

Study on Properties of Photocatalytic Concrete

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Abstract—Environmental pollution is a significant risk factor for a number of pollution related disease and health conditions living organisms. Self-cleaning concrete having a technique to reduce the air contaminants such as NO_x , SO_2 , CO_2 and VOC'S from vehicular traffic on streets, any industrial activity and the urban environment. Photocatalytic materials are used in Ordinary Portland Cement conventional concrete for urban buildings and road pavements to reduce air pollution. The primary photocatalytic material is Titanium dioxide (TiO_2) is white coloured powder. TiO_2 is activated by the energy from the sun light or UV lamps and it decompose the external pollutants on the surface of the concrete, which is removed by wind and rain action. The presence or removals of pollutants are monitored by the laboratory tests. The workability and compressive strength of the self-cleaning concrete is also tested. As a result, it reduces the air pollution (also smog) and causes to self-cleaning active in this project different parameters like workability, compressive strength and durability and photocatalytic effect of TiO_2 were studied. Grade of concrete used is M40, W/C ratio is 0.45, $TiO_2 + OPC$ After 28 day of curing all samples were tested with NO_x gas and observations of the reduction in the gas was measured between different time intervals. Titanium Dioxide (TiO_2) was added in the percentage of 0 to 5% to find the optimum dosage of TiO_2 for maximum workability, compressive strength and durability of photocatalytic and self-cleaning concrete.

Keywords—photocatalytic concrete, self-cleaning concrete, Titanium dioxide.

I. INTRODUCTION

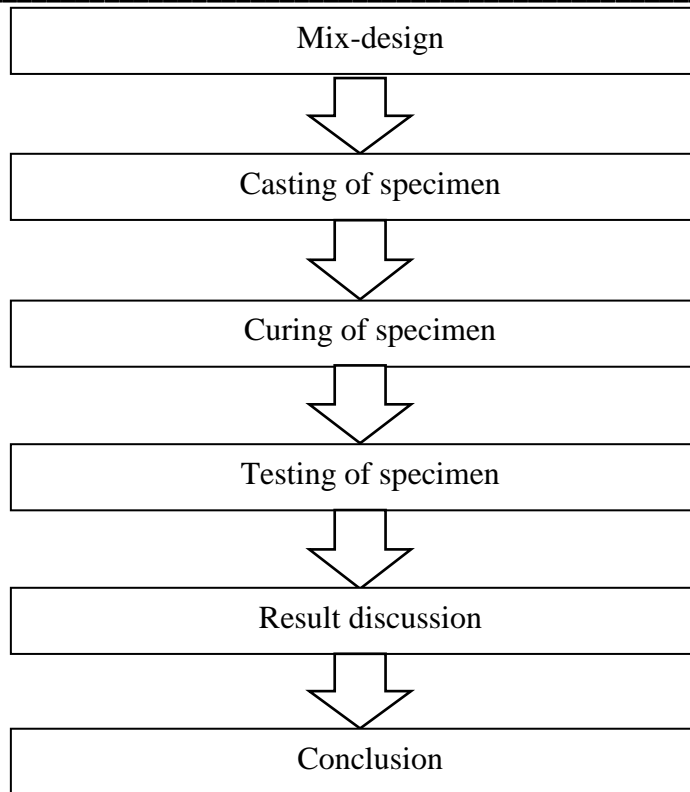
Air pollution is an environmental problem that Cause significant negative health implications for humans as well as other living organisms. Major primary pollutants that are produced by human activity include the nitrogen oxides (NO_x), Sulphur dioxide and volatile organic compounds (VOCs).which are emitted from combustion at high temperatures. When photocatalytic materials absorb ultraviolet radiations from the sun, hydroxyl radicals and superoxide anions are created that have the ability to react with pollutant molecules such as NO_x , SO_x , thus converting to less harmful substances.

Heterogeneous photo catalysis has been intensively studied in recent decades because it only requires photonic energy to activate the chemical conversion contrasting with conventional catalysis which needs heat for thermo-activation.

The major applications of TiO_2 based photocatalytic building materials include environmental pollution remediation, self-cleaning ,air cleaning and self-disinfecting. The advantage of using solar light and rainwater as driving force has opened up a new domain for environmentally friendly building materials.

II. METHODOLOGY

Cement and fine aggregate material selected for use in the present study were characterized in accordance with the IS code. Physical and mechanical properties of the materials were observed to ensure that there was no interference in the quality of the produced concrete.



III. MATERIAL AND METHOD

3.1 MATERIALS USED

- Cement (PPC)
- Basalt aggregates
- Fine Aggregate (Sand)
- Titanium Oxide (TiO₂)
- Brass Powder (Cu)
- Nitric Acid (HNO₃)
- Water

2.2 Test Performed

Test on aggregate -

- Specific gravity on aggregate.
- Water absorption on aggregate.
- Sieve analysis of coarse and fine aggregate.
- Silt test on fine aggregate(sand).

Test on Cement –

- Consistency Test
- Initial and Final Setting Time
- Specific Gravity Test.

IV. TEST RESULT (MATERIAL)

Sr.No	Properties	Test Result
1	Initial setting time of cement	30 mins
2	Final setting time of cement	600 mins
3	Specific gravity of fine aggregate	2.57
4	specific gravity of coarse aggregate	2.75
5	Water Absorption on Aggregate	2.50%
6	Silt Content Test	3.651%
7	Normal consistency of cement	25-30%

V. CONCLUSION

- Workability of the fresh concrete was not affected significantly by 1% TiO₂. However, the workability was decreased with further increase in TiO₂ percentage.
- Self-cleaning concrete helps to make pollution free environment and helps to reduce global warming by its huge amount of application

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