PARTIAL REPLACEMENT OF CEMENT WITH HOSPITAL WASTE ASH IN CONCRETE

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1. ABSTRACT:

Out of the total healthcare institution in India, Kerala has about 27%. It is estimated that about 1.5 to 2 kg/day of solid waste are generated by each individual. 80% of solid waste is non hazardous. Biomedical waste generation is a huge problem. The year by year production of biomedical waste are getting increased day by day. Mismanagement of this waste will greatly affect the human health. This waste creates many bad effects to the environment. So as a solution, research has been found out that the biomedical waste ash can be utilized in the concrete production. This paper research about the feasibility of using hospital waste ash in KIMS Hospital Trivandrum as a replacement of cement in M20 grade concrete. The ash proportion utilized here is 5,10 and 15% by the weight of cement, weight of fine aggregate, coarse aggregate and water cement ratio is kept constant.

As a result the replacement the slump value has decreased with increase in percentage of hospital waste ash. Thus shows that the workability is being decreased. Density and water absorption decreased as the proportion increased. At 7 day the compressive strength of 5% ash replaced

concrete is higher than that of control mix because hospital waste ash consist of high percentage of calcite. But for 10% and 15% the compressive

The various proportions are 5,10 and 15% ash. The concrete with HWA designated by XHWA. X

strength is comparable to control mix. Flexural strength and split tensile strength also shows the similar trend. So the use of hospital waste ash in concrete is economical as well as it provide a solution to hospital waste disposal issues.

2. INTRODUCATION:

Hospital waste ash is a special type of waste. It may sometime toxic or non-toxic. Non-toxic waste is usually utilized for the partial replacement of cement in concrete. These non-toxic waste is generated in incinerator. This waste which consist of broken glass bottles, paper wastes, syringes, tablet packets etc.

The idea of using this ash as cement replacement has been made because of the over dumping of Hospital wastes. The consequences of dumping HWA creates pathogenic and environmental diseases. The HWA is main content in this investigation.

3. SPECIMEN REPRESENTATION:

For this research five different mix prepared. 1 Control mix, 3 concrete mix with various proportion of Hospital waste ash and 1 concrete mix with fiber.

prepared in the incinerator and it is lighter than cement. The physical and chemical properties of ash is shown as follows:

means 5, 10 and 15%. The concrete with fiber represented by FHWA.

4. MATERIALS

4.1. Cement

OPC (Ordinary Portland cement) from Pathanamthitta is used throughout in this research.

4.2. Fine Aggregate

M sand from Pathanamthitta is used throughout.

4.3. Coarse Aggregate

Crushed stone with 10 to 20 mm size from Pathanamthitta is used throughout.

4.4. Hospital Waste Ash

Hospital Waste Ash is obtained from KIMS Hospital Trivandrum. The ash coloured ash obtained was a mixture of fine and coarse particles (broken glass bottles, metallic pieces, syringes etc.). The ash is sieved through 90 micron and residue is discarded. The ash is

4.5. Polypropylene Fiber

Polypropylene fiber is a synthetic fiber formed from a polypropylene melt. Polypropylene fiber is generally superior to polyamide fibers in elasticity and resiliency. It increases strength and displays good heat insulating properties.

FIG.1. HOSPITAL WASTE ASH

4.6. Portable Water

Portable Water is used throughout in this research.

TABLE 1: PHYSICAL AND CHEMICAL PROPERTIES OF CEMENT AND ASH

	Cement	Ash
Silicon Dioxide (SiO_2) (%)	17.45	19.603
Aluminum Oxide (Al_2O_3) (%)	4.42	10.37
Ferric Oxide (Fe_2O_3) (%)	3.93	6.27
Calcium Oxide (CaO) (%)	65.84	36.63
Sodium Oxide (Na_2O) (%)	0.252	2.69
Potassium Oxide (K_2O) (%)	1.11	0.701
Magnesium Oxide (MgO) (%)	2.34	2.136
Titanium Dioxide (TiO_2) (%)	0.348	3.395

5. TEST RESULT AND ANALYSIS

5.1. Test Results On Cement And Ash

TABLE 2: TEST RESULTS OF CEMENT AND ASH

	Cement	Ash
Soundness Test	1.5 cm	1 cm
Consistency Test	30 %	34 %
Fineness Test	3 %	4 %
Specific Gravity	3	2.71

5.2. Test Results On Aggregate

TABLE 3: TEST RESULTS OF FINE AND COARSE AGGREGATE

	Fine Aggregate	Coarse Aggregate
Bulk Density	1.59 g/cc	1.515 g/cc
Void Ratio	0.42	0.78
Porosity	29.9 %	44 %

5.3. Test Results On Fresh Concrete

5.3.1. Workability Test

Measure the materials and mixed thoroughly. And fill it as three layers in the cone and tamp 25 times on each layer filling. After that strike out the surplus concrete and rise the cone. Note the slump.

