Experimental Investigation Of Different Color Pigments On Concrete

D. Maruthachalam, G.Shyamala, M. Sugunadevi, M. H. Plato Gandh, K.Rajesh Kumar

Abstract: In recent time, colored concrete with different pigments are used in the construction of new buildings or restoration of prevailing buildings and quadrangles. These colored pigment concrete has properties namely high strength, good durability and weather resistance similar to that of traditional concrete. Color pigments signify a fractional weight replacement of the binder. In this research, influence of color pigments and its characterization on concrete properties is given in a brief manner with experimental outcomes. The experimentation work focuses mainly on determining the physical and mechanical properties of composite concrete (with color pigments) and compare them with reference samples (without color pigments)

Index Terms: Pigment concrete, Color pigments, Physical and mechanical properties, Binder, durability, high strength, traditional concrete

1. INTRODUCTION

Aperiod of time, when concrete with different colored pigments were specified most of the individuals are ignorant to the conventional variations in regular concrete, they often have discriminating prediction. Certain people anticipated that colored concrete to be absolutely uniform in appearance like a painted surface which is unrealistically. Colored concrete can be compared with build materials like wood and stone which are formed by natural process or any other hand crafted materials. These materials aesthetic mainly focuses on their inconsequential variations in their appearance. The aesthetic potential can be improved when these types of colored concrete were constructed with evenhanded concern. Concrete with attractive intrinsic quality can be produced by undertaking certain measures [1]. Generally, outer appearance defects are due to the characteristics of concrete itself and not a outcome of the coloring method. The concrete appearance is usually affected by abundant factors collectively with mix design and its ingredients, procedures adopted for handling and insertion, curing methods and form works, textures, surface finishes and craftsmanship along with its environmental circumstances. Usually, Installation of coloured concrete is carried out using the same tool and techniques adopted for uncoloured concrete. For both cast-in-situ and pre-cast concrete, manufacturers and planners who recognize circumstances that produce variation can figured out more practical expectations and accomplish preferred outcomes. The pigments influence on properties of concrete and its durability is still a question of debate and several investigations are carried out in this area.

- *Dr. D. Maruthachalam is currently working as a Professor in Civil Engineering Department in Sri Krishna College of Engineering and Technology, Coimbatore, India, E-mail: maruthachalamd@skcet.ac.in*
- *G.Shyamala, is currently working as a Professor in Civil Engineering Department in S R Engineering College, Warangal, India, E-mail: shyamala@srecwarangal.ac.in*
- *M. Sugunadevi is currently working as a Assistant Professor in Civil Engineering Department in Sri Krishna College of Engineering and Technology, Coimbatore, India, E-mail: sugunadevim@skcet.ac.in*
- *M.H.Plato Gandhi was an Under Graduate student in Civil Engineering Department in Sri Krishna College of Engineering and Technology, Coimbatore.*
- *K.Rajesh Kumar is currently working as a Associate Professor in Centre for Construction Materials and Methods,Civil Engineering Department in S R Engineering College, Warangal, India, E-mail: dr,rajeshkumar@srecwarangal.ac.in*

The workability characteristics of fresh concrete and hardened concrete properties like compressive strength may be affected due to the presence of pigments in colored concrete. .In this type of concrete still there is not sufficient information in relation to stability of color and its resilience. Conclusions of several experimental research work shows that with enhanced concern, colored concrete can perform well as same as that of conventional concrete. Margoldova work discovered that inorganic pigments provide color tone stability for long period when it exposed to different types of weather conditions. Pigments with metal oxides can be used for highly influencing climatic and weather conditions. It can as well be utilized in cement matrix which resisting alkali reactions. Pecur and etal's study revealed that pigments influences on mechanical properties and color shade characteristics of concrete. This experimental study exposed the influence of different types and amount of pigments on compressive strength and elasticity modulus characteristics at different ages. This research work aims on finding out persuade of the different pigment color on final concrete characteristics like water absorption, compressive strength and density variation distinctiveness in comparison with specimens having no pigments.

2 MATERIALS USED AND METHODOLOGY

2.1 Materials Used

For this study, Portland cement of 53 grades was used along with locally accessible river sand as a fine aggregate and coarse aggregates. These fine aggregates were dry and clean and it must passes through IS 4.75 sieve. Portable water as per IS 456 – 2000 is used for casting and curing of samples and sometimes bore water can also be used if it satisfies the norms.

Colored Pigments: Red, Yellow and brown colored liquid pigments were used. The recommended pigment dosage by the producer is about 3-6% by weight of the binder.

2.2 Specimen Preparations

Mixtures for the experimental work were equipped. Density, Water absorption and compressive strength characteristics for every sample were considered as the average of the two calculated value. The reference sample(conventional concrete) consist of cement, 4 – 8mm aggregate and water alone. The composite concrete I, II, III contains Yellow, red and brown color pigments respectively. These pigments are added

for about 5% of their binder weight to make them colored concrete. The concrete sample compositions are tabulated in table I

TABLE I
SAMPLE COMPOSITION DETAILS

Sample Composition	Cement	Aggregate 4 – 8mm	Water	Pigment		
				Yellow	Red	Brown
Reference Sample	*	*	*			
Composite Concrete I	*	*	*	*		
Composite Concrete II	*	*	*		*	
Composite Concrete III	*	*	*			*

Specimen Preparations were carried out with the help steel blocks having standard dimensions of 40 mm x 40 mm x 160 mm. Curing of the specimens were done at about +18 °C for 2 days in the indoor climate conditions afterwards they were removed and kept in the water bath for 26 days. Cured composites were taken out of water later than 28 days and then the surface has been dried with the help of clean dry cloth. Specimens were measured and weighed for its density measurements, absorption characteristics and compressive strength. To determine the water absorption characteristics, the specimens were immersed in water bath for the duration of 72 hours in laboratory at a temperature of 20 ºC. Afterwards samples be again weighed and then placed in an oven at 105 °C until stable weight is reached for the water absorption measurement.

