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Consequence of Concrete due to Acids

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Abstract*: Concrete is a monolithic fabric made out of coarse blend braced in to be partaken in numerous occasions by method for fluid bond that hardens finished in time. Most prominent cement use are mostly lime based binding materials with most of the examples with Portland lime based cement total by other concrete, for event ,for example, bond fondue. Regardless, dark top solid, that is go to use the pavement smooth surfaces , is too a kind of solid, where the bond fabric is bitumen based, and polycements are utilize the spot the solidifying material is mostly polygrou . The paper investigate affect of acidic remedial situation on the strength and durability for M40 grade concrete on dissimilar age. Cured on hose contain a variety of percentage for NITRIC ACID(HNO3), HYDROCHLORIC ACID(HCL) and SULPHURIC ACID(H_2SO_4).

***Keywords : Acid attack on concrete, Hydro Chloric acid, Sulphuric acid, Nitric acid, Compressive Strength, Split Tensile Strength, Flexural Strength, , Durability and Weight loss*.**

I. INTRODUCTION

Couple of sorts of cement are open, one of a kind with the guide of the degrees of the basic fixings underneath. Thusly or by method for implemented for the cementinious by total steps in finished terms could be altered outfitted for their implementations. Class, width, in addition, substance and luke against the failure are factors.Total includes enormous bits of material in a solid blend, normally the apllication shake and squashed disturbance to lime based materials, along by higher particlesnamely binding material, fined stone powder best regularly Portland bond, is related by means of the run of the mill term "concrete." An extent of unmistakable substances can be use as the bond in concrete too. A standout amongst the most unreasonable not irregular of these elective bond is dark top cement. Distinctive cementitious materials for example fly searing flotsam and jetsam and slag bond, are in certain cases secured as admitures of variant minerals both premixed with guide of the concrete or straight as a solid segment - and develop to be a bit of the latch to the coarse stone particles.for concrete productiongenerally noteworthy concrete (excepting dark top), water is consolidated by means of the dry powder and total, that gives you required shape to the slurry, ordinarily through placement of slurry into a structural form work. The solid concretes and cements through a The composition of derived materials procedure named as heat of hydration. When the fluid reacts by means of concrete, that binding selective parts acts combinedly to make a hard rock like element.

II. CONSQUENCES OF CONCRETE

Ordinary Portland Cement (OPC) is highly alkaline in nature and having the pH values above 12. So whenever the concrete or matrix paste comes into contact with the acids. The reaction between the concrete and acid will start and finally leads to disintegration of its components, this phenomenon is known as acid attack.

If pH decreases to values lower than stability limits of cement hydrates, then the corresponding hydrate loses calcium and decomposes to amorphous hydrogel. The final reaction products of acid attack are the corresponding calcium salts of the acid in addition as hydrogels of siliceous, aluminum, and ferric oxides.

Acid Attack on Concrete Cube

III. MIX DESIGN

1. Mild Concrete surface confined beside weather or insistent conditions, except for folks situated in coastal area.
2. Moderate Concrete surfaces protected as of cruel rain or glacial whilst wet Concrete noticeable to concentration landmine Concrete continuously underwater Concrete in contactor buried undergone aggressive soil or ground water Concrete surfaces sheltered from saturated salt airing coastal

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area Now for the check we use to cast some cubes of M40 and then we use to test them.

Table 1 : Material required for M40 grade concrete per cubic meter quantity of concrete

Material	Water	Cement	Fine aggregate	Coarse aggregate
Kgs/cum	197.2	493	604	1164
Ratio	0.40	1	1.23	2..36

IV. EXPERIMENTAL PROCEDURES

CONCRETE TEST PROCEDURES**:**

Now we are considering two acids H_2SO_4 Sulfuric,HNO_3 NITRIC acid acid and HCL Hydrochloric acid with different concentrations and mixing separately into water and treating cubes in the tubs which contain acid mixed water. After treating for 7, 28 and 60 days we use to takes cubes out for the interval of times and tests under lab.

Figure 1: Cubes of HCL O% Concentration and 2% Concentration.

