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Effect of Air Entrainment on the Properties of Concrete Structures Using Hydrogen per Oxide as an Admixture

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Abstract: ***Air entrained concrete can be produced by introducing suitable air-entraining agent, one such commonly available material in India is hydrogen peroxide which is being used in my experimental work. The primary objective of this study to find the appropriate amount of hydrogen peroxide (3%) for strength and density, water absorption, other properties of concrete. For which the amount of H2O2 is varied from 0 %, 2.5%, 5%, and 7.5% H2O2 by weight of 100 kg of cement. The test which was carried out in the experimental work were density, workability, strength, water absorption, the slump of air-entrained concrete and aggression resistance of air-entrained concrete against an acid attack such as H2SO4, etc. Total 48 No. of the concrete cube was cast for the experimental work. The result of the experiment work shows if H2O2 is used in the range of 5-6% it will provide better workability, less water absorption and improved resistance against acid attack with acceptable 5-7% decrease in compressive strength***

I. INTRODUCTION

A. General

Cement concrete is perhaps the most widely construction material across the world. Advances in construction methods and a better understanding of concrete engineering has led to concrete being used in more challenging and harsher conditions. There is also a growing realization that concrete is not a maintenance free material. At the same time, several cases of premature deterioration have also been reported. These factors have led to a lot of research in diverse areas related to durability of concrete structures. The present work is also an effort to improve the understanding of the role of special absorbing formwork in improving the quality of concrete close to the surface (referred to as'near surface concrete'), and thereby contributing to the durability of the structure.

B. Air Entrained Concrete (AEC)

Modern use of this concrete originated from united states in 1930 its benefits discovered accidentally, it was observed that concrete mixed with beef tallow as grinding aid it results more durable than normal, nowadays tallow is called as a natural air-entraining admixture. These air-entraining admixture used to create microscopic air bubble in the concrete paste, later on, more advantage of air-entrained concrete known with time and nowadays it becomes one of the most promising admixtures for concrete work. Air entrained concrete used in various countries especially in cold countries and it has gain popularity due to its properties and advantages over normal . This air-entrained concrete is prepared with the help of several air-entraining admixtures but AEC has density much above to thus and also here purpose for entraining the air into concrete is something different although it is very similar to lightweight concrete in term of air void but these bubble size.

C. For clear understanding proper classification is given below

1) *Lightweight Aggregate Concrete:* Low specific gravity aggregate used in concrete instead of normal aggregate.
2) *Aerated, Cellular, Foamed or Gas Concrete:* Large voids are introduced to get a cellular mass, here density goes below 800kg/$m^{3.}$
3) *No-Fines Concrete:* A complete absence of fine aggregate only coarse aggregate is used in this concrete.

Now if talk about air-entrained concrete then it has a similar effect for lightening the weight of concrete but not density is still in the range of 2100-2200 kg/m^3. It uses different admixture and also their properties are entirely different from lightweight concrete here we get properly distributed void with small air bubble distributed uniformly and due to a reduction in w/c ratio, strength reduction also compensated. purpose of air-entrained concrete is to increase the following resistance

a) Scaling
b) Abrasion
c) Decoration due to freezing and thawing
d) Workability increase

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D. Admixture that is used for Air-Entrained Concrete

1) *Alkali Salts Of Wood Resins (Sodium Abietate):* Most widely used. Example of this is Vinsol resin. Extracted from pinewood, neutralized as thesodium salt, or as by-products from the production of tall oils.
2) *Alkyl Aryl Sulphonates:* These are also usually in the form of their sodium salt. Typical of this group is sodium dodecylbenzene sulphonate.
3) *Alkyl Sulfates:* These include materials such as sodium dodecyl sulfate, sodium cetyl sulphate, and sodium alkylsulphate.
4) *Salts of Fatty Acids Generated from Animal and Vegetable Fats and Oils:* The alkali metal or triethanolamine salts of fatty acids such as oleic and caproic acid are used asair-entraining agents for concrete.

