Smog Eating Concrete

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***Abstract*:** In our Project we are aiming to make a 'Smog Eating Concrete', which contains Titanium dioxide in addition to the conventional ingredients. Titanium dioxide is already commonly used to coat surfaces that are hard to clean -- it is a component in some paints because it functions as a self-cleaning chemical, meaning the new concrete has the additional advantage that it breaks down algae and dirt so its surface stays clean.
The concrete is made up of traditional cement mixed with titanium dioxide. This unique mixture allows air to pass through while simultaneously capturing nitrogen-oxide particles, a main component of smog. Titanium dioxide functions as a catalyst to the chemical reaction which is activated by UV light. Not only does it filter the air, but the collected smog residue washes off with a light rainfall.

***Key Words* – Our aim is to decide the best proportion of Titanium dioxide in the concrete which will filter the air to the max limit and will purify the air.**

I. INTRODUCTION

Pollution is one of the biggest concerns of the world right now. As our population increases, more roads are needed to get people from one place to another. Unfortunately, by adding more cars on the road, there is a higher concentration of air pollution. The only way to reduce that pollution is to encourage people to take eco-friendly forms of transportation, such as bikes or car pooling. But with 9 billion people on Earth, it's not very likely that many people will actually take those forms of transportation. The problem in many cities is that vehicle exhausts emit nitrogen oxides, which cause acid rain and smog that damages not only human health and quality of life but also the fabric of buildings. One such solution to the problem of pollution is used of Titanium Dioxide which has property of absorbing pollutants.Titanium dioxide has been studied extensively in the field of surface science due to the wide range of its applications and the expectations for insights into surface properties have been motivated in part by the discovery that TiO2 is the photocatalyst with relatively high efficiency for the decomposition of water and the degradation of organic species .The photocatalytic activity of TiO2 is oftened dependent on the nature and density of the surface defect site. An overview on current literature on the subject of TSD in TiO2 has been provided , but the works that have been done and the progresses that have been achieved on this subject are far from being completely resolved. While some of this results reviewed here might be turned out to be of fundamental interest and irrelevant for the particular environment and applications some might help to understand behavior of this material. Since TiO2 is used in so many different fields, TSD would attract more attention. Carbon dioxide and water vapour were effectively photoconverted to methane using either pure or modified-TiO2 and UV-Vis irradiation. The reduction of carbon dioxide has recently been regarded as an important research area in chemical technology, not only for solving the problems resulting from environmental pollution, but also for finding ways to maintain carbon resources, which are being depleted by burning fossil fuels.

1.1 Aim

To find appropriate percentage of Titanium Dioxide so as to absorb maximum amount of pollutants from surrounding area.

1.2 OBJECTIVES

1. To evaluate the possibility of using nano-sized materials, mainly Titanium Dioxide in producing economic self-cleaning concrete using photo-catalysis process.
2. To find out amount of nitrogen oxide removal for different percentage if Titanium dioxide.

1.3 PROBLEM STATEMENT

Cities produce a significant amount of air pollution due to vehicle emissions, These problems are not natural the larger cities grow, the more they will disturb the quality of life on the earth by contributing more to this problem.

II. METHODOLOGY

1. Collection of basic material (TiO2)
2. Measurement of percentage pollutants present in garage. Test conducted as follow-
    - Oxides Of Nitrogen
    - Suspended Particulate Matter
3. Application of surface treatment –
   By spraying Titanium Dioxide in different surfaces like asbestos sheet, wooden material etc.
4. Measurement of percentage reduction of pollutant after application of TiO2
5. Trial for different surfaces for application of TiO2
6. Comparison
7. Result.

2.1 MATERIALS

- **Titanium Dioxide**

Titanium Dioxide {TiO2} has high absorbing capacity of air pollutants. So we used Anatase grade synthetic product material. Nano particle size of TiO2 is used. It has self cleaning photocatalytic concrete.

- **Cement**

The ordinary cement contains to basic ingredient namely argillaceous and calcareous. The argillaceous material clay predominates and calcareous material calcium carbonate predominates. In the present work 53 grade for OPC was used for plastering. The cement was uniform colour i.e. grey with a light greenish shade and was free from any hard lump.

- **Sand**

Natural sand is available from any narby source of river. It is not completely free from mud or any impurities hence it is essential to washing with water. For this sand particle of size 1.18 mm was used.

- **Water**

Water is an important ingredient of concrete as its actively participates in the chemical reaction with cement. Portable water is generally consider satisfactory.

III. OBSERVATIONS AND RESULTS

The pollutants measured from the recovered air before and after the photocatalytic device allowed for a determination of the absorbed level of pollutants. Following the test procedures developed for photocatalytic materials, the efficiency of nitrogen-oxide removal was measured using the Respirable Dust Sampler. The constant flow rate was maintained at 1.4 m^3/minute. Test were conducted at room temperature (23°C) and at a relative humidity of 50%.The effects of the flow rate, humidity level, and pollutant concentration have been considered. Testing was conducted for a total of eight hours.