Figure 2: Cubes of HCL 5% Concentration. and 8% Concentration.

Figure 1: Cubes of HNO_3 O% Concentration and 2% Concentration.

Figure 2: Cubes of HNO_3 5% Concentration. and 8% Concentration

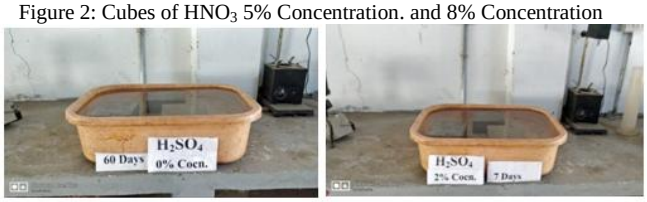

Figure 3: Cubes of H_2SO_4O%Concentration and 2% Concentration

Figure 4:Cubes of H_2SO_4 5%Concentration and 8%Cocncentration

Figure 4: Testing cubes of H_2SO_4 5%Concentration. And 8%Concentration.

V. RESULTS AND DISCUSSIONS

5.1 COMPRESSIVE STRENGHT OF CUBES

Table 2: **Effect of H_2SO_4 on compressive strength at 7, 28 and 60 days**

Sl. No	Grade of concrete M40	Cured in different % of H_2SO_4 solution	7 days strength (MPa)	28 days strength (MPa)	60 days strength(MPa)
1	M40	Water	31.5	46.5	46.5
2	M40	2% H_2SO_4	30.04	45.2	45.4
3	M40	5% H_2SO_4	29.2	43.6	44.2
4	M40	8% H_2SO_4	26.6	42.0	43.10

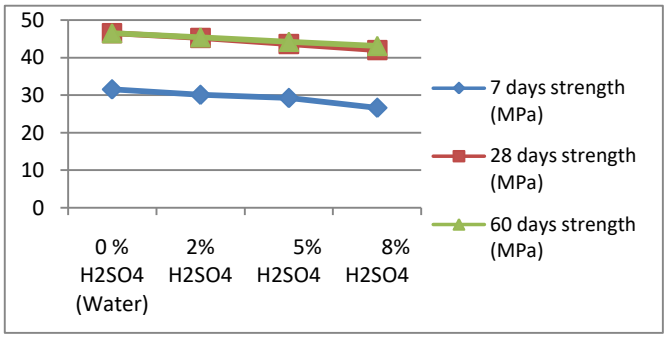

Figure 5 : **Effectof H_2SO_4 on compressive strength at 7, 28 and 60 days**

Table 2: **Effect of HCL on compressive strength at 7, 28 and 60 days**

Sl. No	Grade of concrete M40	Cured in different % of HCL Solution	7 days strength (MPa)	28 days strength (MPa)	60 days strength (MPa)
1	M40	Water	31.5	46.4	46.6
2	M40	2% HCL	30.5	44.2	45.0
3	M40	5% HCL	29.2	41.8	42.2
4	M40	8% HCL	28.1	39.8	40.0

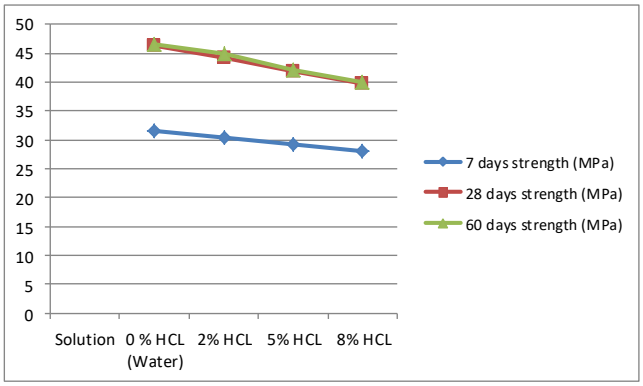

Figure 6 : Effect of HCLon compressive strength at 7, 28 and 60 days

Table 3: Effect of HNO_3 on compressive strength at 7 days, 28 days and 60 days

Sl. No	Grade of concrete M40	Cured in different % of HNO_3 solution	7 days strength (MPa)	28 days strength (MPa)	60 days strength (MPa)
1	M40	0 % HNO3 (Water)	31.50	46.40	46.60
2	M40	2% HNO3	31.00	46.00	46.20
3	M40	5% HNO3	30.04	44.20	44.60
4	M40	8% HNO3		42.20	42.40