II. LITERATURE REVIEW

A. Review on Air Entrained Concrete Of Previous Studies

1) *"Response of air-entrained concrete to severe chemical aggression" Safwan A.Khedr, M.ASCE; MOHAMED Nagib abou-zeid ; and jane M.abadir (2006)*

The paper revealed that the use of air entraining concrete enhanced the stability of concrete under chemical attack. The workability of the concrete is highly enhanced also abrasion resistance of the concrete.

S NO	AUTHOUR	JOURNAL	MATERIAL	RESULTS
1	KhedarS.A.	ASCE 2006	Aea Wood Resin Based (1% to 7%) aircontent	80% enhancement in chemical disintegration,sulfuric acidat 5-7 % of air content. 5% Strength Decrease Due To 5-6 % Of Air Content

2) *"Influence Of Hydrogen Peroxide and Polypropylene Admixtures In Pervious Concretewith a Partial Replacement of Flyash In Cement" Godasi S V Sai Chaitanya1, Gundu Navya*

Authors deduce some following result Compressive strength for specimens with 1:4 with Polypropylene, Polypropylene+ Fly ash, Hydrogen peroxide, Hydrogen peroxide + Fly Ash increased by 33.7%, 62.2%, 8.6%, and 27.8% respectively when compared to a standard specimen. Tensile strength for specimens with 1:4 with Polypropylene, Polypropylene+ Fly ash, Hydrogen peroxide, Hydrogen peroxide + Fly Ash increased by 20%, 25.9%, 5%, and 22.2% respectively when compared to a standard specimen.
Flexural strength for specimens with 1:4 with Polypropylene, Polypropylene+ Fly ash, Hydrogenperoxide, Hydrogen peroxide + Fly Ash increased by 11.11%, 18.52%, 3.7%, and 14.8% respectively when compared to the standard specimen.
Bond strength for specimens with 1:4 with Polypropylene, Polypropylene+ Flyash, Hydrogen peroxide + Fly Ash increased by 7.17%,9.8%, 2.02%, and 27.8% respectively and decreased by 7.17% with Hydrogen peroxide when compared to the standard specimen. Permeability for specimens with 1:4 with Polypropylene, Polypropylene+ Flyash, Hydrogenperoxide, Hydrogen peroxide + Fly Ash increased by 7.17%, 9.6%, 93.54%, and 10.4% respectively when compared to the standard specimen.

3) *"Effect of sodium sulfate and sodium nitrite on the air-void system in air-entrainedconcrete" (Qinfei li, yong ge, and wencui yang)*

Paper elaborate that the use of sodium nitrite as an air entraining admixture in the concrete helps in enhancing the compressive strength and durability requirement.

4) *"Freeze-Thaw Durability of Air-Entrained Concrete"(Huai-Shuai Shang and Ting-Hua Yi)*

Freeze and thaw resistance of concrete is being enhanced by the use of AEC.The ordinary concrete can also have high freeze and thaw resistance if air entraining admixture at adequate proportion is introduced in the concrete matrix.

5) *"Mechanism of air entrainment in concrete"(Lian Xiang du, Kevin j. Folliard)*

This paper concluded that producing an air bubble in concrete through admixture is a very complex mechanism. Every constituent of concrete-like cement, fine aggregate, coarse aggregate,and water affect the air void system in varying degree.

6) "Characterization of air-void systems in concrete"(Zhichao Liu, Ann Arbor, and Will Hansen)
Air-void in concrete is characterized from microscopic observations of surfaces of finished concrete and quantitative representation of the size distributions based on the code ASTM C457.

7) "A CRITICAL APPRAISAL OF THE AIRENTRAINMENT IN CONCRETE"(Sakshi Gupta, Ankit Batra)
The use of air entraining admixture in the concrete helped in enhancing the compressive strength as well as durability aspect of the concrete.

III. MATERIAL & METHODOLOGY

This study is carried out by the effective use of hydrogen peroxide as an admixture in the concrete. The experimental investigation is carried out by taking varying percentage of hydrogen peroxide, as 0%, 2.5%, 5% and 7.5% and the variations in the properties of concrete is observed. This chapter gives a brief overview about the material which is used in the study and the series of investigations which are being carried.

