

# Study on Behavior of Concrete when Cement is Replaced Partially by Poultry Waste

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**Abstract:** Ordinary Portland cement the major construction material works out to be costly and causes environmental problem by emitting 5% to 8% of global CO<sub>2</sub>. To overcome this problem utilization of agricultural and industrial waste which would not only be economical but may also results in foreign exchange earnings and environmental pollution control in India the concept of smart city is growing very fast as main emphasis is on green and sustainable development. Several researches and even Portland cement industry are investigating alternative to produce green buildings. Currently the attempt is to utilize the large amount of poultry waste, the waste from poultry form as supplementary replacement material. The poultry waste obtained by poultry farms is studied for mechanical property and their suitability as binders.

In this research, poultry waste is used in concrete since it has high silica content and other comparable cement constituents. Mechanical properties such as compression strength and split tensile strength of M20 grade concrete is tested for 10% replacement of cement by poultry waste in concrete and the results are compared with the conventional concrete.

**Index Terms – Poultry waste, Hardened property, Concrete technology.**

## 1. INTRODUCTION

### Concrete

Concrete is a constructional material composed of cement, fine aggregates and coarse aggregates mixed with water which hardens with time. In a building construction, concrete is used for the construction of foundations, columns, beams, slabs and other load bearing elements.

### Cement

Cement is a mixture of lime, clay and gypsum with some iron oxide as a flux. India is the second largest producer of cement in the world. India's cement production reached almost 280 million metric tons in 2017.

### Poultry Waste

Poultry or broiler waste is a mixture of chicken excreta, spilled feed, feathers and material used as bedding in poultry i.e., rice husk.

## 2. LITERATURE SURVEY

Harshitvarshney “Utilisation of Rice Husk Ash in Concrete as Cement Replacement”, IOSR Journal of Mechanical and Civil Engineering. The compressive strength of concrete increased with increase in percentage of RHA from 10% to 15% after 7 & 28 days of curing when compared with conventional concrete.

Bandhavya G B, Sandeep K, Bindhushree G B “An Experimental Study on Partial Replacement of Cement with Egg Shell Powder in Concrete”, International Research Journal of Engineering and Technology (IRJET), in June 2017. Compressive strength was higher than conventional concrete for 5% & 10% ESP Replacement at 3, 7 & 28 days of curing. ESP replacement greater than 10% had lower strength than conventional concrete.

Amit Kumar Sharma “Chicken Feather as a substitute of Fine aggregates in Mortar”, International Journal of advances in engineering & scientific research, in Dec-2016. According to the tests that were conducted on sample shows that the strength remains stable upto 5% of feather and strength of sample decreases with increase in percentage.

D.Gowsika, S.Sarankokila, K.Sargunan “Experimental Investigation of Egg shell powder as partial replacement with cement in concrete”, International Journal of Engineering Trends and Technology (IJETT), in Aug 2014. Egg Shell Powder obtained from industrial wastes is added in various ratios for cement replacement & it was found that replacement of 5% ESP+20% microsilica can be added without any reduction.

## 3. OBJECTIVE OF THE STUDY

To compare the compressive strength and Tensile strength of natural poultry waste reinforced concrete with conventional concrete. To obtain the most optimised concrete mix by replacing cement with poultry waste.

By using poultry waste as partial replacement of cement, can reduce the emission of CO<sub>2</sub> into environment by cement manufacturing industries

#### 4. MATERIALS USED

##### a. CEMENT

Ordinary Portland Cement is used in our experimentation. It has been tested as per Indian standard specification IS: 1489 PART-1 1991.

##### b. FINE AGGREGATE

M Sand is used for experimental program. It has been tested as per Indian standard specification IS: 383-1970.

##### c. COARSE AGGREGATE

20mm size aggregates are used for experimental program. It has been tested as per Indian standard specification IS: 383-1970.

##### d. POULTRY WASTE



Figure 4.1: Poultry waste

Table 4.1: Chemical Properties of poultry waste

Property	Value
Silica as $\text{SiO}_2$	47.94%
Calcium as $\text{CaO}$	2.38%
Aluminum as $\text{Al}_2\text{O}_3$	0.52%

##### e. MIX PROPORTION

Mix proportioning is the process of selecting suitable ingredients for concrete and determining their relative quantities with the objective of producing a concrete of the required strength, durability, and workability as economically as possible. M20 grade concrete was designed as per the Indian standard specification IS: 10262-2009.

