

Smog Eating Tiles as an Eco-Friendly Construction Material

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Abstract— Our Project is about to study the ill effects of smog and air pollution and control it by using smog eating tiles. Our aim is to study the economy of this construction and contribute our part in „SWACHA BHARAT ABHIYAN“. The rapid growth in pollution is due to excessive use of vehicles. Previous and growing Industries such as steel industries, thermal electric power plants, etc. These tiles are normal roofing tiles which are installed on the roof. The only thing which differs is titanium dioxide on it. The coating of titanium dioxide (single coat) is applied on the tiles which can be done in the form of paint. Titanium dioxide is available in the form of powder it is mixed with water and prepared in the form of paint. It is applied on the roofing tiles with painting tools. Cost of these tiles is just 25% more than the normal roofing tiles.

I. INTRODUCTION

There is a growing account of air pollution and the Outbreak of smog every year in one of the parts of the World. Huge amount of pollutant gases is emitted by Burning of fuels through the consumptive or productive Activities. The air pollution has been one of the biggest Concerns of the environmental protection agencies all Through the world owing to the hazards it causes to Human health, monuments and ecology. An average Human being consumes about 10,000 to 20,000 liters of Air every day; there is an intake of 7-14 liters of air by us in a minute. This certainly points out the criticality of clean air. It is said that more than the external effects.

That a smog produces, like choking hazards etc., it Reduces the immune system, so more deaths are due to the weakening immune system of human beings. The Smog is as simple as that, smog is a combination of Smoke and fog, but what lies within smog? Here is a Deep insight on the same.

The research and the project revolve around one basic Concept of not letting the nitrogen oxide interact with Sunlight. This could be achieved by introducing a Compound which helps in the absorption of nitrogen Oxide. The solution which was developed by the University students involves coating the roof tiles of Residential building by titanium dioxide. They call it as “Smog eating roof tiles”. In the course of a year, 2000 Square feet of SMOG EATING TILE reduces the same Amount of nitrogen oxide that produced by one car Driving up to 10,800 miles, thus smog eating tile is used to solve issues.

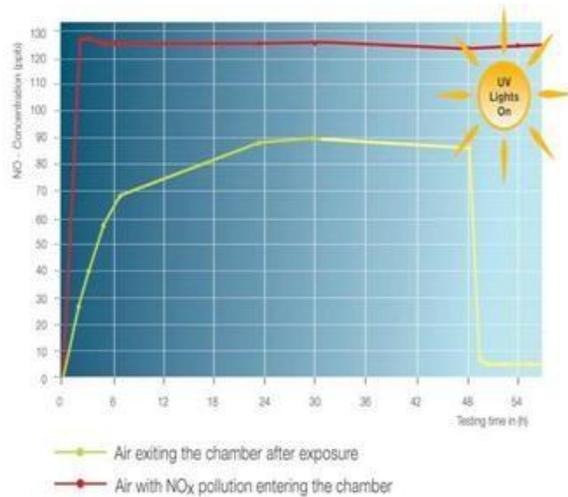
Titanium Dioxide

Titanium Dioxide, the photo-catalyst that instigates the smog-eating tile’s air-cleaning process, is a proven de-pollutant that is both naturally occurring and safe for humans. The compound is commonly found in a number of items that we interact with daily such as paints, cosmetics toothpaste, and white roof membranes. It is now also being used in hospitals on operating room walls for sterilization purposes.

Titanium Dioxide’s de-polluting and de-soiling capabilities are proven. The notable European Project PICADA studies demonstrate the capabilities of TiO₂ as a key ingredient in coatings. Conducted by a consortium of leading European contractors, manufacturers and research centers, the PICADA Project fully demonstrates Titanium Dioxide’s de-polluting properties against Nitrogen Oxide and Volatile Organic Compounds (VOCs), the key ingredients of smog.

“In the studies conducted in Europe where they actually applied it (Titanium Dioxide) to roadways the air was measurably cleaner,” notes President Michael Chasid of Chasid Associates, a marketing

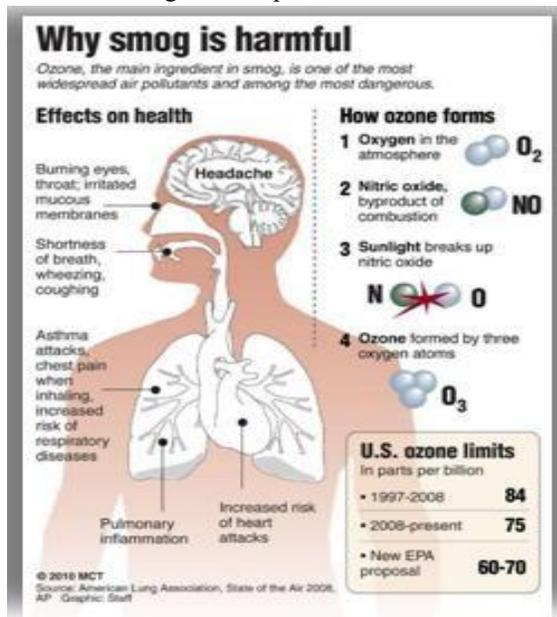
and technical consultancy on building products. “It works.”



