REVIEW PAPER ON EFFECT ON CONCRETE PROPERTIES USING VARIOUS METHODS OF CURING

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Abstract: The properties of concrete, especially the durability are generally influenced by curing. It has effect on the hydration of the cement. Due to technological advancement in curing techniques and introduction of several chemical compounds, a considerable enhancement in the properties of concrete is observed today. Self-Curing agents prove to be suitable in dry regions. In this review paper, effort has been made to understand the working efficiency of various curing methods which are generally adopted in the construction industry**.**

Index Terms - Wrapped Curing, hardened properties, durability, curing compounds and curing efficiency.

I. INTRODUCTION

In present phase, concrete has proved itself to the most important element in construction. Therefore the portion of concrete is an important factor for strength and durability. Concrete is the extensively used man made material in the world. It has been used for construction of pavement, dam, bridges, building, tunnels etc. In 1999, Lambert Co-operation attempted to introduce that concrete curing is the treatment of newly placed concrete during the period in which it is hardening, so that enough is retained so that it can reduce cracking and shrinkage. It is recognised that curing is the most essential part in obtaining the desired structural and durability properties of concrete. Two main categories of curing of concrete are: those that maintain availability of water and those that minimize the loss of mixing water from concrete by sealing its exposed surfaces. The availability of curing materials, the size and shape of structure, environmental conditions etc. are necessary in judging which curing method will be suitable to adopt. Traditionally, quality of concrete in construction work is calculated in terms of its 28 days compressive strength. If after 28 days, the quality of concrete is found to be dubious, it would have been buried by subsequent construction.

II. LITERATURE REVIEW

Most of the researches have worked in publishing their work in comparison of different curing method on the compressive strength of concrete. The observation, methodology, conclusions and further scope of work are used to finalise the objectives of present work.
The available literature of review is as follows:

A.S.Thakare(2016) this paper presents the comparison between the Self Cured Concrete and Conventionally Cured Concrete. This work includes the Designing, Casting and Testing of Cubes, Beams, and Cylinders of various grade of concrete [M20 to M40]. Now a day's most of the region are facing scarcity of water, lack of good workmanship. There are various method of curing in whichwater is the necessary thing for curing, but due to deficiency of available water this type of water curing method are not favorable for arid region mostly, this methods are also Uneconomicalas various point of view. The aim of this paper is to apply another method of curing to overcome mentioned problems and after applying such method we used to compare the result. The various set of Cube, Beam and Cylinder was cast for different grades, water curing method and self-curing method by using plastic sheet we use to take different grades, after done all this procedure we used to compare results for both. The result reveals that Self Cured Concrete maintained higher strength till 14 days as compared to Conventionally Cure Concrete but after 28 days both results are reached up to their Target Strength.

Obam (2016) Different methods are usually adopted to cure concrete. Concrete strength partly depends on the method and duration of curing. The structural use of concrete depends largely on its strength, especially compressive strength. This study uses three curing methods to determine their effects on the compressive strength and density of concrete. These methods are immersion of concrete cubes in curing tank (Ponding), covering of cubes with wet rug (Continuous wetting) and the use of polythene sheet (Water-barrier). Laboratory experimental procedures were adopted. A total of sixty (60) cubes were cast with 1:2:4 mix ratios. The cubes

were cured in the laboratory at room temperature. The results showed that the average compressive strength values for 28-day curing vary with curing methods. The cubes cured by immersion have an average compressive strength of 29.7 N/mm2 while the ones cured by wet rug and polythene sheet have average compressive strength of 26.8 and 24.7 N/mm2 respectively. The traditional curing by immersion appeared to be the best method to achieve desired concrete strength.

B.MOHAN (2016)In this study strength parameters of self-compacting concrete, self-curing concrete, Self-compacted self-curing concrete M20 and M25 grade are compared with Conventional Concrete. Mechanical properties of the concrete specimens such as compressive strength, and flexural strength are to be performed. Self-compacting concrete describes concrete with the ability to compact itself by means of its own weight the requirement for vibration. It is proved to fill all recesses reinforcement spaces and voids even in highly reinforced concrete members. Self- compacting concrete incorporating self-compacting agents have been studied and tests are performed using self-compacting agents. The Self-curing of concrete is for maintaining satisfactory moisture content in concrete during its early stages in order to develop the desired properties. The concept of self-curing agents is to reduce the water evaporation from concrete and hence increase the water retention capacity of the concrete compared to conventional concrete. The chemical admixtures used in this study are complots SP-430 for self-compacting concrete and polyethylene glycols (PEG) 600 as self-curing agents. The mechanical properties are found by testing the casted specimens such as cubes and beams of standard sizes for varying proportions. The parameters that very are fly-ash as 10%, 20% and 30%. The percentage of conplast SP-430 and self-curing agents is kept constant as (0.9%)with reference to literature studies. The objective of this study is to compare the mechanical properties of self-compacting concrete, self-curing concrete, self-compacted self-curing with conventional concrete.