A. Methodology

1) Collection & Testing of material physical properties
2) Trial % of H_2O_2 in mortor cube
3) Mix design (M30)& casting of the cube
4) Workability determination
5) Compressive strength found at 7, 14, 28 days
6) Water absorption found
7) Density determination
8) Acid attack factor and durability factor determination
9) Weight loss and strength loss due to acid dipping investigated

B. List Of Material Which Is Used

1) Cement
2) Fine aggregate
3) Coarse aggregate
4) Hydrogen peroxide
5) Water
6) Sulfuric acid
7) Hydrochloric acid

IV. RESULTS

A. Compressive Strength of AEC (in MPA) (IS 516-1959)

This test is carried out on standard cube sample which is prepared in the cube mould of size 150 mm *150mm* 150mm which is air dried and tested under standard compression testing machine.

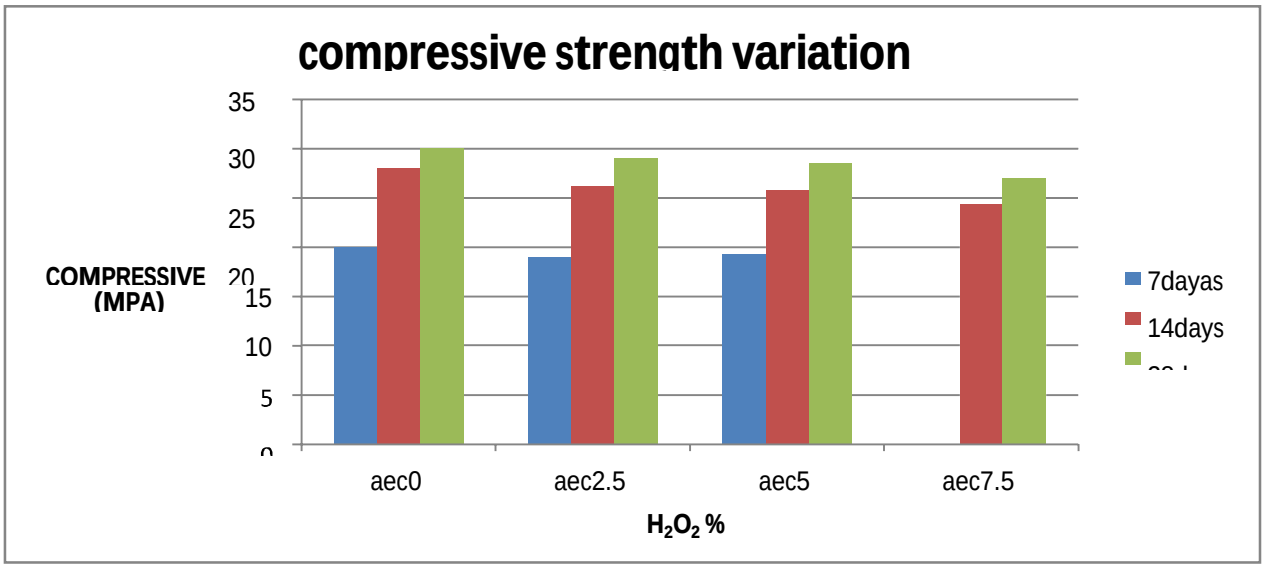


Figure 1

Table 1

S.No.	Specimen	7 days	14 days	28 days
1.	AEC-0	20	28	31
2.	AEC-2.5	18.9	26.1	29
3.	AEC-5	19.23	25.65	28.5
4.	AEC-7.5	-	24.3	27

Graph 1



B. Workability (IS 1199-1959)

Slump cone testing performs the workability of concrete according to IS 1199-1959. M20 mix design of concrete is evaluated using slump cone apparatus for this fresh property test. First, the concrete is filled 1/3rd of the height of the mould and tamped in 25 stokes by the tamping rod. Similarly, this method is repeated twice. Then the mould is immediately separated from the concrete by gently and thoroughly lifting it in a vertical direction.

