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Smog Absorbing Pavement

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***Abstract*:- The main aim of our project is to make our environment "Green" and to control the air pollution in a highly polluted area..Pavements which have been blended, coated, sprayed etc..,
with photo catalytic $_2$ additives have attracted worldwide interest during the past decade plus period based on their environmentally beneficial abilities to provide reactive (ie) smog
absorbing pavement. The photo catalytic concrete contains $_2$ which allow for the oxidation of air pollution occurs on the surface of the pavement. In our project we are making a paver blocks using titanium dioxide and we stored it in a highly polluted area for a one day,one week and two weeks. And we done "SCANNING ELECTRON MICROSCOPIC" test for each pavement which have been absorbed a different quantity of pollutants such as Carbon, No_x., etc. The Tio_2 can absorbed the certain amount of air pollutants from the vehicle emission.**

Keywords: Titanium dioxide, photo catalytic concrete, scanning electron microscope

1.INTRODUCTION

Titanium dioxide ($_2$) is a white solid inorganic substance that is thermally stable, non-flammable, poorly soluble, and not classified as hazardous according to the United Nations' (UN) Globally Harmonized System of Classification and Labelling of Chemicals (GHS). A concrete block pavement is made up of precisely dimensioned, individual concrete blocks that fit closely together to form a segmented pavement surface, which performs similarly to a flexible pavement consequently, the pavements in which non interlocking blocks are used are designed as concrete block pavement or non inter locking block pavement and those in which partially , fully or multiply interlocking blocks are used are designated as inter locking concrete block pavement. The common names for the concrete blocks pavers, paving blocks , paving stones, interlocking paving blocks and road stones. Pavers are with the thickness from 2.5 to 4 inches. They are usually laid manually, but mechanical installation are also available. Mechanical installation can increase productivity upto three fold over manual installation. From performance perspective, a paver may be preferable to conventional pavement for some applications. Measurement of paver performance is similar to that of either asphalt concrete or Portland cement concrete Pavers are commonly laid in either of two ways, stretcher and herringbone. A herringbone pattern can be created by setting the blocks at either 45 degrees or 90 degrees to the perpendicular. This pattern is the strongest of the paving bonds as it offers the more interlock, therefore making it a good choice for driveways and road surfacing. The stretcher bond with the letter being better suited to paved areas that will only receive light foot traffic, due to its weaker bond.

1.1 Tio_2 is a Nanomaterial

Pigment grade $_2$ is manufactured to optimise the scattering of visible light and consequently white opacity. This requires a primary particle size of approximately half the wavelength of the light to be scattered, that is half of 400 - 700nm for visible light.

Pigment grade $_2$ is manufactured in order to maximise the number of primary particles in this size range (approx. 200 – 350 nm). However as in all production processes of particulate materials, there will be a distribution of primary particle sizes around the average value and it is likely that a small fraction of the primary particles are < 100 nm, and therefore covered by the nano particle ISO definition (ISO/TC 229 Nomenclature system for (nano particles). In practice, all these particles tend to agglomerate into the micron (µm) size range.

$_2$ nano materials (ultrafine) are transparent and more effective as UV absorbers or photo catalysts. The transparency and UV absorbance allow for effective use as a protective ingredient for sunscreens.

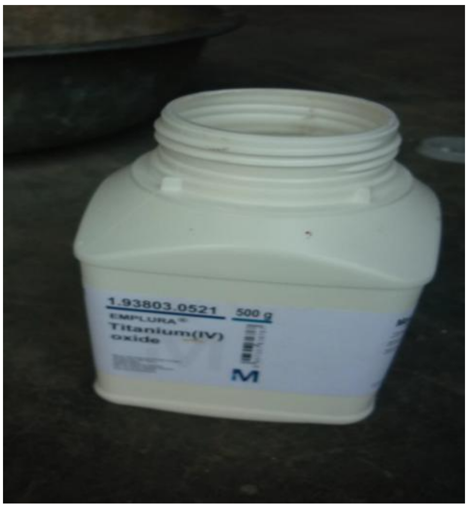


Figure-1 Tio_2

1.2 Smog Absorbing Pavement

Nitrogen oxide is a poisonous gas. It's released into the air by both gasoline powdered vehicle and coal burning power plants – when it reacts with other chemicals in the air smog results in negative health effects on people living in cities. Researches have been looking for novel ways to reduce the amount of air pollution in the air. In this new effort, the team turned to titanium oxide(a naturally occurring oxide of titanium), a material that has been known to absorb nitrogen oxide and carbon.

1.3 Objectives

The main objective of our project is to make our environment "GREEN"

To reduce the amount of air pollution in the air due to vehicle and industrial emission. Being a Civil Engineering student we are doing our part to save our mother nature by Paving a sustainable pavement called smog absorbing pavement.

