

# Investigation on Utilization of Medical Waste Ash in Concrete

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**Abstract:** There is a major problem in India for generation of biomedical waste from health care units, research laboratories, clinics and other medical sources. Generation of waste adversely affect the whole environment for human being. Therefore Utilization of medical waste ash is a challenging work for all over India. Some researches revealed the scope for the use of medical waste ash in concrete as partly replacing of cement. In this paper the study describes the workability, density and compressive strength of concrete after partly replacing of cement with medical waste ash.

**Keyword:** Medical waste, ash, concrete, coarse, aggregate, workability.

## I. INTRODUCTION

There is great threat to the environment and human being for the generation of biomedical waste from hospitals, research laboratories and other medical sources. Biomedical waste is hazardous and nonhazardous. As per ministry of environment and forest of India. The total biomedical waste produces is 619 ton per day in which approximately 73% of the waste generated is treated but rest is left out untreated. Incineration process is the common disposal method for the treatment of biomedical waste and produces ash. Land filling is the process used for disposal of ash but huge land area is required for this process. Therefore land area reduced by partly replacing of cement in concrete for this experimental work.

## II. REVIEW OF LITERATURE

(Genazzini et al., 2003) describe the opportunity for the use of hospital waste ash in cement based material. Al-Mutairi et al., (2004) shows in his studies that 5 % silica combine with incinerated ash, the compressive strength of cubes were increased. Aubert et al., (2004) suggested that there was potential means for the use of waste in concrete. (Genazzini et al., 2005) shows that hospital ash and cement matrices was potential use as construction material. Anastasiadou et al., (2011) describe the mechanical properties of incineration ash with different quantity of Portland cement, result shows the strength decrease after reduction of percentage of cement. Al-Rawas et al., (2005) describes the use of hospital waste ash as a substitute with replacement of sand and cement in cement mortars. Filipponi et al., (2003) suggested that the property of bottom ash shown the partial pozzolanic property. Anastasiadou et al., (2011) investigate that generation of fly and bottom ash from hospital waste reduce the leachability of the heavy metals present in these materials. Azni et al., 2005 investigate that in Germany insulation walls making at national roads by use of producing 50% hospital waste ash. In Netherland making asphalt for constructing road by the use of 60 % of the hospital waste ash.

## III. MATERIAL AND METHODS

In the study of experimental work, use of very small amount of ash of medical waste for partly replacing cement in concrete and measure the workability and compressive strength of concrete for this experiment

### (i) Cement

For this work ordinary Portland cement was used confirming to IS 269 (1989) specification. There were some physical properties of the cement i.e. specific gravity 3.15, mean grain size 23.6 micrometer, specific area 2250 cm<sup>2</sup>/gm.

### (ii) Fine Aggregate

In this experimental work fine aggregate was used i.e the sand of Natural River passing away 3.57 mm opening sieve. Specific gravity and fineness modulus were 2.65 & 2.1

### (iii) Coarse Aggregate

The use of coarse grading was in nominal size i.e. 22 mm and 12 mm and the ratio was 62: 38

**(iv) Medical Waste Ash**

Medical waste ash was collected from the plant of Incinerator situated at Etmadpur, Agra. There are some physical properties of ash such as greyish, color, light weighted and coarser comparison to cement.

The collection of BMW ash was through incinerator plant situated at Etmadpur Agra.

**(v) Super Plasticizer (Water Reducer)**

Water reducer as sulphonated super plasticizer was used in liquid form and well suited with the used cement, the color was brown and specific gravity 1.3. The properties of dispersion and de flocculation was excellent with the particles of cement and uniformly flow with the concrete mixture. Therefore enrichment in workability of concrete mixture occurs

**(vi) Concrete**

The density of cement content was  $370 \text{ kg/m}^3$  used in mixture design. The minimum requirement of density is  $300 \text{ kg/m}^3$  to avoid the balling affect.

**(vii) Workability as Slump Test**

This experiment was continue for 7 days and 28 days and study the workability, fresh concrete density and compressive strength. This study achieved with conventional concrete as reference and concrete with hospital waste ash as partly stand of cement.

**IV. RESULTS AND DISCUSSION**

The outcomes of the work find out compressive strength, workability and density of concrete.

