AN EVALUATION OF THE AMOUNTS AND IMPACTS OF NANO TIO2 ON THE MECHANICAL ASPECTS OF CONCRETE

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ABSTRACT
From a very long time ago, concrete has been employed in the construction industry. Concrete comes in a variety of grades, including M20, M25, and M30. Here, 30 denote the concrete's MPa strength. With cement-containing concrete, it is particularly challenging to get the desired compressive strength. To solve this issue, we employ a variety of materials. One of the materials is nano materials.
The impacts of nano Titanium Di Oxide (TiO2) in relation to cement will be discussed in this research, and the findings for compression, flexural, split tensile, chloride attack, and sulphate attack will be examined.
Keywords: Cement, Concrete, Nano, Titanium.

INTRODUCTION
Little people are referred to as "Nano" in this sentence. In reality, the term "nano" is Greek. By altering matter at the atomic level, the material may be preplanned (dimensions between 1 and 100 nm). This reorganisation is known as nanotechnology. Scientists have been able to benefit from the distinctive physical, chemical, mechanical, and optical properties of materials that exist naturally at the nanoscale thanks to the application of nanotechnology. Due to their enormous surface area and high reactivity, nanoparticles are becoming more and more common in the concrete industry. Some unfavourable characteristics of cement-containing materials include brittle failure, poor tensile strength, and early cracking. Nanotechnology is clearly chosen in the research field to avoid these failures. Titanium Di Oxide (TiO2) is the finely researched and well known material. Titanium is having the atomic number 22 and atomic weight 47.86. Three mineral forms of the Titanium Di Oxide exists which are Anatase, Brookite and Rutile. Here we will study the use TiO2 in concrete and effects generated because of it.

LITRATURE REVIEW
Various experiments have been performed on the Titanium Dioxide. With some further investigations many research scholars had given results for the use of nano Titanium Dioxide. Following literature review shows some of the studies on use of nano technology in concrete. Porro et al. (2010) had given an overview on use of nano technology in concrete, giving wide range of approach needed for successful breakthroughs leading to high-performance materials and new multiscale models for the prediction of bulk material properties from composition and processing parameters. Grove et al. (2010) used nano technology for the reducing carbon foot print of the concrete for sustainability of environment. Bjornstrom etal., 2004 Lin,(2008) has observed that nanoparticles fills nanosize pores present in cement paste, and further showed that nano-SiO2 reacts with Ca(OH)2 (i.e., pozzolanic reaction) and generates additional C-S-H. Yazdanbakhsh et al., (2010)has investigated for the relationship between cement particle size and the dispersion of CNFs-CNTs in paste and presented that large cement particles prevent a uniform distribution when fibers are very small or used in high dosages. Nazari, Ali, et al. added 0.5%, 1.0%, 1.5% and 2.0% of nano-TiO2 particles, respectively per weight of cement in the concrete and used a fixed w/c ratio of 0.4. the conclusion was that the workability reduction, increase with the increase in Nano Titanium Dioxide content and compressive strength of concrete after 28 days was 13.86%,17.93%,15.49% and 6.79% increased with the addition of 0.5%, 1%, 1.5%, and 2% Nano Titanium Dioxide respectively its original strength.

TESTS ON MATERIAL
For the further experiment first we had did some tests on the raw material. Following datashows the results of the tests.

Aggregate

Sr. No.	Material	Specific Gravity	Fineness Modulus
1.	Coarse aggregate	2.9	7.01
2.	Fine aggregate	2.6	2.94

Cement

Sr. No.	Properties	Values
1.	Fineness	7.25%
2.	Standard Consistency	33 mm
3.	Initial setting time	45 min
4.	Final setting time	580 min

Titanium Dioxide

Sr. No.	Properties	Values
1.	Appearance	White
2.	Specific Gravity	4.26
3.	Density	3.28 g/cc

Mix Design

For the preparation of M30 grade of concrete following mix design values and proportionsare used.

Cement	Fine Aggregate	Coarse Aggregate	Water
425.73 kg	686.3 kg	1168 kg	191.58 lit
1	1.52	2.64	0.45

EXPERIMENT AND RESULTS

For testing the effect of Titanium Dioxide on the M30 grade of concrete we have mixed Titanium Dioxide in the concrete in various proportions. These proportions are in percentage of the weight of the cement used. Number of quantities of Titanium Dioxide used is 0.25%, 0.5%, 1%, 1.25% and 1.5%.

For this Experiment we have casted cubes of 150mmX150mmX150mm with 53 grade of cement, natural sand and coarse aggregate. For the testing of the specimen Universal Testing Machine is used.

Following are the results obtained from the experiment obtained by testing various number of specimens on UTM.

Compressive Strength

For the test of compressive strength we took 135 number of cubes with different amount of titanium dioxide. Following table shows the obtained results.