Table 4.2: Mix proportioning

Materials	for 3 Cubes
Cement	4.38 kg
Fine aggregate	7.36 kg
Coarse aggregate	14.73 kg
Water	2.75 litres
W/C ratio	0.5

**f. SPECIMEN DETAILS**

The specimens like cubes, cylinders and beams are used to conduct the strength tests according to IS: 100086 – 1982.

- Compressive strength test- In this research, moulds of size 150×150×150mm were tested for knowing the compressive strength of different mixes at 7,21and 28days.
- Split tensile strength test- Cylindrical moulds of 150mm diameter at 300mm height were tested for knowing the tensile strength of different mixes at 7, 21 and 28days.

**5. RESULTS AND DISCUSSIONS**

**a. WORKABILITY OF CONCRETE**

**Slump test**

The slump value increases up to 0.3% of poultry waste addition and then it gradually decreases. The graphical representation is shown in figure 5.1.

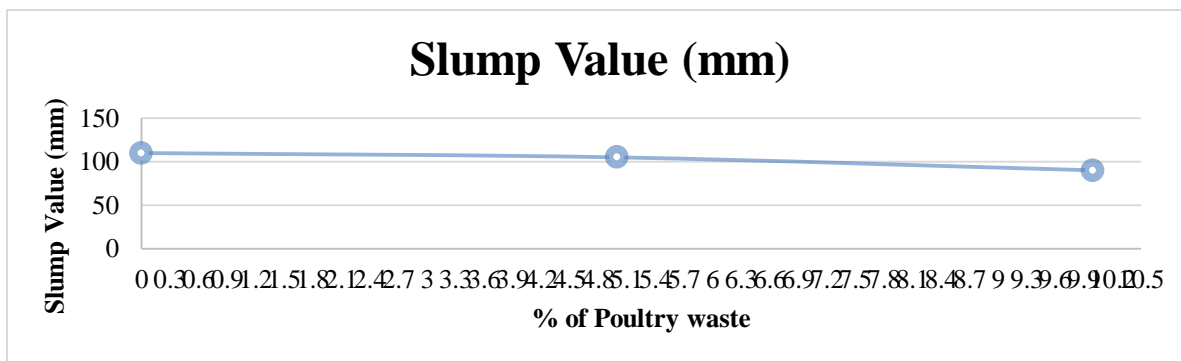


Figure 5.1: Slump value of concrete mix for varied % of Poultry waste

**b. COMPRESIVE STRENGTH TEST**

The compressive strength results of 7, 21and 28<sup>th</sup> day are tested and results are represented graphically as shown in fig 5.2.

Table 5.2: 7, 21 and 28<sup>th</sup> day Compressive Strength Results

Days	Normal Concrete (N/mm <sup>2</sup> )	Concrete with Partial replacement of Poultry waste (N/mm <sup>2</sup> )
<b>Percentage of Replacement</b>	<b>0%</b>	<b>10%</b>
7	12.79	16.18
21	17.56	19.94
28	21.20	21.82