II. METHODOLOGY

Photochemical smog is the chemical reaction of sunlight, nitrogen oxides and volatile organic compounds in the atmosphere, which leaves airborne particles and ground-level ozone. This noxious mixture of air pollutants may include the following:

- Aldehydes
- Nitrogen oxides, particularly nitric oxide and nitrogen dioxide
- Phenoxyacid nitrates
- Tropospheric ozone
- Volatile organic compounds



III. MIX PROPORTIONS

One of the ultimate aims of studying the Various properties of the materials of concrete and titanium dioxide is to enable a concrete technologist to design a concrete mix for a particular strength and durability.

Mix design can be defined as the process of selecting suitable ingredients of concrete and titanium dioxide to determining their relative proportions With the Object of producing concrete of certain minimum strength and durability as economically as possible.12)

Following are the methods of concrete mix design:

- Indian Road Congress, IRC 44 method
- High strength concrete mix design
- Mix design based on flexural strength

Standard Indian recommended method is 10262 .82 was replaced with 10%, 20% 30%, 40% 50% and 70% fly ash (by mass) respectively.

IV. MIXING AND CASTING

A total of three series of tiles specimens including the control specimen were prepared in order to examine the effect of substituting titanium dioxide (20% by weight) in place of cement to investigate the basic strength properties of concrete. For each mix three samples of tiles were prepared. Ordinary Portland cement (OPC), grade 53 is used throughout the investigation. The Titanium Dioxide obtained from Wardha local market.

The Stones chips used in this investigation have a maximum size of 20 mm with grading confirming to IS-383-1970. The natural river sand passing through 4.75mm sieves is used throughout the process. Ordinary clean potable tap water free from suspended particles and chemical substances was used for mixing and curing of concrete throughout the experiment.

The design of concrete mix is done as per guidelines of IS 10262: 2009 with a grade of M 20 of concrete. The simple hand mixing method was employed for mixing of concrete.[2] First coarse and fine aggregates are fed

Following action is carried out for casting of smog eating tiles

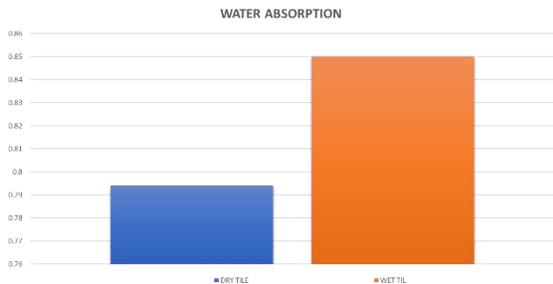
- 1 Proportioning
- 2 Mixing
- 3 Compacting
- 4 Curing
- 5 Drying

V. TEST ON SMOG EATING ROOF TILES

V.I WATER ABSORPTION TEST

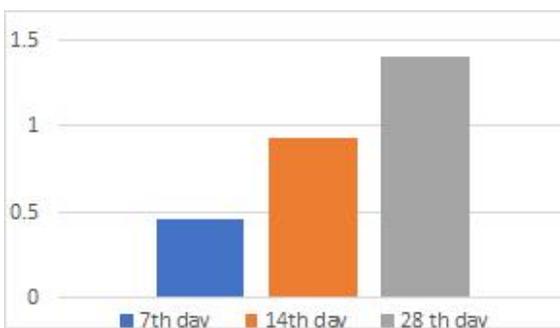
| | |
|---------------------|----------|
| Dry weight of tiles | 0.794 kg |
| Wet weight of tiles | 0.850 kg |
| Water absorption | 7.05 % |

GRAPH OF WATER ABSORPTION TEST



V.II FLEXURAL TEST ON TILES

Flexural Strength test



Flexural testing is used to determine the flex or bending properties of a material. Sometimes referred to as a transverse beam test, it involves placing a sample between two points or supports and initiating a load using a third point or with two points which are respectively call 3-Point Bend and 4-Point Bend testing

VI. RESULTS

The test was conducted on the tile specimen of size 140X140X25mm.

| Type of Tile | Flexural Strength in N/mm ² | | Avg. Flexural Strength in N/mm ² | |
|------------------|--|---------|---|---------|
| | 7 Days | 14 Days | 7 Days | 14 Days |
| Mix Tile | 15.30 | 30.23 | 14.345 | 32.76 |
| | 13.39 | 33.29 | | |
| Without Mix Tile | 9.56 | 19.13 | 10.52 | 23.34 |
| | 11.48 | 27.55 | | |

VII.CONCLUSION

- Benefits outweigh the costs.
- Smog level reduction creates a healthier environment and inhabitants.
- Tiles reduce home heating and cooling costs.
- Recyclable tiles mitigate the amount of landfill waste.

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