Sr. No.	Type of Concrete	At 7 days (N/mm2)	At 28 days (N/mm2)	At 56 days (N/mm2)
1	0.50%	25.88	31.76	31.92
2	0.75%	26.63	33.68	34.51
3	1%	28.90	36.97	36.89
4	1.25%	25.05	34.61	35.29
5	1.5%	24.34	33.50	34.21

Flexural Strength

For the test of flexural strength we had taken 45 numbers of beams with different amount of titanium dioxide. Following table shows the obtained

Sr. No.	Type of Concrete	At 7 days (N/mm2)	At 28 days (N/mm2)	At 56 days (N/mm2)
1	0.50%	7.66	7.66	7.99
2	0.75%	8.26	8.26	8.63
3	1%	8.91	8.91	9.25
4	1.25%	8.89	8.89	9.26
5	1.5%	7.54	7.54	7.91

Split Tensile Strength

For the test of Split Tensile strength we had taken 45 numbers of cylinders with different amount of titanium dioxide. Following table shows the obtained.

Sr. No.	Type of Concrete	At 7 days (N/mm2)	At 28 days (N/mm2)	At 56 days (N/mm2)
1	0.50%	6.65	7.45	7.79
2	0.75%	8.86	7.64	7.98
3	1%	9.29	10.37	10.71
4	1.25%	7.55	8.21	8.56
5	1.5%	6.91	7.73	8.07

Sulphate Attack Test (Potassium sulphate (k2so4))

Following table shows the strength of the concrete after immersing the cube of 150mmX150mmX150mm in the solution of potassium sulphate. Potassium Sulphate is mixed with the water in an amount of 5% of the water.

Sr. No.	Type of Concrete	At 7 days (N/mm2)
1	Normal Concrete	26.21
2	0.50%	24.52
3	0.75%	24.91
4	1%	25.62
5	1.25%	23.56
6	1.5%	22.28

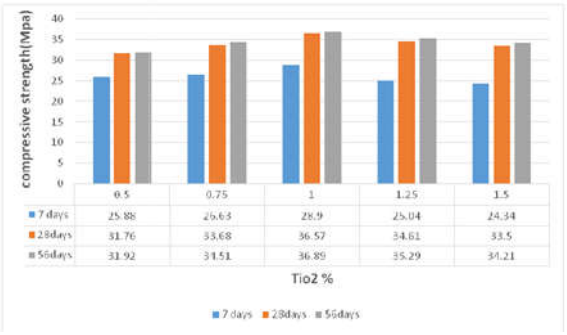
Chloride Attack (Sodium chloride(Nacl))

For this experiment water from the bore well near the college is taken. It is observed that bore well water does contain the good amount of salt.

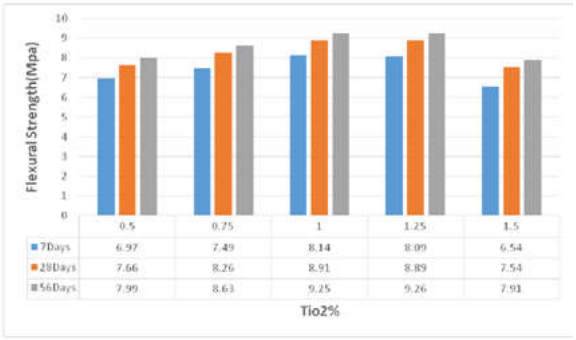
Sr. No.	Type of Concrete	At 7 days (N/mm2)
1	Normal Concrete	26.21
2	0.50%	25.11
3	0.75%	25.94
4	1%	28.39
5	1.25%	23.96
6	1.5%	23.11

Graphs for the Obtained Test Results

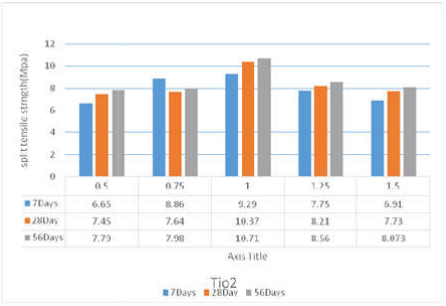
Compressive Strength



Flexural Strength



Split Tensile Strength



CONCLUSION

From the above discussion it can concluded that nano materials are the good source of chemicals used for the incrementation of the strength of the ordinary concrete. In this report we had used Titanium di-oxide which is also a nano material. Use of nano material does gives a good results for compression strength, flexure strength, split tensile strength, attack of possaium sulphate and chloride attack.

When it comes to compressive strength, flexural strength and split tensile strength Nano Titanium di-oxide does provide the increase in the strength but upto a certain amount of TiO2 Added in the concrete mix i.e. 1% TiO2 of the weigth of the cement. After this value with increase in the amount of the titanium dioxide all the strengths of the concrete starts degrading. Hence it can be concluded that use of TiO2 should be done at up to the 1% of the weight of the cement.

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