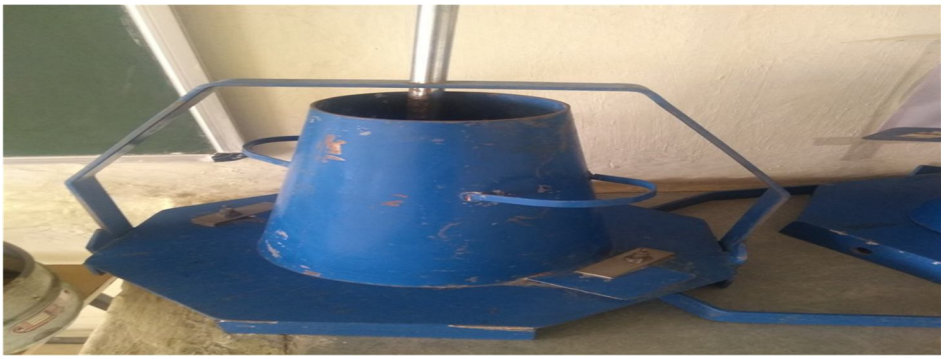
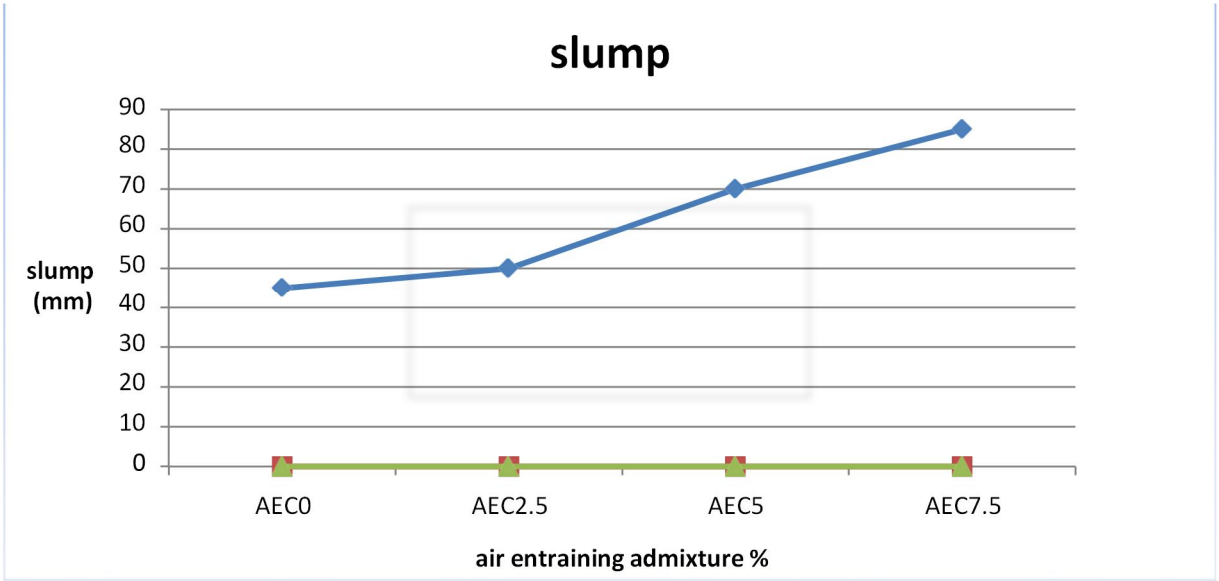


Figure2

S.No.	Specimen	Slump(mm)
1.	AEC-0	45
2.	AEC-2.5	50
3.	AEC-5	70
4.	AEC-7.5	85

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(Graph 2)