1.4 Scope

To protect our environment from air pollution.

It should be achieved in economical level.

Absorb NOx and carbon from the vehicle emission.

It is more suitable in highly industrialized areas.

2. MATERIALS USED:

The materials normally used for the paver blocks is same as that of the materials used in concrete. There must be a change only in the shape and the orientation. The following are the materials used

Cement

Fine aggregate
Coarse aggregate
Titanium di oxide

2.1 Physical Properties

2.1.1 Cement

Cement is a binding material used in the preparation of concrete. It binds in the aggregate with help of water, to a monolithic matter. And also it fills the fine voids in the concrete. There are two intrinsic requirements for any cement in the concrete mix design. That is compressive strength development with time and attainment of appropriate rheological characteristics, type and production of concrete. Vibration in the chemical composition and physical properties of cement affect the strength parameters.

Specific gravity test -2.8
Fineness modulus test -95.45%
Standard consistency test - 132
Initial setting time – 40 mins
Final setting time - 6 hrs

2.1.2 Aggregates:

The particle size distribution of an aggregate as determined by sieve analysis is termed as grading of aggregate. If all the particles of an aggregate are of uniform size. Compacted mass will contain more voids, whereas aggregate comprising particles of various sizes will give a mass contains lesser voids. The particle size distribution of a mass of aggregate should be such that the smaller particles fill the voids between the larger particles. The proper grading of an aggregate produce a dense concrete and need less quantity of fine aggregate, cement, pastes. Therefore it is essential that the coarse aggregate be well grade to produce quality concrete. The grading of an aggregate is expressed in terms of percentage by weight retained or passing percentage through a series of sieves taken in order of 4.75mm,2.36mm,1.18mm,600µ,300µ and 150µ for fine aggregate and 40mm,20mm,10mm,4075mm for coarse aggregate.

2.1.3 Fine aggregate:

Specific gravity:2.37
Water absorption test:1%

2.1.4 Coarse aggregate:

Water absorption test:7.3%
Impact test: 13.63%
Specific gravity:2.74

2.1.5 Titanium oxide:

Specific gravity:3.1

3. PREPARATION OF PAVER BLOCK

The paver block can prepared from M15 grade of concrete.

Figure-2- preparation of paver blocks

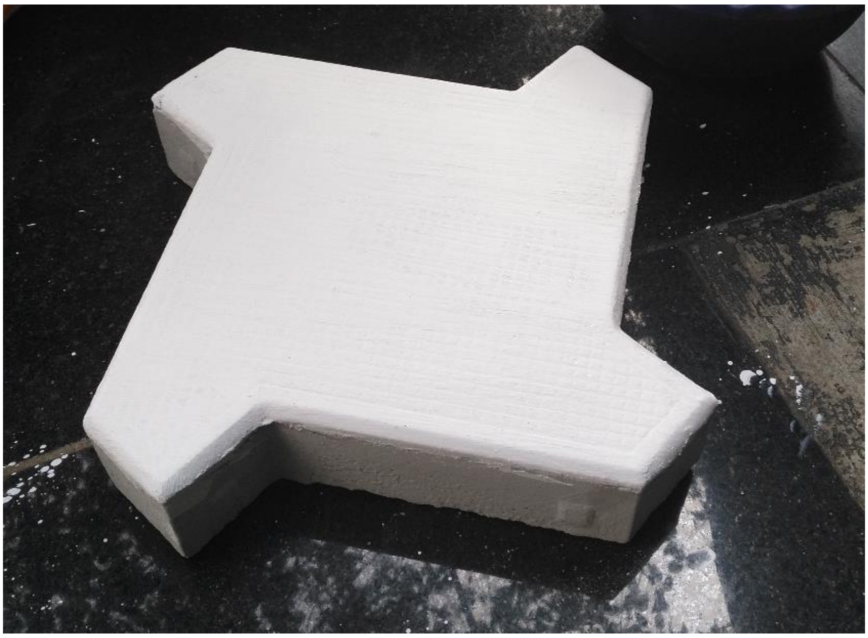


Figure -3- coating by Tio_2

4.RESULT AND DISCUSSION

4.1 Compressive Strength (N/mm^2) of Paver Block

Table .1 Testing Result for 7 Days

S. No	Size of the specimen (^{2})	Ultimate load (N)	Cross sectional area (^{2})	Ultimate compressive stress (N/ 2)
1	20×12	310000	420	12.91
2	20×12	320000	420	13.33

