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AN EXPERIMENTAL INVESTIGATION OF PHOTOCATALYTIC CONCRETE

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Abstract- *Most of the cities around the world struggle with increasing of car exhaust fumes, Industrial smog and other forms of Air pollution. It can produce negative health implications for Humans as well as other living Organisms. The major primary pollutants are produced by the human activities. That are NOx, SOx and VOCx which are emitted from high temperature. Photocatalytic materials (TiO2) are absorbing the UV rays from the Sun, and then Hydroxyl radicals and the Superoxide anions are created. It will have the ability to react with air pollutants such as NOx and SOx, thus converting to less harmful substances. It involve depolluting the environment automatically. In this project we are using M30 grade of concrete. Cement is to be replaced by TiO2 for 0%, 3%, 4% and 5%.*

Keywords: *Photocatalytic material, TiO2, Depollution, Air pollution, UV Rays*

I. INTRODUCTION

Most of the cities in the world struggle by increasing the harmfull gases and other form of air pollution. Other gases like nitrogen oxides (NOx), volatile organic compounds (VOC's), carbon monoxide (CO) and sulfur oxides (SOx). Photocatalytic materials (TiO2) Most of the cities in the world struggle by increasing the harmfull gases and other form of air pollution. Other gases are that could help reduce the air pollution and ultraviolet rays. Photocatalytic materials to use energy from sunlight then its converted into harmless substances. Its reduce the NOx, SOx, tobacco smoke, Bacteria and other harmful gases from the air and also act as self-clean material. Photocatalytic concrete used in japan architectural and civil engineering buildings as depolluting concrete. Photocatalytic material directly reduce the air pollution. hydroxyl radicals and superoxide anions are created When the photocatalytic materials absorb ultraviolet radiation from the sun that have the ability to react with pollutant molecules such as NOx to convert them to other less harmful substances. its advantageous in areas with high levels of air pollution.

The photocatalytic material of titanium dioxide (TiO2), is a naturally occurring compound it can decompose gaseous pollutants with the presence of sunlight. Applying titanium dioxide to pavement of road it can help to remove emission pollutants right next to the source, near the vehicles that drive on the pavement itself.

II. OBJECTIVES

a. Now a days other than any pollution plays main role in the mass destruction of environment.
b. Mainly air pollution. We need to reduce the air pollution because heat is increasing day to day
c. As a civil Engineer we need to provide the solution. Because we are the responsible to reduce the pollution
d. then to form the dust on the surface
e. Heat reduction upto the 100%
f. To reduce the air pollution and to provide prevention from ultra violet radiations emitted from the Sun by using TiO2(Photocatalytic material).

III. BENEFITS

a) It is mostly used in the Tunnels and Pavements.
b) Reduces NOx content in the atmosphere
c) Reduces corrosion and patch formation in the concrete
d) Concretely, the photocatalytic process can be applied to a wide range of building materials and urban elements which, once treated with TiO_2 (catalyst), acquire decontaminant properties.
e) Keeps the concrete young at this entire life of the concrete
f) Eco friendly concrete
g) To reduce heat in the air pollution

h) To make the air fresh
i) Another possible application: on façades and roofs, through ceramic panels or paints and waterproof asphaltic sheets including photocatalytic grainy.