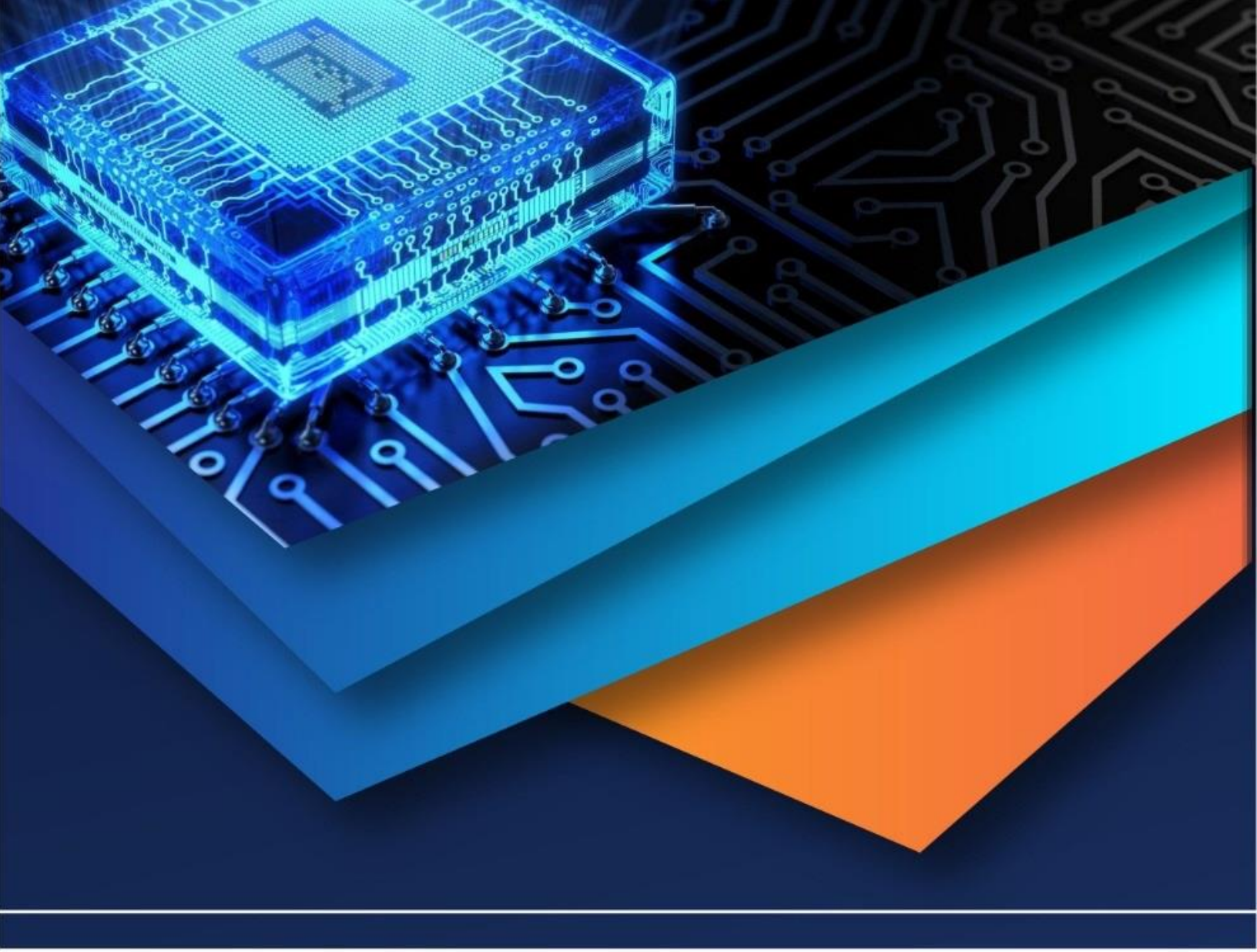
V. CONCLUSION

Observations drawn from the research are listed as following :

1) On enhancing the content of H_2O_2 the density of concrete is gradually lowered.
2) On increment of H_2O_2 water absorption decreases.
3) On enhancing the H_2O_2 content workability of concrete considerably increases.
4) Decrement of compressive strength due to enhancing H_202 content is being observed.
5) Air entrainment concrete enhanced acid attack factor.
6) Weight reduction less in air-entrained concrete and compressive strength reduction also less in airentrainment concrete due to acid dipping.
7) Sulfuric acid is more dangerous for concrete that hydrochloric acid which is obvious due to thelower pH of sulfuric acid.

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