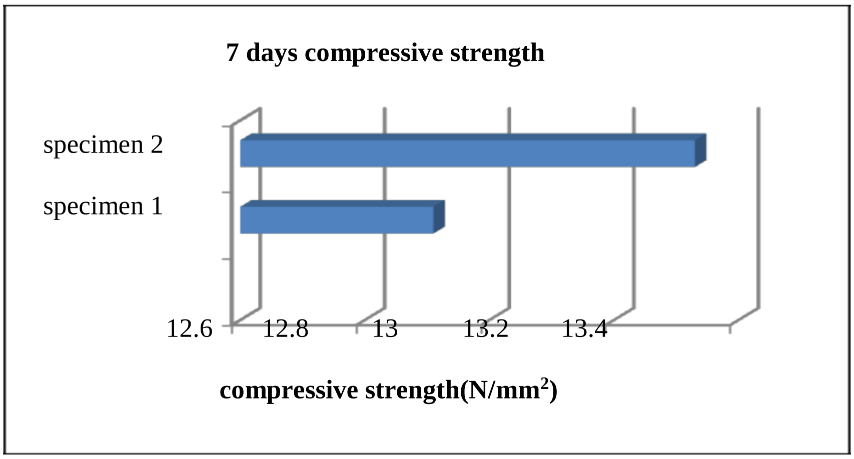


Chart 1 . compressive strength at 7 days

Table-2. Testing Result For 14 Days

S. No	Size of the specimen (^{2})	Ultimate load (N)	Cross sectional area (^{2})	Ultimate compressive stress (N/ 2)
1	20×12	430000	420	17.91
2	20×12	470000	420	19.58

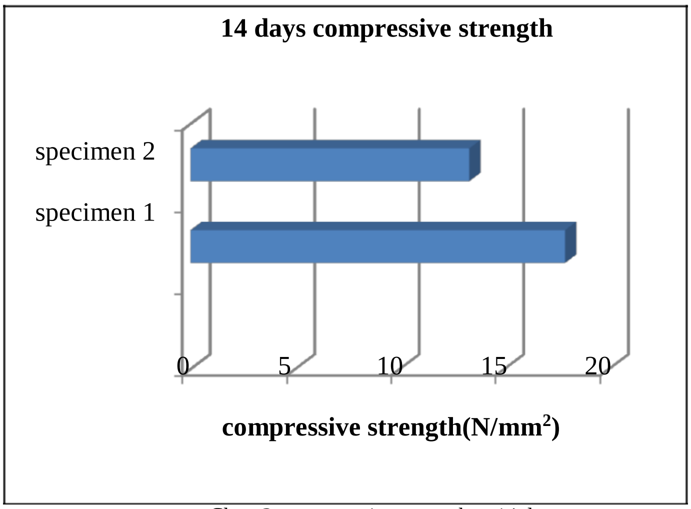


Chart 2 . compressive strength at 14 days

Table-3.Testing Result For 28 days

S. No	Size of the specimen (2)	Ultimate load (N)	Cross sectional area (2)	Ultimate compressive stress (N/ 2)
1	20×12	510000	420	21.25
2	20×12	490000	420	20.41

