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 polygroup. 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(H₂SO₄).

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 cementitious 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 application shake and squashed disturbance to lime based materials, along by higher particles namely 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 slag bond, are in certain c
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\(_2\)SO\(_4\) 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 3: Cubes of H\(_2\)SO\(_4\) O% Concentration and 2% Concentration

V. RESULTS AND DISCUSSIONS

5.1 COMRESSIVE STRENGTH OF CUBES

Table 2: Effect of H\(_2\)SO\(_4\) on compressive strength at 7, 28 and 60 days

| Sl No | Grade of concrete | Cured in different % of H\(_2\)SO\(_4\) | 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\(_2\)SO\(_4\)               | 30.64                | 45.2                  | 45.4                |
| 3     | M40              | 5% H\(_2\)SO\(_4\)               | 29.2                 | 43.6                  | 44.2                |
| 4     | M40              | 8% H\(_2\)SO\(_4\)               | 26.6                 | 42.0                  | 43.3                |

Figure 5: Effect of H\(_2\)SO\(_4\) 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 | Cured in different % of HCL | 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                     | 30.64                | 45.2                  | 45.0                |
| 3     | M40              | 5% HCL                     | 29.2                 | 41.8                  | 42.2                |
| 4     | M40              | 8% HCL                     | 28.1                 | 39.8                  | 40.0                |
Table 3: Effect of HNO₃ on compressive strength at 7 days, 28 days and 60 days

| Sl. No | Grade of concrete M40 | Cured in different % of HNO₃ solution | 7 days strength (MPa) | 28 days strength (MPa) | 60 days strength (MPa) |
|--------|----------------------|--------------------------------------|----------------------|-----------------------|-----------------------|
| 1      | M40                  | 0 % HNO₃ (Water)                     | 31.50                | 48.80                 | 68.60                 |
| 2      | M40                  | 5% HNO₃                             | 30.04                | 44.20                 | 64.20                 |
| 3      | M40                  | 8% HNO₃                             | 42.20                | 42.40                 |                       |

Figure 6: Effect of HCL on compressive strength 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 HCL 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% 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 HNO₃ on split tensile strength of concrete at 7 days, 28 days and 60 days

| Sl. No | Grade of concrete M40 | Cured in different % of HNO₃ solution | Split tensile strength 7 days (MPa) | Split tensile strength 28 days (MPa) | Split tensile strength 60 days (MPa) |
|--------|----------------------|---------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| 1      | M40                  | 0 % HNO₃ (Water)                      | 2.1                               | 4.12                              | 4.17                              |
| 2      | M40                  | 2% HNO₃                              | 2.8                                | 4.00                              | 4.04                              |
| 3      | M40                  | 5% HNO₃                              | 2.98                               | 3.96                              | 4.11                              |
| 4      | M40                  | 8% HNO₃                              | 2.84                               | 3.82                              | 3.99                              |

Figure 10: Effect of HNO₃ on split tensile strength of concrete at 7 days, 28 days and 60 days

5.2 SPLIT TENSILE STRENGTH

Table 4: Effect of H₂SO₄ on split tensile strength of concrete at 7, 28 and 60 days

| Sl. No | Grade of concrete M40 | Cured in different % of H₂SO₄ 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% H₂SO₄                              | 3.08                 | 4.02                  | 4.05                  |
| 3      | M40                  | 5% H₂SO₄                              | 2.96                 | 3.96                  | 3.98                  |
| 4      | M40                  | 8% H₂SO₄                              | 2.82                 | 3.45                  | 3.82                  |

Figure 7: Effect of H₂SO₄ on split tensile strength of concrete at 7, 28 and 60 days

5.3 FLEXURAL STRENGTH

Table 6: Effect of H₂SO₄ on flexural strength of concrete at 7, 28 and 60 days

| Sl. No | Grade of concrete M40 | Cured in different % of H₂SO₄ solution | 7 days Flexural strength (MPa) | 28 days Flexural strength (MPa) | 60 days Flexural strength (MPa) |
|--------|----------------------|---------------------------------------|-----------------------------|--------------------------------|--------------------------------|
| 1      | M40                  | Water                                 | 3.6                          | 4.78                           | 4.79                           |
| 2      | M40                  | 2% H₂SO₄                              | 3.52                          | 4.71                           | 4.74                           |
| 3      | M40                  | 5% H₂SO₄                              | 3.48                          | 4.66                           | 4.68                           |
| 4      | M40                  | 8% H₂SO₄                              | 3.36                          | 4.52                           | 4.56                           |

Figure 12: Effect of H₂SO₄ on flexural strength of concrete at 7, 28 and 60 days
Consequence of Concrete due to Acids

- This thesis clearly explained how the environment conditions effect the 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 reveals that body exposed to acidic atmospheric situation did not achieve 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.

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