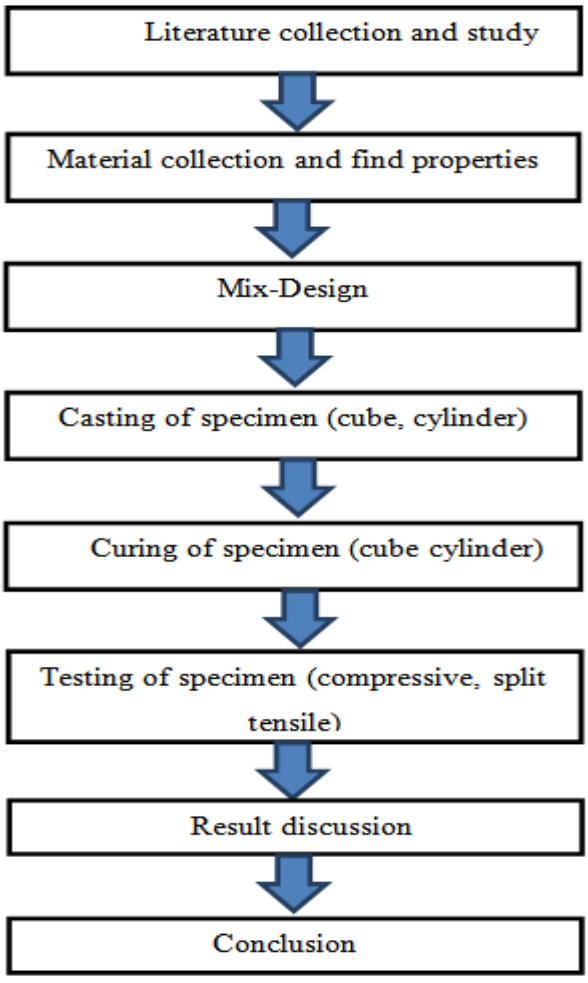
IV. SCOPE OF THE INVESTIGATION

a) The ordinary Portland cement is to be replaced by a titanium dioxide for very less amount it should be a photocatalyst
b) material. Automatically it will be started photocatalytic activity
c) The required strength should be attained

S.NO	Type of specimen	No of specimen	%of Titanium dioxide replaced			
1	Cube	3	0%	3%	4%	5%
2	Cylinder	3	0%	3%	4%	5%

Table.1. Types of specimen and replacing and

V. METHODOLOGY



VI. MATERIAL USED

a) Cement (OPC 53).
b) Coarse Aggregate.
c) Fine Aggregate (M-sand)
d) Titanium dioxide (TiO2)
e) Water

a) Cement

OPC 53Grade conforming IS 12269:1987,Minimum cement content : 320 kg/m3 (IS456:2000), Specific gravity of Cement: 3.09

Fig.1. Cement

b) Coarse aggregate

As per IS 383:1970 the nominal size of aggregate is 20mm used. The shape of coarse aggregate is angular, water absorption is 0.5%. Specific gravity of coarse aggregate is 2.73.

Fig.2 Coarse aggregate

c) **Fine aggregate (M-sand)**

As per IS 383:1970 fine aggregate properties were tested. Water absorption is 2.5%, specific gravity of fine aggregate is 2.74

Fig.3 M-SAND

d) Titanium dioxide (TiO2)

Titanium dioxide, also known as titanium oxide or titania, is the naturally occurring oxide of titanium, chemical formula TiO_2. When used as a pigment, it is called titanium white, Pigment White

Fig.4 TiO2

e) Water

Normal water to be used for mixing the concrete. Water cement ratio 0.45

VII.MIX DESIGN

The mix design was made confirming IS 10262:2009. We are used for M30 grade of concrete. The mixes were made by partially replacing cement by Titanium dioxide of percentage 0%, 3%, 4%, 5%.

VIII. WORKABILITY OF CONCRETE

WORKABILITY OF CONCRETE S.NO	DESCRIPTION OF WORK	WORKABILITY BY SLUMP VALUE(mm) (IS 1199-1959)
1.	Conventional concrete 0%	75
REPLACEMENT OF TiO2		
S.NO	DESCRIPTION OF WORK	SLUMP VALUE(mm)
2.	3%	68
3.	4%	61
4.	5%	55

IX. TESTING OF SPECIMEN

a) Compressive strength test
b) Split tensile strength test

a). COMPRESSION STRENGTH TEST

S.NO	Cement + TiO2	Compressive Strength in N/mm^2		
		7 Days	14 Days	28 Days
1	100%+0%	23.7	28.4	36.8
2	97%+3%	19.5	25.3	34.7
3	96%+4%	21.3	30	38.2
4	95%+5%	14.7	18.6	27.21

Table.3. compressive strength of cubes in different proportions

b). SPLIT TENSILE STRENGTH TEST

S.NO	Cement + TiO2	Split tensile Strength in N/mm^2		
		7 Days	14 Days	28 Days
1	100%+0%	2.5	3.0	3.5
2	97%+3%	2.0	2.3	3.3
3	96+4%	2.3	2.9	3.6
4	95%+5%	1.5	1.9	2.7

Table.4 Split tensile strength

X. CONCLUSION

Photocatalytic technology will continue to improve with the time and development becoming more efficient and effective. Photocatalytic concrete offers to a building professionals unique opportunity to contribute to sustainable development goals potentially improving the value of their investment.
Photocatalytic performance on loading: while increasing the titanium dioxide content in the cement to reduce their strength. The maximum strength attained in 4% replacement of the cement in the concrete.

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