Slump value of all concrete mix as shown as below:

TABLE 4: SLUMP FOR VARIOUS CONCRETE MIX

Concrete Mix	Slump
Normal concrete	11.5
5HWA	11
10HWA	10.5
15HWA	8.5
FHWA	9

beam or slab to resist failure in bending. Take out the prepared specimen from the curing tank and clean the surface. Mark the center of the specimen. Place the specimen 1 below the load

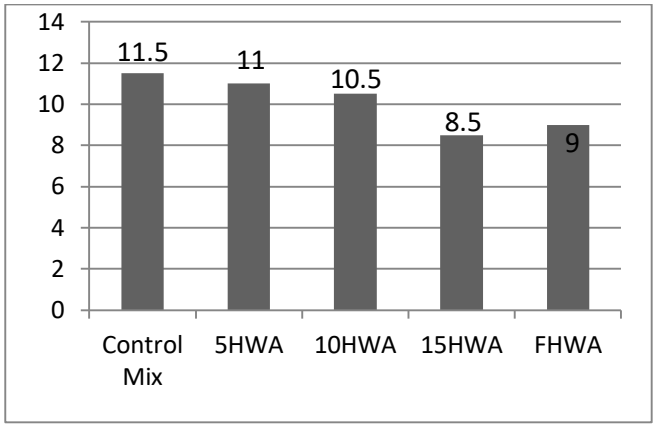

FIG.2. SLUMP FOR DIFFRENET MIX CONCRETE

5.4. Test Results on Hardened Concrete

5.4.1. Density Test

Take the prepared specimen after 3 day curing. Clean it and weigh. Density is calculated by dividing the mass by volume.

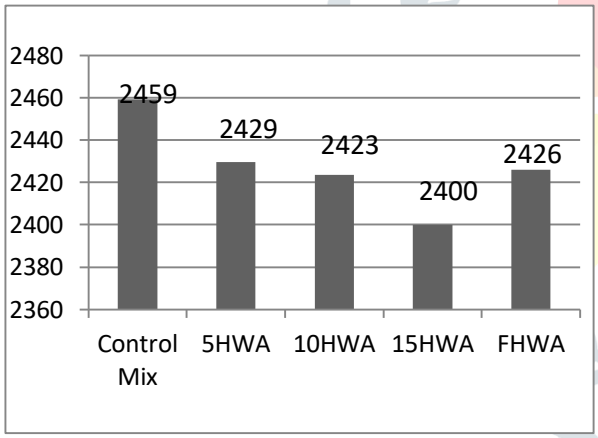

FIG.3. DENSITY FOR DIFFERENT MIX CONCRETE

5.4.2. Flexural strength

Flexural strength is the measure of tensile strength of concrete. It's a measure of an unreinforced in such a way that load should act at exact center of the beam. Increase the load till the specimen breaks.

5.4.3. Split tensile strength test

Split tensile strength is one of the basic and important property which affect the extent and size of cracking in structures. Take out the specimen from curing tank. Wipe out the surface water and dirt well. Calculate the probable load at failure using the limit state method for the cross section. Mark the center and support points of specimens. Apply load at the center of the specimen. Increase the load until the specimen fails and note the maximum load.

TABLE 5: FLEXURAL STRENGTH OF VARIOUS MIX

	Specimen 1	Specimen 2	Specimen 3	28 Day Flexural Strength
CM	6.25	6.3	6.25	6.26
5HWA	6.5	6.6	6.6	6.56
10HWA	5.5	5.5	5.45	5.48
15HWA	5.25	5	5.25	5.16

5.4.4. Compressive strength

Take out the prepared specimen from the curing tank and clean the surface. Measure the dimensions nearest to 0.2mm and note its weight. Place the specimen 1 in the machine in such a way that the load is applied to opposite side of the cube. The load is applied till the cube break.

TABLE 6: SPLIT TENSILE STRENGTH OF VARIOUS MIX

	Specimen 1	Specimen 2	Specimen 3	28 Day Split tensile Strength
CM	3.11	2.82	3.11	3.01
5HWA	3.67	3.6	3.67	3.64
10HWA	3.53	3.46	3.6	3.53
15HWA	3.25	3.25	3.18	3.22

TABLE 7: COMPRESSIVE STRENGTH TEST RESULTS

		7 DAY		14 DAY		28 DAY	
	Specimen 1	17.7		26		29.11	
CM	Specimen 2	18	17.8	26	25.9	29.33	29.2
	Specimen 3	17.7		25.7		29.11	
	Specimen 1	18.8		26.2		31.11	
5HWA	Specimen 2	19.1	18.9	26.2	26.26	30.6	30.9
	Specimen 3	18.8		26.4		31.11	
	Specimen 1	18.6		24		30.4	
10HWA	Specimen 2	18.4	18.5	24.2	24.06	30	30.13
	Specimen 3	18.6		24		30	
	Specimen 1	17.3		22.2		28.8	
15HWA	Specimen 2	17.7	17.5	21.7	22	29.3	28.9
	Specimen 3	17.7		22.2		28.6	

The compressive strength of concrete with 5% ash is higher than the control mix. Because the ash which contain high percentage of calcium oxide.

5.5. CONCLUSION

Based on the result that have carried out here as part of this research, we concluded that the replacement of ash obtained from hospital wastes can be used for the preparation of concrete. The best advantage of this partial replacement is reducing the over dumping of hospital waste to public. In this research the workability decreased with increasing percentage of proportion of ash. The density also decreased as the percentage increased. Because the specific gravity of ash is decreased. The compressive strength of specimen with 5% ash shows higher than that of control mix. The compressive strength of other samples are comparable to control mix. And the flexural strength and split tensile strength of 5HWA shows similar trend of control mix.

5.6. REFERENCES

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