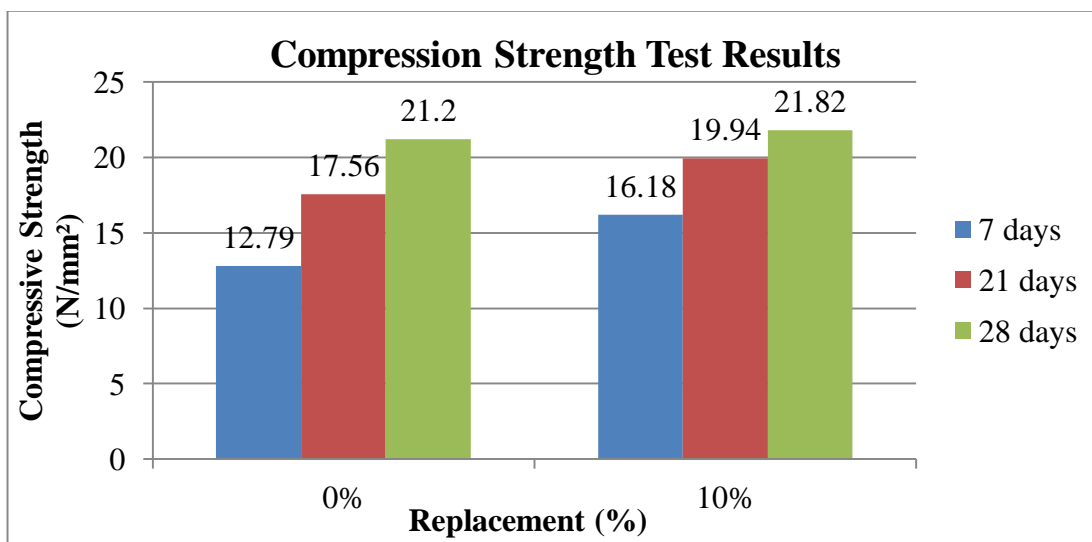


Figure 5.2: Graph of Compressive Strength V/S Replacement

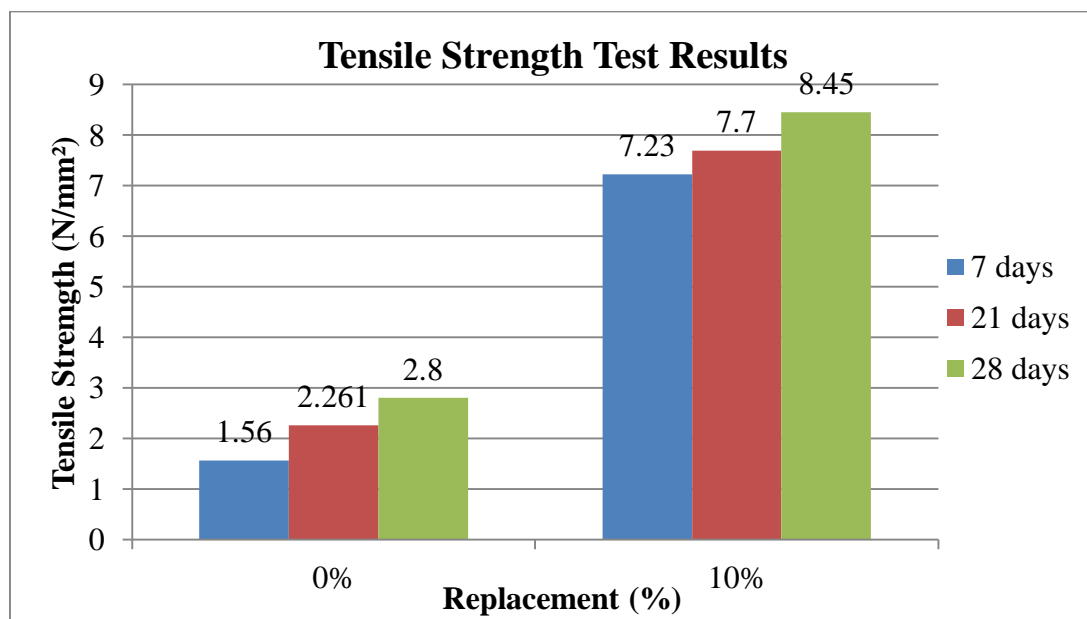
- The compressive strength of concrete has been increasing with the percentage of mix with 10% when compared to conventional concrete.

### c. SPLIT TENSILE STRENGTH TEST

The tensile strength results of 7, 21 and 28<sup>th</sup> day are tested and results are represented graphically as shown in fig 5.3.

**Table 5.3: 7, 21 and 28<sup>th</sup>days split tensile strength results**

Days	Normal Concrete (N/mm <sup>2</sup> )	Concrete with Partial replacement of Poultry waste (N/mm <sup>2</sup> )
Percentage of Replacement	0%	10%
7	1.56	7.23
21	2.261	7.70
28	2.80	8.45



**Figure 5.3: Graph of Split Tensile Strength v/s Replacement**

- We know that, concrete is weak in tension. By adding poultry waste tensile strength of concrete can be increased.
- For 10% replacement, tensile strength of concrete is increased when compared to conventional concrete.

## 6. CONCLUSION

- The result obtained from basic material testing are within the limit and satisfactory.
- The Compressive strength of concrete in which 5% of cement being replaced by poultry waste for at 7days, 21days and 28days of curing is increased by 2.92% when compared to conventional M<sub>20</sub> grade concrete.
- The Tensile strength of concrete in which 5% of cement being replaced by poultry waste for at 7days, 21days and 28days of curing is increased by 201.78% when compared to conventional M<sub>20</sub> grade concrete.
- By observing the above results, we can conclude that 10% replacement of cement by poultry waste gives the desired compressive strength and tensile strength. Further increase in percentage of replacement of poultry waste leads to decrease in compressive and tensile strength.

## 7. REFERENCES

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