**(i) Work ability**

Workability is the characteristics which means the work needed to compact the concrete without difference in the end product

The figure shows the monitoring of workability of concrete as referral and the concrete made by use of ash as partial substitute of cement. Workability measured through slump test. It is revealed from the figure that substitution level increases with decreasing workability of concrete. The cause of the trend of graph is being due to lighter weight than cement. The volume of ash acquires great extent than the cement. Therefore it is required more water for making smooth.

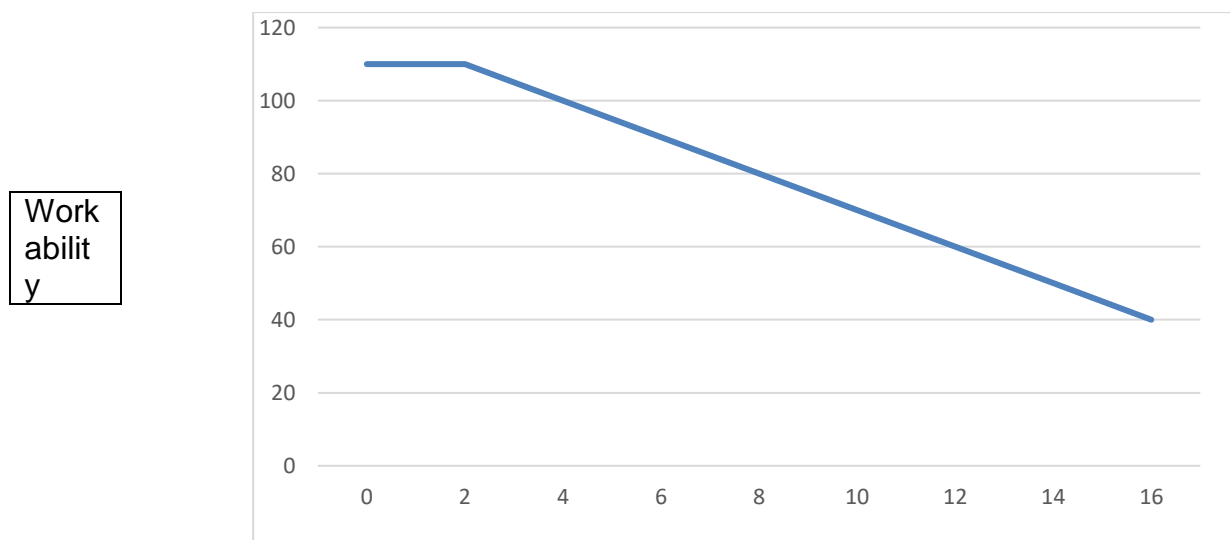


Figure 1 Concrete Workability at various replacing Level of Cement

**(ii) Density**

The solidity of concrete was measured by density of concrete. Higher or lower density of concrete for final product can be modified the operation of mixing concrete.

The figure 2 shows that the replacing level increases with decreasing density of concrete. The reason behind this the lighter weight of ash than the cement.

