A Comparitive Study of Partial Replacement of Tapioca Powder for Cement in Concrete

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***Abstract*: This paper reports the results of experiments evaluating the use of natural product as partial replacement for ordinary Portland cement in concrete.While concreting is done the main ingredients are coarse aggregate, fine aggregate, cement and water. Out of these cement has more demand and if we can replace it with another natural product which is economical, it may become a great success. We choose tapioca powder for partially replacing the cement in concrete. We founded an optimum percentage of 1.0 for partially replacing the cement by tapioca powder in concrete, through which we can achieve high strength while comparing with normal concrete. At the same time while using tapioca powder by partially replacing cement, it will increase the setting time of concrete when compared to ordinary Portland cement. OPC has an initial & final setting time of 30 minutes and 10 hours respectively. But when partially replacing cement by tapioca powder it has an initial and final setting time of 90 minutes and 24 hours respectively.**

Key Words :- Partial replacement, Optimum percentage, Ordinary Portland cement, Tapioca powder

1. INTRODUCTION

Concrete is the most generally used material for construction. The main ingredients of concrete are coarse aggregate, fine aggregate, cement and water. The ordinary conventional concrete cannot be used in all regions because of changes happening in environment. For such situation there is a need of change in physical and chemical properties of the concrete. Normally we used admixtures for such changes in environment.

Various admixtures are used to change a specific property of concrete. But most of the admixtures used for such purposes are not economical. In such situation, changing the properties of concrete through a natural product which is economical is the only choice.

Cement is one of the main ingredient of concrete which act as a binding material. The cement is produced from factory and there is no any alternative choice for it. Hence if we can partially replace the cement in concrete by any natural product it become a great success.

1.1 COARSE AGGREGATE

The coarse aggregate is strongest and least porous component of the concrete. It increases the hardness, abrasion resistance, impact strength and elastic modulus of concrete. The maximum size of aggregate is used in concrete as 20mm.The shape of aggregate is angular. It is also reduce the drying, shrinkage and permeability of concrete. For our present study locally available blue granite crushed stone aggregate is used. The specific gravity and Fineness modulus of the cement is 2.44 and 7.0.

1.2 FINE AGGREGATE

River sand is used as fine aggregate. Fine aggregate with rounded particles shape and snooty text are has marling water in the concrete and for this reasons is preferable in coconut fibre reinforced concrete.ACI committee – 363 reports that's sand with a fineness modulus below 2-5 gives the concrete a sickly consistency it difficult to compact and sand with a fineness modulus of about 3.0 gives best workability and compressive strength. For our present study ordinary river sand was used. The specific gravity and Fineness modulus of the cement is 2.77 and 2.88.

1.3 CEMENT

The ordinary Portland cementof 53grade confirming to IS 12269-1987 was used in this study. Among the chemical composition of the cement the most important ones are C_3A, C_3S, and C_2S. The C_3A of the cement hydrates very fast there by reducing the workability of the fresh concrete. It also apostles the chemical admixtures quickly which leads to a reaction in the availability of these admixtures for comparatively slow setting components. This further affect the workability of fresh concrete and also its rate of retention and workability. The specific gravity of the cement is 2.98.

1.4 WATER

Water is the important ingredient of concrete. The water is used for the study is portable water which is used for drinking. Some water containing a small sum of salt is not suitable for concrete. The ph valve of water between 6 and 8 the water is accepted for suitable.It is free from acids, alkaline and over other minerals.

1.5 TAPIOCA POWDER

`Tapioca is natural product it can be used for food and pharmaceutical, paper, etc.The basic chemical structure of tapioca powder is a polymeric carbohydrate consisting of a hydro glucose units linked together by glycosidic bonds. Starch granules consist of two types of molecule, amylose and amyl pectin, which arrange themselves in semi-crystalline granules.

Fig 1.1Tapioca powder

2. OBJECTIVES

To investigate the utilization of natural product as partial replacement for ordinary Portland cement in concreteand influence of this on the Strength of concretes made with different replacement levels with cement.

2.1EXPERIMENTAL PROGRAM

Table 1. Physical Properties of Cement

S.NO	Description	Test Values
1	Standard Consistency	33%
2	Initial Setting Time	34 min
3	Final Setting Time	350 min
4	Compressive Strength	54.5 N/mm^2
5	Fineness Modulus	3.2%

Table 2. Physical Properties of fine aggregate and coarse aggregate

S.NO	Description	Fine Aggregate	Coarse Aggregate
1	Fineness Modulus	2.369	6
2	Water Absorption	0.51 %	0.3 %
3	Specific Gravity	2.63	2.68

2.2 SPECIMEN PREPARATION

2.2.1 MOULD PREPRATION

Before concreting all the moulds were tightened. The junctions of vertical and bottom planks were coated with plaster of Paris (or) coat of oil in slurry. The inside of the mould was oiled in order to avoid the adhesion of concrete.

2.2.2 CASTING OF SPECIMENS

The mould was kept ready in position. The required quantity of tapioca powder is weighed and placed layer by layer .care was taken to see that sprinkled powder in position.The cement slurry with required proportions prepared and was infiltrated through the fiber beds, and compacted using compact rod.

Fig 2.1 Casting of concrete

2.2.3 CURING

The specimens were kept in mould for one day. After 24 hours all the specimens are marked for identification and demoulded and kept in water tank for curing. The curing done for 7days and 28days. As already mentioned the potable water is used for curing also.

Fig 2.2 Testing before specimens

2.3COMPRESSIVE STRENGTH TEST RESULTS

The compressive strength of the specimens are tested after a curing period of 7days and given below.