3 EXPERIMENTAL PROCEDURE

3.1 Casting

Once the mix is properly prepared, it is then placed in three layers inside the mould. While placing the mix in the mould 25 blows were given for each layer with the help of tamping rod. Finally the top most surface of the cube and cylindrical mould is leveled. Then the mix is allowed to set for one day and then it is demoulded. These demoulded concrete cubes and cylinders are immersed into the curing tank for a curing period of 28 days. In the similar manner composite concrete with pigments were prepared and placed for curing.

3.2 Curing

The cube and cylindrical specimens were taken out of the curing tank at the end of 7 days, 14 days and 28 days and then they were tested for its compressive strength, flexural strength and splitting tensile strength characteristics of concrete.

3.3 Experimentation

Experimentation work is carried out with the help of prepared specimens of standard dimensions. Specimens are casted for three different color pigments i.e red, yellow and brown and also for its corresponding reference samples. Compressive strength, splitting tensile strength and flexural strength tests were conducted for 30 samples including reference samples and their results were discussed subsequently.

4 RESULTS AND DISCUSSIONS

Experimental results show a clear evident that the concrete with brown color pigment posses more compressive strength than conventional concrete. Increase in percentage was found to be 26. 72% in compared with reference sample. Compressive strength results are presented in the bar chart form in the fig 1.

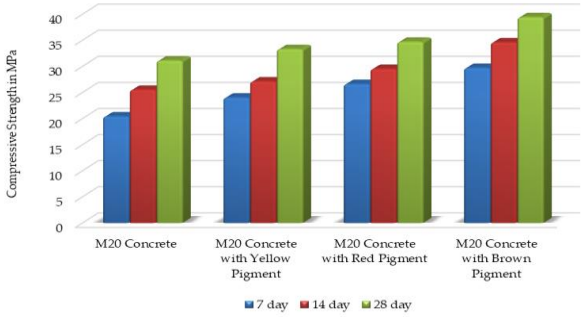

Fig. 1 *Comparison of Compressive strength characteristics of colored concrete*

Split tensile strength results shows that concrete with brown color pigment have higher strength than the other colored concrete but this strength is 5 % less when related to normal concrete which are exposed in Fig 2

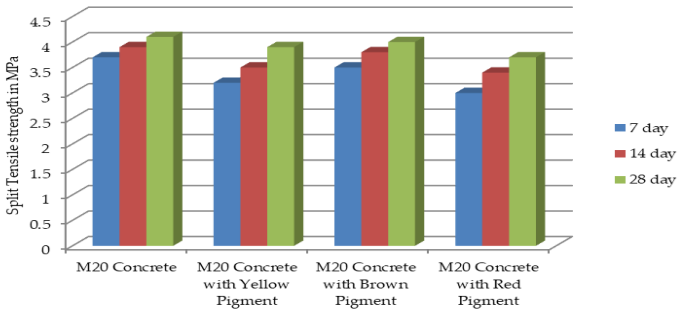

Fig. 2 *Correlation of splitting tensile strength behavior of colored concrete*

Finally, the flexural strength results conclude that the strength of brown pigment concrete is 15% more than M2O concrete

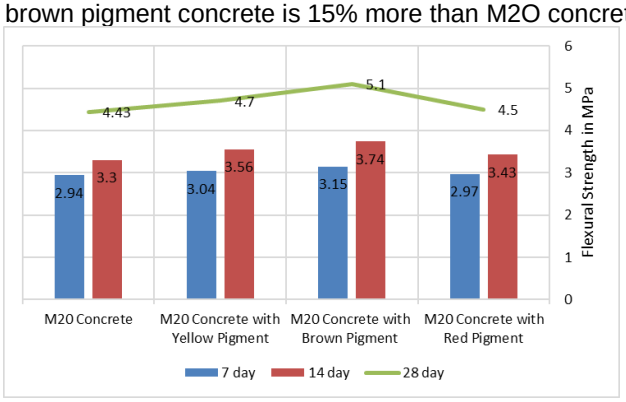

Fig. 3 *Comparison of Flexural Strength characteristics of colored concrete*

and 13% more strength than Red colored concrete and these results are revealed in Fig. 3 .

5 CONCLUSIONS

Based on the investigation carried out in the colored concrete specimens and reference samples with no pigments, the following conclusions are specifiedThe specimens with a brown colored concrete were found to be excellent in split tensile characteristics when compared with concrete having red and yellow pigment but it is 5% less on comparing with conventional concrete. On comparing with reference specimen, concrete with red colored pigments has more strength and that increase in strength was upto 20.87%. Thus, it is observed that adding color pigments in M20 grade concrete will enhance the performance in normal M20 concrete by increasing compressive strength while maintaining its flexural and tensile strengthFrom the Experimental results, it can be inferred that the usage of pigments in colored concrete do not contain unconstructive impact on the strength and substantial attributes of hardened concrete. Outcomes of properties of concrete with coloring pigments are based on the pigment color and its composition from acquiescence with dosage and technical method adopted for its manufacture.

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