A self-curing concrete is provided to absorb water from atmosphere from air to achieve better hydration of cement in concrete. It solves the problem that the degree of cement hydration is lowered due to no curing or improper curing, and thus unsatisfactory properties of concrete. The self-curing agent can absorb moisture from atmosphere and then release it to concrete. The self-curing concrete means that no curing is required for concrete, or even no any external supplied water is required after placing. The properties of this self-cured concrete of this invention are at least comparable to and even better than those of concrete with traditional curing.

Mr. Ram Lohar(2016) Self-curing is done in order to fulfill the water requirements of concrete whereas self-compacting concrete is prepared so that it can be placed in difficult positions and congested reinforcements. This investigation is aimed to utilize the benefits of both self-curing as well as self-compacting. The present investigation involves the use of self-curing agent viz., polyethylene glycol (PEG) of molecular weight 400 (PEG 400) for dosages ranging between 0.1 to 1% by weight of cement added to mixing water. Comparative studies were carried out for compressive strength for conventional SCC and self-cured SCC. The optimum dosage of PEG-400 for maximum strength was observed to be 1%. It were observed that increase in dosage of PEG shows that also increases strength of SCC

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GeetKalra (2016) as the construction industry is flourishing day by day, modelling techniques are becoming more and more important in making predictions. Artificial neural network is one of the techniques through which these predictions can be made with limited errors.This research paper deals with the prediction of the compressive strength of concrete using artificial neural network (ANN). The parameters under consideration were different grades of concrete (M-20 and M-30), different curing techniques that are commonly used during the construction of a building (sprinkling, ponding etc.), duration of curing and ageing of the concrete block samples (cubes and cylinders). These parameters were given as input to train the network for the output compressive strength obtained experimentally. Different weights were obtained for the network layer which were used for getting the target value. The network formed was validated for the compressive strength of concrete for the required sample by giving inputs and obtaining the desired output. The network formed can help in estimating the in situ compressive strength of concrete and thus can help designers in designing appropriate structural elements.

Nuruddeen Usman (2015) there are a lot of arguments on which method of curing concrete gives good strength. These different opinions results into this study, which aim at investigating the effects of different curing methods on the strength of concrete. Laboratory test was employed for this study. Normal concretes were prepared using specified mix ratio of 1:2:4 and 1:3:6. The cubes tested for compressive strength at 3, 7, 21, and 28 days of curing respectively using four curing methods namely immersion, sprinkling, polythene sheeting and sharp sand coating. Testing indicate that water immersion curing method as well as sprinkling (spraying) methods of curing, provide better results than membrane (polythene sheeting) method of curing. While sharp sand gives least strength. The rate of drying was significant when the specimens were subjected to curing with polythene sheet method of curing. This thus hampered the hydration process and thus affected the compressive strength property of the hardened concrete. The overall findings of this study suggests that concrete should be cured by water immersion or spraying regularly to achieve a better compressive strength in concrete.

Dr. Pamnani Nanak J.(2015) Self-Compacting Concrete (SCC) is highly workable concrete with high strength and high performance that can flow under its own weight through restricted sections without segregation and bleeding. SCC is achieved by

reducing the volume ratio of aggregate to cementitious materials, increasing the paste volume and using various viscosity enhancing admixtures and superplasticizers. It is observed that the behaviour of the design concrete mix is significantly affected by variation in humidity and temperature both in fresh and hardened state. In this paper effect of few water-based curing techniques on shear strength of M30 grade self-compacting concrete (M30SCC) is discussed and compared with shear strength of normal vibrated concrete of same grade (M30NVC). It is concluded that although pond immersion method is best for curing, Sea water and wet covering curing can deliver more than 83% shear strength compared to immersion method. It can be observed that shear strength of M30SCC is more than M30NVC in all the curing techniques.

