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Strength Assessment of Concrete Structures Due to Various Chemical Attacks

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Abstract: The strength and durability of concrete after casting changes at variance factors regarding physical and chemical damages Concrete structures with steel-reinforcement are in a continuous and losing life with corrosiveness that naturally occurs from long-term exposure to an aggressive environment. The concrete structure like dams, canals, bridges which have the influence of water forms various types of chemical reactions which include carbonation attack, sulphate attack, chloride attack, alkali aggregate reaction etc. Chemical reactions, either intrinsic or extrinsic, are one of the main reasons for concrete's deterioration. The present dissertation consists on an analysis of the chemical expansive reactions in concrete element, the alkalis aggregate reaction, and the internal sulphuric reaction. During the carbonation process the fundamental element identified in the concrete microstructure is calcite which comes outs at the surface of concrete structure, in the form of cracks. When carbon dioxide causes by environment come contact into the concrete structure and effect with calcium hydroxide to create calcium carbonate this phenomenon is called as carbonation. Carbonation usually describe by pH value which indicate the depth of reaction in the structure. The depth of carbonation directly affects the life of structure in year. Through the years to overcome this problem the solution is being discovered by performing various experiments on Concrete after and before the casting. Which gave us the Chemical test like by increasing the C02 binding capacity, improving CaO Value and physical tests such as applying epoxy coating, etc.? After all, performing the various types of test for particular outcome finally check for durability tests for concrete structure is take place for better result. There are many of them but in this case it will be pH indicator, UTM and CTM is being discussed. This project addresses the study of chemical reaction which is taking place on various type of concrete structures and affect the durability and strength of it.

Keywords: *Strength Assessment, Concrete Structure, Chemical Attack, Epoxy, Chlorine, Sulphur.*

I. INTRODUCTION

What is chemical attack?? When we are dealing with durability of concrete chemical attack which result in volume change, cracking of concrete and the consequent deterioration of concrete become an important part of discussion. Chemical attack is the reaction of chemical element from exposure and moisture present in the concrete which results into deterioration of RCC structures.

Ordinary Portland Cement (OPC) is highly alkaline in nature with pH values above 12. When the cement paste comes into contact with the acids its components break down, 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 as well as hydrogels of siliceous, aluminium, and ferric oxides.

Fig 1: Hydrochloric Acid Attack on Concrete

II. OBJECTIVE

1. To study about attacks of the chemical.
2. To study the effect of various acid attacks on concrete.
3. To study preventive methods of concrete deterioration caused by chemicals and acid attacks.

III.LITERATURE REVIEW

1. Durability of Concrete Exposed to Sulphuric Acid Attack, Seyed Mahmoodreza Joorabchian.

   This thesis investigates the effects of aggressive sulfuric acid attack on the concrete mixtures prepared with metakaolin (MK) and limestone filler (LF) at various replacement levels. In addition, rapid chloride permeability (RCPT), water sorptivity, water porosity and rapid freezing and thawing tests were also performed on the concrete samples. Three sulfuric acid solutions with concentrations of 3%, 5% and 7% were used for examining the resistance of concrete specimens for a total exposure period of eight weeks. The performance of the degraded specimens was evaluated by measuring the weight loss, change in strength and visual assessment

2. Concrete Deterioration Caused by Sulfuric Acid Attack, Sept2018, K. Kawai, S. Yamaji, T. Shinmi

   Biological deterioration of concrete in sewage and wastewater treatment plants has been reported. This deterioration is caused by sulfuric acid attack and is dependent on the concentration of sulfuric acid, this in turn being a function of both the specific location within the plant and also the time over which the concrete is exposed to elevated concentrations of acid. Given that concrete may often be exposed to very strong acid solutions, resin coatings are applied to the concrete to protect them

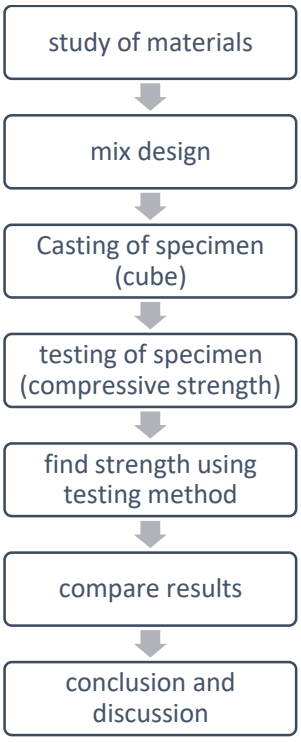
3. Concrete against acid attack: Preventive measures, Oct19, Dr. Anwar Khitab, [2]Dr. Mohsin Usman Qureshi, [3]Mr. Muhammad Nadeem

   This paper addresses the measures taken to prevent or minimize the deterioration of concrete, which confronts an acidic environment. Primarily, the mechanism of reaction between alkaline concrete and acid is clearly demonstrated. The mechanism of reaction clearly sets guidelines as to how the chances of this disastrous reaction should be minimized or eliminated at all. The suggested preventive measures are two-fold i.e. the improvement of the basic microstructure of concrete and the provision of barriers against acids. Concrete can be made acid resistant using classical as well as novel techniques like nanotechnology.

4. Response of Concrete to Sulfuric Acid Attack, Emmanuel K. Attiogbe and Sami H. Rizkalla

   The study shows that all three indicators of deterioration are effective measures of concrete response to the acid attack. However, the study suggests that the increase in thickness (expansion) of small specimens (with large surface area-to-volume ratios) may be a more consistent measure than the weight loss of larger specimens when comparing the effects of different sulfuric acid concentrations on concrete.

IV. METHODOLOGY



V. MATERIALS USED

1. **Cement:** -
   Ordinary Portland Cement (53 grade)
2. **Sand**
3. **Coarse Aggregate**: -
   Size of aggregate 20mm
4. **Water**
5. **Chemicals**: -
   Chlorine Solution
   Sulphur Powder
6. **Epoxy Resin Solution**

VI. CONCLUSION

1. Performed 7/14/28 days Compressive strength on cube and results shown.
2. After 7/14/28 day compressive strength when 0.35% of Sulphur is added decreases and by using epoxy coating compressive strength of concrete increases.
3. After 7/14/28 day compressive strength when 0.35% of Chlorine is added decreases and by using epoxy coating compressive strength of concrete increases

VII. REFERENCES

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