the contents of fine aggregate, micro fillers and resin content. Excessive use of catalyst may result in ignition and even fracture due to production of excessive heat.

II. MATERIALS

2.1 .Unsaturated polyester resin

In this study, the binder used for the mortar was unsaturated polyester resin with styrene monomer as diluents. The various properties of the unsaturated polyester resin used are shown in table 1.

Table 1. Properties of USP

Property	Polyester Resin
Appearance	Slightly yellowish clear liquid
Density @25°C	1.12-1.13
Viscosity @ 25°C	500±50
Specific gravity @ 25°C	1.10±0.01
Volatile content	34±4
Acid value (mg KOH/gm)	25±4
Catalyst (51%DMP)	1.5 ml/100gm of resin
Accelerator	1.5 ml/100gm of resin
Styrene content	38

2.2 Fine aggregate

River sand passing through 4.75mm sieve was used as fine aggregate in this study. The properties such as such as

fineness modulus, specific gravity, void content and void ratio was found experimentally which is shown in detail below.

2.3 Fineness modulus

1500 grams of river sand passing through 4.75 mm sieve was taken for determining the fineness modulus. The various sizes of sieves used apart from 4.75mm sieve for finding the fineness modulus of river sand were 2.36mm, 1.18mm, 600 microns, 300 microns and 150n microns. The fineness modulus details are shown in table no 2.

Table 2. Fineness modulus of river sand

Sieve size	Wt retained	% of wt retained	Cumulative %
4.75	0	0	0
2.36	24.80	1.653	1.653
1.18	186.3	12.420	14.073
0.60	621.3	41.420	55.493
0.30	567.8	37.853	93.346
0.15	85.2	5.680	99.026
	14.6	0.970	100.00

Table 4. Mix proportion of resin mortar with various micro fillers.

Type of FA	Type of MF	Mix proportion (wt %)		
		FA	MF	Resin
River sand	Fly ash	76.00	12.00	12.00
		74.00	13.00	13.00
		72.00	14.00	14.00
	GGBS	63.33	25.56	11.11
		55.00	31.36	13.64
		50.69	34.37	14.94

Table 5. FA/MF and MF/R ratios for different percentages of resin

Type of FA	Type of MF	Resin %	FA/MF	MF/R
River sand	Fly ash	12.00	6.33	1.00
		13.00	5.69	1.00
		14.00	5.14	1.00
	GGBS	11.11	5.70	2.30
		13.60	4.03	2.30
		14.94	3.39	2.30

III. FABRICATION AND CURING OF SPECIMEN

The cubes casted with resin mortar are of size 70.6 x 70.6 x 70.6 mm. the specimens were casted and tested for compressive strength after curing in room temperature for 7 days.

IV. TEST RESULTS AND DISCUSSIONS

The compressive strength of resin mortar using river sand and various micro fillers was determined and is tabulated below.

Table 6. Compressive strength of resin mortar

MF	FA (g)	Resin %	Load	Comp strength
Fly ash	642.67	12.00	174.8	35.069
	625.76	12.00	218.9	43.917
	608.84	14.00	316.4	63.479
GGBS	544.03	11.11	67.4	13.520
	472.45	13.60	302.5	60.690
	644.94	13.60	334.7	67.150
	435.44	14.94	382.4	76.720

Table 7. Density of resin mortar with different resin and fine aggregate contents

MF	FA (g)	Resin %	Weight of cube	Density (g/cm ³)	Comp strength
Fly ash	642.67	12.00	746.5	2.121	35.069
	625.76	12.00	781.5	2.221	43.917
	608.84	14.00	765.0	2.174	63.479
GGBS	544.03	11.11	747.7	2.125	13.520
	472.45	13.60	801.9	2.279	60.690
	644.94	13.60	820.3	2.331	67.150
	435.44	14.94	811.6	2.306	76.720

From the test results it was found that river sand resin mortar using fly ash had maximum strength for a resin% of 14 and in case of GGBS maximum strength was obtained at a resin % of 14.94 i.e almost 15% for a suitable workable mix.

V. CONCLUSION

The characteristics of river sand as a constituent of polyester resin mortar with fly ash and GGBS as micro filler were investigated and the results are as follows.

- i. The workability of the resin mortar improved with increase in the percentage of resin content.
- ii. In case of GGBS for same percentage of resin content two cubes were casted by varying the fine aggregate content and the result showed that out of both the combinations the combination which contained more fine aggregate content showed more compressive strength than the other.
- iii. In case of polyester resin mortar with fly ash as micro filler, the maximum strength was obtained with a resin percentage of 14 whereas in case of resin mortar with GGBS as micro filler the maximum strength was obtained for a resin percentage of 14.94 i.e almost 15 for suitable workable mix.

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