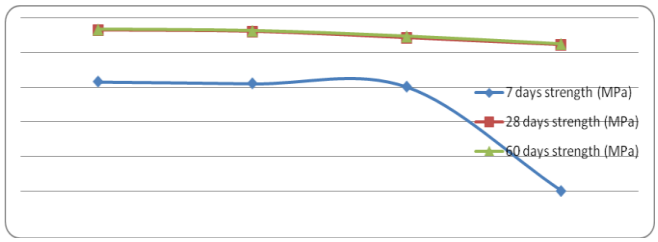

Figure 33: Effect of HNO_3 on compressive strength at 7 days, 28 days and 60 days .

5.2 SPLIT TENSILE STRENGH

Table 4 :Effect of H_2SO_4 on split tensile strength of concrete at 7, 28 and 60 days

Sl. No	Grade of concrete M40	Cured in different % of H_2SO_4 Solution	7 days strength (MPa)	28 days strength (MPa)	60 days strength (MPa)
1	M40	Water	3.1	4.12	4.13
2	M40	2% H_2SO_4	3.08	4.02	4.03
3	M40	5% H_2SO_4	2.96	3.96	3.98
4	M40	8% H_2SO_4	2.42	3.45	3.82

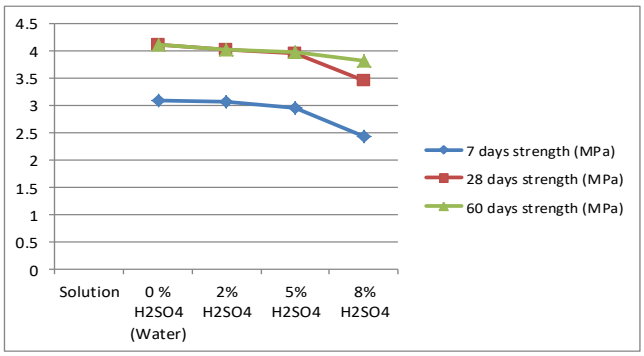

Figure 7 : **Effect of H_2SO_4 on split tensile strength of concrete at 7, 28 and 60 days**

Table 5 : Effect of HCL on split tensile strength of concrete at 7, 28 and 60 days

Sl. No	Grade of concrete M40	Cured in different % of HCLSolution	7 days strength (MPa)	28 days strength (MPa)	60 days strength (MPa)
1	M40	Water	3.1	4.12	4.13
2	M40	2% HCL	3.00	4.00	4.01
3	M40	5% HCL	2.92	3.96	4.02
4	M40	8% HCL	2.84	3.72	3.98

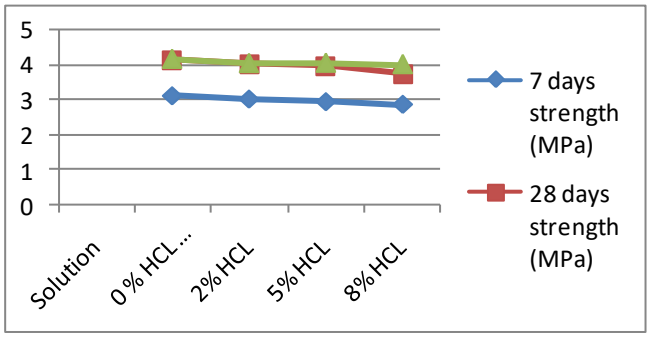

Figure 8 : **Effect of HCL on split tensile strength of concrete at 7,28 and 60 days**

Table 6 :Effect of HNO_3on split tensile strength of concrete at 7 days, 28 days and 60 days