Fig.2.3 Testing of cube

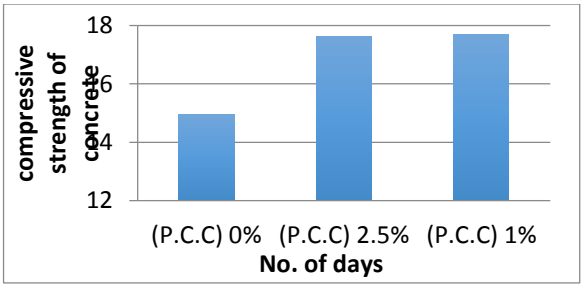

Fig 2.4Compressive strength at 7days

The compressive strength of the specimens are tested after a curing period of 28days and given are below.

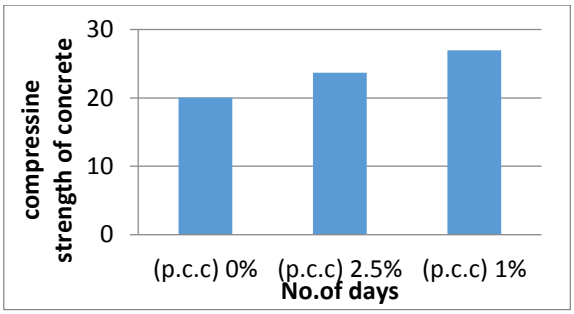

Fig 2.5Compressive strength of 28 days

2.4 SPLITTENSILE STRENGTH TEST RESULTS

The split tensile strength of the specimens are tested after a curing period of 7 days and given are below.

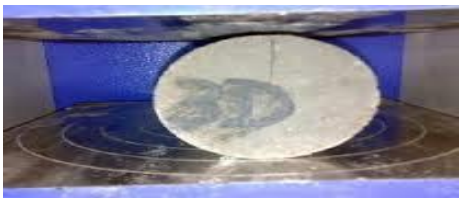

Fig 2.6 Testing of cylinder

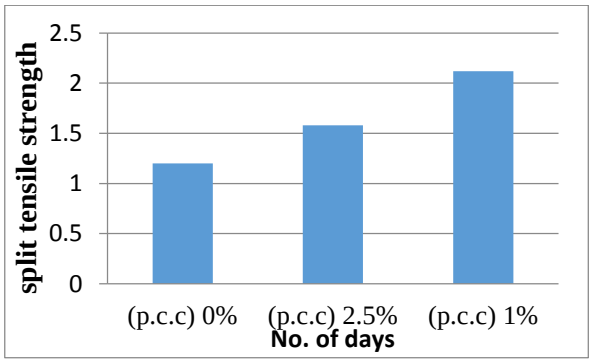

Fig 2.7 Split tensile strength at 7 days

The split tensile strength of the specimens are tested after a curing period of 28 days and given are below.

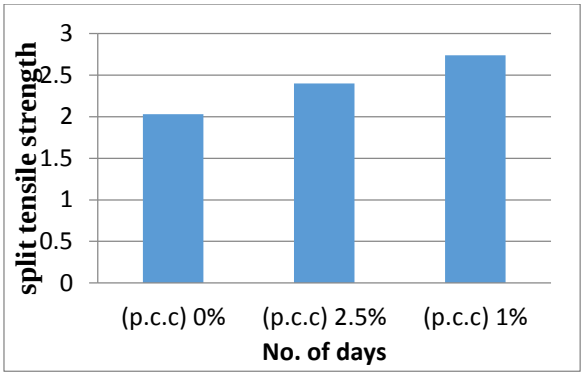

Fig 2.8 Split tensile strength at 28 days

2.5 FLEXURAL STRENGTH TEST RESULTS

The flexural strengthof the specimens are tested after a curing period of 7 days and given are below:

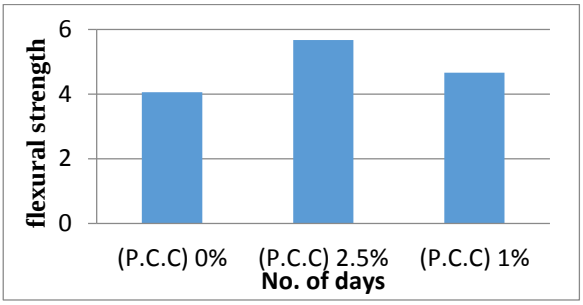

Fig 2.9 Flexural strength at 7daysThe flexural strengthof the specimens are tested after a curing period of 28 days and given are below:

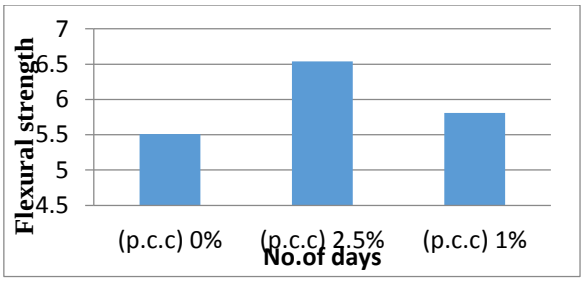

Fig 2.10 Flexural strength at 28 days

3. CONCLUSION

We come to a conclusion that if an optimum percentage of 1.0 are used for partially replacing the cement by tapioca powder in concrete, the concrete can achieve high strength than the conventional concrete. Since the tapioca powder used for replacing is cheaper, this method of concreting is economical.

Due to the using of tapioca powder in concrete the setting time of concrete gets increases. This advantage of increasing the setting time of concrete can be used when concreting is done in hot climatic regions.

Also now a days ready-made concrete are used and such concrete need to be in motion while transporting from one place to another. Such process can be avoided while using such concrete which having a property of increasing the setting time.

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