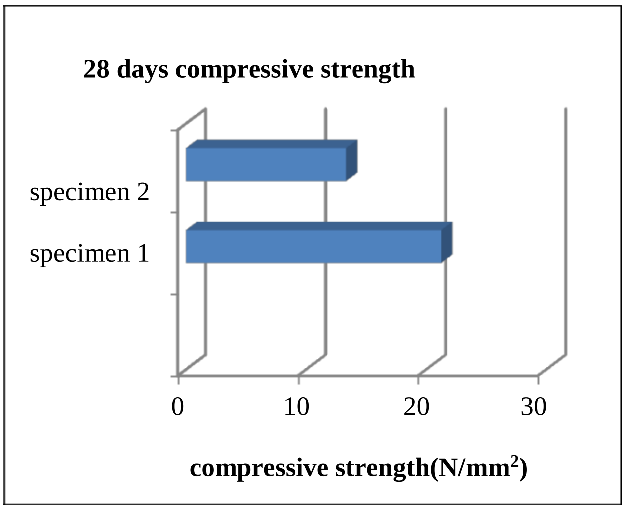


Chart 3 . compressive strength at 28 days

4.2 SEM Test Result

Spectrum processing :No peaks omitted

Processing option : All elements analyzed

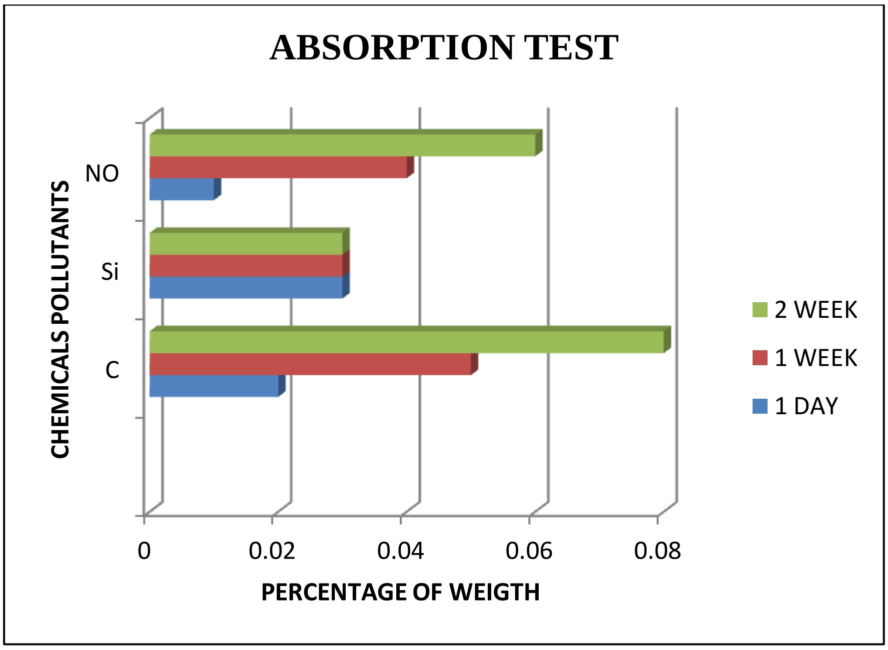
Number of iterations = 1

Standard :

C CaCO3 1-Jun-1999 12:00 AM Si SiO2 1-Jun-1999 12:00 AM
NO NO2 1-Jun-1999 12:00 AM

4.2.1 Test Result For 1 Day

Elem...	Weight%	Atomic%
C K	0.02	70.00
Si K	0.03	9.87
NO K	0.01	20.13



4.2.2 Test Result For 1 Week

Elem...	Weight%	Atomic%
C K	0.05	62.52
Si K	0.03	9.87
NO K	0.04	27.61

4.2.3 Test Result For 2 Week

Elem...	Weight%	Atomic%
C K	0.08	73.33
Si K	0.03	9.87
NO	0.06	16.80

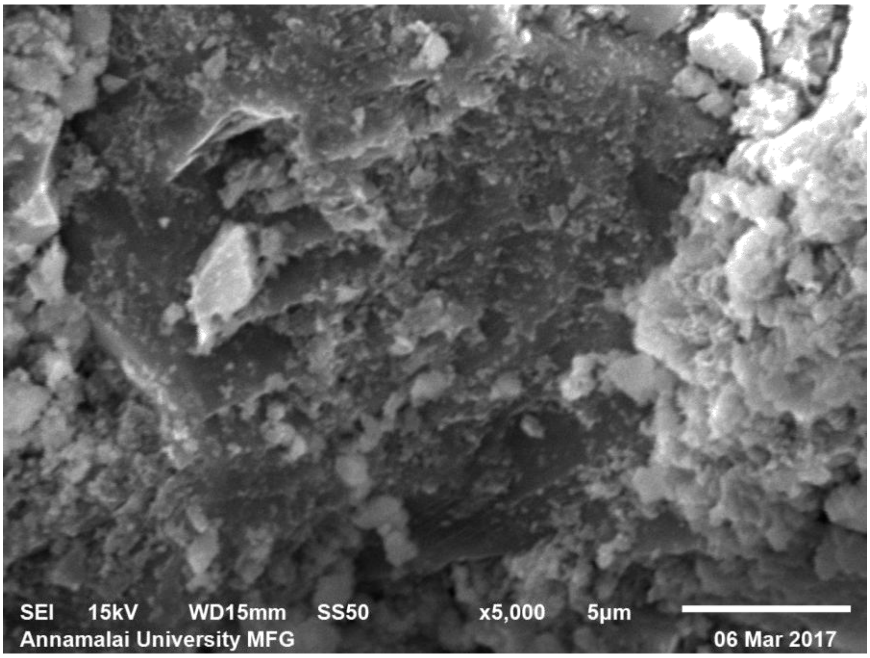


Figure -4 SEM Analysis

Conclusion

Now a days air pollution is one of the major problem in our world. It can causes many harmful things to the atmosphere as well as human beings. Air pollution is one of the source which leads to cause the global warming and cause some health effects. Our main aim is to prevent the environment from air pollution. Being a civil engineer we are doing a part to save our mother nature by paving sustainable “green pavement” called smog absorbing pavement.In this study,we have conducted experimental investigation on the paver blocks by coating titanium dioxide which can absorbed carbon,Nox pollutants from the air.By laying a sustainable green pavement it can absorbed the pollutants from the highly polluted area.Hence in our project the pollutants can be absorbed in certain level for 1 day,1 week and 2 weeks.so our main aim of controlling air pollution in highly polluted area is satisfied

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