Sl. No	Grade of concrete M40	Cured in different % of HNO_3 solution	Split tensile strengthat 7days (Mpa)	Split tensile strengthat28 days (Mpa)	Split tensile strengthat 60 days (Mpa)
1	M40	0 % HNO3 (Water)	3.1	4.12	4.13
2	M40	2% HNO3	3.06	4.00	4.04
3	M40	5% HNO3	2.98	3.96	4.1
4	M40	8%HNO3	2.64	3.62	3.96

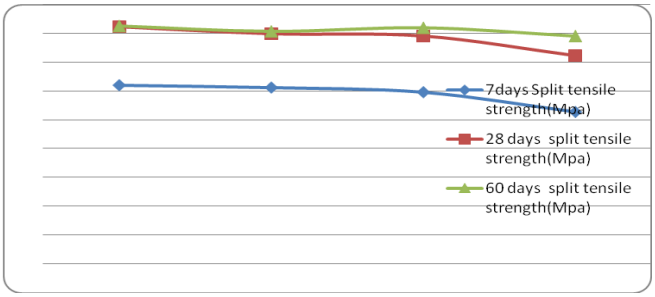

Figure 36: Effect of HNO_3 on split tensile strength of concrete at 7 days, 28 days and 60 days

5.3 FLEXURAL STRENGTH

Table 6 :Effect of H_2SO_4 on flexural strength of concrete at 7, 28 and 60 days

Sl.No	Grade of concrete M40	Cured in different % of H_2SO_4 solution	7days Flexural strength(Mpa)	28days Flexural strength(Mpa)	60days Flexural strength(Mpa)
1	M40	Water	3.6	4.78	4.79
2	M40	2% H_2SO_4	3.52	4.71	4.74
3	M40	5% H_2SO_4	3.48	4.66	4.68
4	M40	8% H_2SO_4	3.36	4.52	4.56

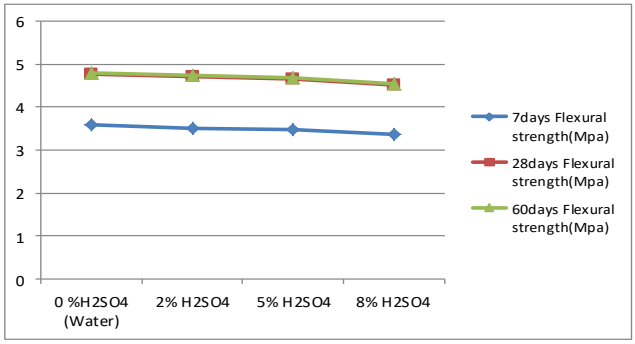

Figure 9 : **Effect of H_2SO_4 on flexural strength of concrete at 7, 28 and 60 days**

Table 7: Effect of HCL on flexural strength of concrete at 7,28 and 60 days

Sl.No	Grade of concrete M40	Cured in different % of HCLSolution	7days Flexural strength(Mpa)	28days Flexural strength(Mpa)	60days Flexural strength(Mpa)
1	M40	Water	3.6	4.78	4.79
2	M40	2% HCL	3.54	4.70	4.72
3	M40	5% HCL	3.48	4.64	4.66
4	M40	8% HCL	3.32	4.42	4.46

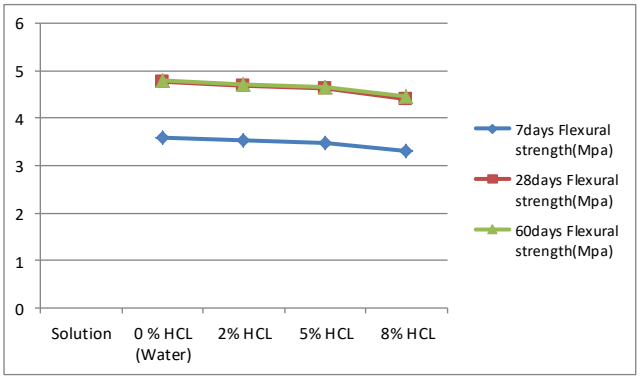

Figure 10: Effect **of HCL on flexural strength of concrete at 7,28 and 60 days**

Table 9:Effect of HNO_3 on flexural strength of concrete at 7 days, 28 days and 60 days .