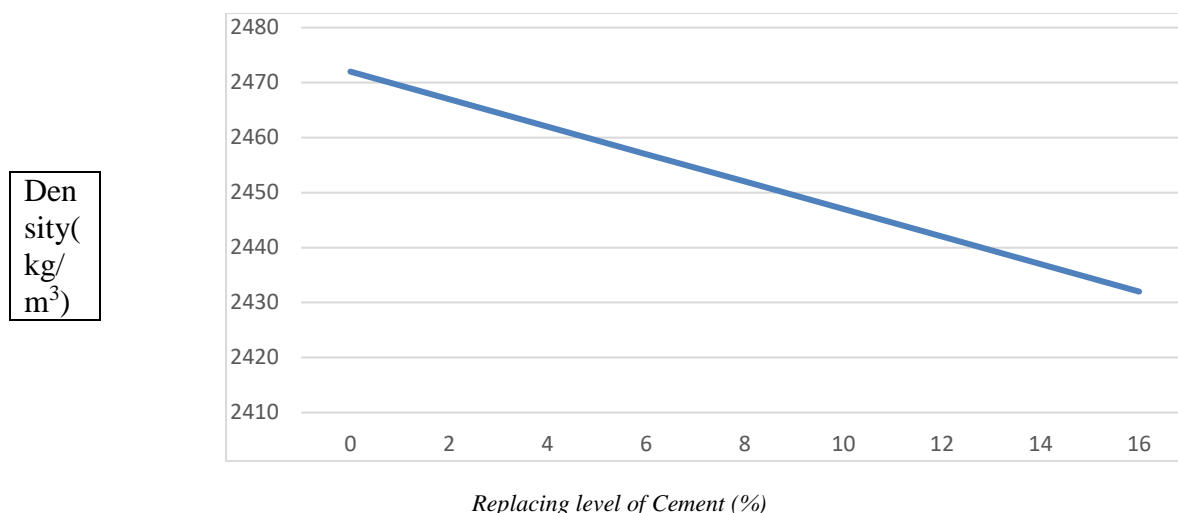


Figure 2 Concrete densities at various Replacing Level of Cement

### (iii) Compressive Strength

It is observed from the experiment and shown in figure that up to 3 % compressive strength increased for one week and four week and up to 10 % ash included concrete is approximately equal to the referral concrete given in figure 3 and table 1.

Table 1– Varying process of compressive strength after inclusion of biomedical waste ash %.

Cube	Inclusion of cement with ash	One week (Average Compressive strength (Mpa)	Four week (Average Compressive Strength (Mpa)
Cube 1	0	22.38	35.65
Cube 2	2	22.41	36.39
Cube 3	3	22.50	37.42
Cube 4	7.5	21.53	36.52
Cube 5	10	22.08	34.62
Cube 6	12.5	20.57	31.17
Cube 7	15	19.71	29.27

Table 1 describes compressive strength of concrete for one week and four week with different amount of cement for replacing with ash. It is viewed from the graph that 3% is the optimum level for process of replacing of cement with ash.

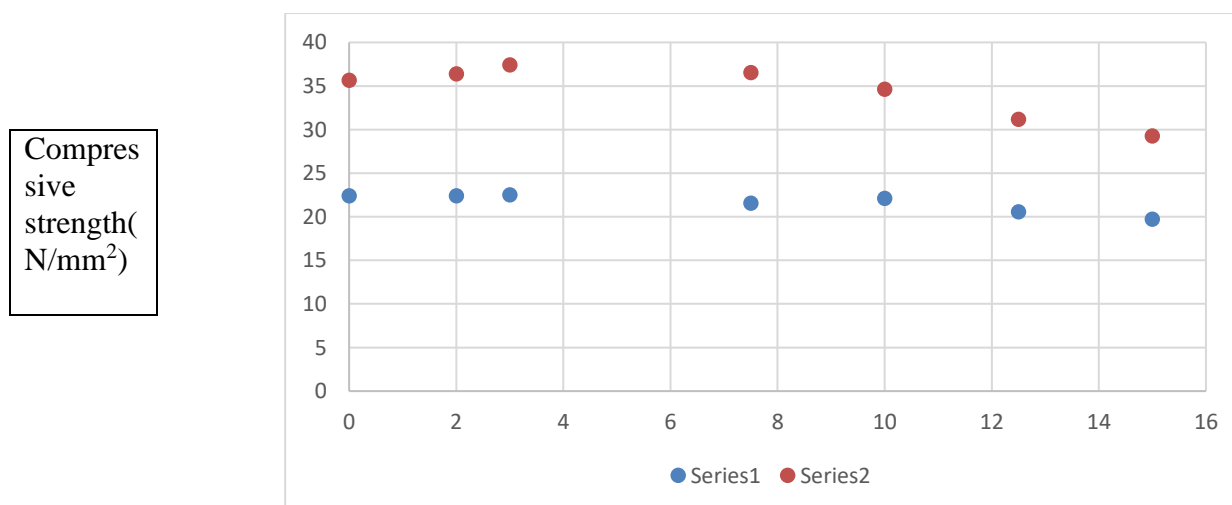


Figure 3 varying process of compressive strength with substitution level of cement

Graphical representations are shown in figure 3. Table 1 shows the most favorable level for substitution of cement with ash. The most favorable level is 3 %.

## V. CONCLUSION

The following conclusions are drawn in accordance with result obtained during study.

- Replacing level of constant dose (0.5%) of super plasticizer increases with decreasing workability
- Replacing level increases with decreases marginally the density of fresh concrete.
- Up to 3% the compressive strength of concrete with ash increases than conventional concrete
- Concrete with ash and conventional concrete are comparable after 10 % replacing level.

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