- **Standard Ranges**

Respirable Suspended Particulate Matter (RSPM)	Quality Classification	Remarks
0-75	Minimal Impact	Good
76-100	Minor breathing discomfort to sensitive people	Satisfactory
101-150	Breathing discomfort to the people with lung, heart disease, children and older adults	Moderate
151-250	Breathing discomfort to people on prolonged exposure	Poor
251-350	Respiratory illness to the people on prolonged exposure	Very Poor
>351	Respiratory effects even on healthy people	Severe

- **Concentration of Air Pollutants**

Sr.No.	Date	RSPM $\mu g/m^3$	Remark
1	03-12-2018	184	Poor
2	04-12-2018	136	Moderate
3	05-12-2018	288	Very Poor
4	06-12-2018	146	Moderate
5	07-12-2018	139	Moderate
6	08-12-2018	115	Moderate
7	09-12-2018	121	Moderate
8	10-12-2018	121	Moderate
9	11-12-2018	137	Moderate
10	12-12-2018	127	Moderate

- **Concentration of Air Pollutants with 5% TiO2**

Sr.No.	Date	RSPM $\mu g/m^3$	Remark
1	13-12-2018	138	Moderate
2	14-12-2018	103	Moderate
3	15-12-2018	150	Moderate
4	16-12-2018	110	Moderate
5	17-12-2018	101	Moderate
6	18-12-2018	87	Satisfactory
7	19-12-2018	92	Satisfactory
8	20-12-2018	89	Satisfactory
9	21-12-2018	104	Moderate
10	22-12-2018	95	Satisfactory

IV. Conclusion

TiO2 improves the surrounding air quality by reducing air pollutants.
Reduction in the Air Pollutants are as follows :-
Using 5% Tio2 in concrete by weight of cement reduces air pollutants by 23-25%.
Using 10% Tio2 in concrete by weight of cement reduces air pollutants by 30-35%.
Using 15% Tio2 in concrete by weight of cement reduces air pollutants by 40-45%.

V. Scope of Future Study

Due the air pollution the small pollutants goes to human body like liver, lungs and it forms smog like structure in the human body due to this many diseases arises like asthama, heart attack, and various liver problems. So the use of smog eating concrete reduces air pollution as it helps to reduce the health problems.

VI. REFERENCES

[1] John Renowden CEng Fimech- "A Real World Product For Reducing The Harmful Effects Of Contaminated Air", Jan. 2012.

[2] Fujishima, Y. Ohko, S. Saitoh, T. Tatsuma, C. Niwa -"Antibacterial and Anticorrosion Effects of Titanium Dioxide Photoactive coatings", Department of Applied Chemistry, School of Engineering, The University of Tokyo, 7-3-1, Hongo, Bunkyo-ku, Tokyo 113-8656, Japan.

[3] Anna Cybula, Marek Klein, Anna Zielinska Ielińska-jurek, Marcin janczarek, adriana zaleska - "Carbon dioxide photoconversion. The effect of titanium dioxide immobilization condition and photocatalst type", Jan. 2012.

[4] Marwa M. Hassan1, Heather Dylla2, Louay N. Mohammad3, and Tyson Rupnow- "Methods for the Application of Titanium Dioxide Coatings to Concrete Pavement" , Vol.5 ,No.1 Jan 2012.

[5] Mohammadreza Foruzanmehr, Seid Mohammad Hosainalipou, Shamsoddin Mirdamadi Tehrani, Mahnaz -"Nano-structure TiO2 film coating on 316L stainless steel via sol-gelntechnique for blood compatibility improvement Aghaeipour, Vol. 1, No. 3, Spring 2014, page 128-136.

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[6] AminTAkhnoukh, Halla Elea, Lawrence Benzmiller-"Photocatalytic Self-Cleaning Concrete Production Using Nano-Size Titanium Dioxide", Vol:3, No:4, 2016.

[7] Takayoshi Fujinio and Teppei Matzud –"Synthetic Process of Titanium Dioxide Coating on Aluminium by Chemical Conversion Method" Vol.47, No.3 200.

[8] Arafa Awadalla, Muhammad Fauzi Mohd Zain, Abdul Amir H. Kadhum and Zeinab Abdalla - " Titanium dioxide as photocatalyses to create self cleaning concrete and improve indoor air quality", Vol.6, 16 Nov. 2011.

[9] Kazuhito Hashimoto,Hiroshi Irie and Akira Fujishima -"Tio2 photocatalysis : A Historical Overview and Future Prospect", , Vol.44.No.12(2005).