Sl.No	Grade of concrete M40	Cured in different % of HNO_3 solution	Flexural strength(Mpa) at 7days	Flexural strength(Mpa) at 28days	Flexural strength(Mpa) 60days
1	M40	0 % HNO3 (Water)	3.6	4.78	4.79
2	M40	2% HNO3	3.6	4.76	4.77
3	M40	5% HNO3	3.5	4.72	4.73
4	M40	8% HNO3	3.42	4.64	4.66

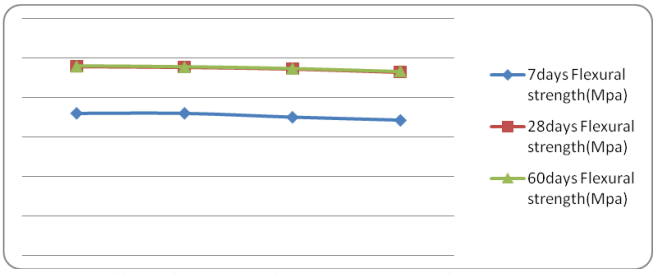

Figure39 :Effect of HNO_3 on flexural strength of concrete at 7 days, 28 days and 60 days .

Durability of concrete

- Concrete is capable of wear and tear due to atmosphere and temperature change throughout its period.
- This thesis clearly explained how the environment conditions effectsthe durability of concrete.
- With application of some advanced epoxy resins one can overcome the fatigue conditions and achieve the desired durability.
- Durability testing is a performance testing technique used to determine the characteristic of a system under various load condition over time.

VI. CONCLUSION

The following conclusions are drawn

1. Acidic curative atmosphere encompass a negative result on the compressive, flexural and tensile strengths in addition to concentration of concrete cured in acidic water. It reveal that body exposed to acidic atmospheric situation did not achieved the desired serviceability.
2. The potency of concrete decrease through increase in period of curing in addition to proportion of acid in curing water.
3. A near linear relationship between loss of weight and strength is observed as the percentage of acid increased in the curing water.
4. The structures that exposed to severe acidic environment should be given a special attention while designing the structure especially while selecting the concrete compositions and a higher safety factor should be adopted . If possible special cements should be allowed reducing the deterioration effect due to the harsh acidic environment.
5. To make structure durable acid resistant Novolac Epoxy floor resins be provided which protects the structure against hundreds of different chemicals and acids and gives the highest level of protection.

REFERENCES

1. B. Madhusudhana Reddy, H. SudarsanaRao and M.P. George "EFFECT OF SULPHURIC ACID (H2SO4) ON BLENDED CEMENT (FLY ASH BASED) AND IT'S CONCRET" 2012 Vol. 2 (2) April-June, international journel of applied engineering and technolog
2. H. SudarsanaRao , V. Venkateswara Reddy and S.G. Vaishal " EFFECTS OF ACIDITY PRESENT IN WATER ON STRENGTH AND SETTING PROPERTIES OF CONCRETE" 29th Conference OUR WORLD IN CONCRETE & STRUCTURES: 25 - 26 August 2004, Singapore Article, international journal of impact engineering(IJIE
3. Seyed M. Joorabchian "DURABILITY OF CONCRETE EXPOSED TO SULFURIC ACID ATTACK" Theses and dissertations1-1-2010,international journal of civil engineering and technology(IJCIET)
4. Bryant Mather "EFFECTS OF SEA WATER ON CONCRETE" MISCELLANEOUS PAPER NO. 6-690 December 1964,journal of construction division
5. Taku, KumatorJosiphiah,Amartey, D Yusuf ,Kassar, T "EFFECT OF ACIDIC CURING ENVIRONMENT ON THE STRENGTH AND DURABILITY OF CONCRETE " Vol.7, No.12, 2015,American journal of civil engineering.
6. M.S. Shetty CONCRETE TECHNOLOGY Theory and Practice, international journal of research of engineering and technology(IJRET)
7. IS 456: 2000 Indian standard, plain and reinforced concrete code of practice, fourth revision