Tae-KyunKim(2015), the manifestation of global warming-induced climate change has been observed through super typhoons, heavy snowfalls, torrential rains, and extended heat
waves. These climate changes have been occurring all over the world and natural disasters have caused severe damage and deterioration of concrete structures and infrastructure. In an effort to deal with these problems due to extreme and abnormal climate changes, studies have been conducted to develop construction technologies and design guidelines. Nevertheless, study results applicable to construction sites continue to be ineffective and insufficient. Therefore, this study proposes ways to cope with climate change by considering the effect of concrete curing condition variations on concrete material performance. More specifically, the 3-, 7- and 28-day compressive and split tensile strength properties of concrete mix cured under various climatic factors including temperature, relative humidity, wind speed, and sunlight exposure time were evaluated to determine whether the concrete meets the current design requirements. Thereafter, a performance based evaluation (PBE) was performed using satisfaction probabilities based on the test values to understand the problems associated with the current mix proportion design practice and to identify countermeasures to deal with climate change-induced curing conditions.

Mark Bediako(2015) Curing of cement based products such as concrete and mortar, is very important to achieve good strength and durable products. However the curing environment plays a pivotal role in the overall quality of cement based products in terms of strength development. ASTM C192 allows moist curing either in a fog room or under water. However, these must meet ASTM C511 which controls temperature, and specifically for water curing, the concentration of calcium ions in the curing solution. Unfortunately in many parts of the world, water curing literally means curing in tap water. This is done primarily because there is a lack of knowledge or ignorance regarding the mobility and roll of calcium hydroxide in the curing process. To illustrate the differences, in this study, straight ASTM Type I/II Portland cement and that mixed with powdered waste clay bricks as a cement extender were used to prepare two different batches of mortars. The chemical properties of the powdered waste clay brick met the ASTM C618 standard specifications for Class N pozzolans. Both mortar specimens were cured under two different environment comprising of either water and lime saturated water. Mortar specimens were tested for compressive strength at 3, 7, 14 and 28 days of either curing conditions. Test results indicated that mortar specimens cured in lime saturated water obtained higher strength than those cured in fresh water at all ages of curing. Statistical inference drawn from ANOVA testing showed that curing conditions had significant impact on strength development of the blended and unblended cement systems. The study recommends that testing of concrete and mortar samples and other research related works be performed in lime saturated water other than fresh water.

AbdulkadirCüneyt Aydin (2015) In this paper an attempt has been made to study the use of micro-silica on the properties of self-ompacting-concrete (SCC) such as compressive strength, splitting tensile strength, flexural strength, ultrasonic pulse velocity (UPV) and micro-hardness when exposed to different atmospheric steam curing temperatures. The influence of micro-silica as partial replacement of cement on the properties of SCC is investigated. In this study, mixes were prepared with three percentages of micro-silica ranging from 5% to 10% and one controlled mixture without micro-silica was also prepared for comparison. The specimens of each concrete mixture were heated upto different temperatures (65◦C, 70◦C and 75◦C). The variables included were the temperature effects (65◦C, 70◦C and 75◦C) using Cem I 42.5. SCC mixes enhanced atmospheric steam curing compressive strength ranging from 29.20 to 38.50 MPa, flexural strength ranging from 4.95 to 6.56 MPa and splitting tensile strength ranging from 1.18 to 1.63 MPa. Test results clearly show that there is little improvement in the compressive strength within temperature range of 70◦C as compared to 65 and 75◦C, although there is little reduction in splitting tensile strength ranging from 65 to 75◦C and with the increase in percentage of microsilica. However, the rate of splitting tensile strength and flexural strength was higher than that of the compressive strength at elevated temperatures and with the increase in percentage of microsilica. In this paper, scanning electron microscopic (SEM) observations were also made to explain the observed residual compressive strength increase between 65◦C, 70◦C and 75◦C.

B. Siva Konda Reddy(2014) Concrete is the most widely used man-made building material on the planet. The reaction of OPC with water results in hydration products, which glue the reacting cement particles together to form a hardened cement paste. When cement & water are mixed with sand and coarse aggregate the resulting product is called concrete. Till now potable water is used for mixing different ingredients of concrete. This paper finds new method of using this potable water by magnetizing which can be used in mixing and curing of concrete. Strength tests conducted on this magnetic water concrete (MWC) showed encouraging results and one can easily replace normal water with magnetic water for mixing and curing of concrete.

Chithra S.(2014)Cement production became an intense energy consumptive activity which produces green house gases and finding a suitable substitute is an important research task in the present scenario. It is also to be noted that temperature also plays a vital role in rate of strength gain. Hence in this paper an attempt has been made to study the effect of thermal curing on strength characteristics of GGBFS based concrete. Concrete with characteristic compressive strength of 20 MPa was chosen for the present study. Concrete specimens were cast with 20%, 30% and 40% replacement of cement with GGBFS and were cured under different curing conditions like hot water and hot air oven. The specimens were exposed to three different temperatures, namely 40°C, 50°C and 60°C for four hours in hot water curing. Compression test and split tensile test were conducted on concrete cubes and cylinders

respectively. From the results it was inferred that higher percentage replacement of cement with GGBFS yielded considerable increase in both tensile and compressive strength of the resulting concrete. It was found that replacement of cement with 40% of GGBFS under hot water curing at 60°C temperature has yielded maximum compressive and tensile strength of concrete.

GnanaVenkatesh. (2014)This experimental work was carried out to investigate the effect of concrete strength in terms of compressive and split tensile strength of normal strength M20and medium strength M40 grade concrete by adopting Immersion curing, Wet gunny bags curing and Accelerated warm water curing as per 10262:1999, IS 9031:1978. Traditionally, quality of concrete in construction works is calculated in terms of its 28 days compressive strength. If after 28 days, the quality of concrete is found to be dubious, it would have considerably hardened by that time and also might have been buried by subsequent construction. What is essentially needed for assessing quality of controlled concrete is an acceptance test which can supply results, within about 24 hours after casting. With the assistance of reliable test methods employing accelerated curing techniques, it is now possible to test the compressive strength of concrete within a short period and thereby the test results of compressive strength and split tensile strength having good agreement with the specified strength at 28 days.

YashNahata(2014) Advancements in construction and chemical industry have paved a way for development of new curing techniques. Significant amount of research has been conducted to evaluate curing effectiveness and its effect on various concrete properties. This paper synthesizes findings from the literature review and experimental investigation carried out as per ASTM standards to evaluate the compressive strength of mortar cubes at 28 days, effect on strength with the application of different curing compounds and methods of structural grade mortar mixes with cement: sand ratio 1:2.75 and varying water/binder ratio between 0.45to 0.60, using field sand, ASTM graded sand and OPC, finally comparing the results of compressive strength of different curing mechanisms.An effort has been made here, to understand the efficiency of curing methods adopted and are compared with conventional water curing. Results indicate that, using Membrane curing compounds, an efficiency of 80-90% can be achieved as compared to Conventional water Curing.

Aliu Adebayo Soyingbe (2013) This study considered the effect of different methods of curing on density and compressive strength of concrete. Concrete cube specimens of mix 1:2:4 were prepared with water-cement ratio of 0.65. The cubes were cured using six methods (air curing, water-submerged curing, spray curing, polythene curing, moist sand curing and burlap curing) until testing ages of 3, 7, 14, 21 and 28 days when their densities and compressive strengths weredetermined. The results showed that densities of the specimens ranged from 2432.59 to 2502.72 Kg/m3. Also, moist sand curing method produced concrete specimens with the highest 28-day compressive strength of 30.5N/mm2 followed by the burlap curing method with a value of 24.4N/mm2. Air curing method showed a 15% reduction in strength after 21-days thereby resulting in the lowest 28-day compressive strength of 17.8 N/mm2. It was concluded that there exists a weak positive correlation between density and compressive strength of concrete specimens.

Dr. K.V.KrishnaReddy(2013) Efficient uninterrupted curing is the key to quality concrete. Proper curing of concrete is crucial to obtain design strength and maximum durability. The curing period depends on the required properties of concrete, the purpose for which it is to be used, and the surrounding atmosphere namely temperature and relative humidity. Curing is designed primarily to keep the concrete moist, by preventing the loss of moisture from the concrete during the period in which it is gaining strength. Curing may be applied in a number of ways and the most appropriate means of curing may be dictated by the site or the construction method. The present paper is directed to evaluate effectiveness of different curing methods and study the influence of climate on the strength properties of concrete.

Nirav R Kholia(2013) The properties of hardened concrete, especially the durability, are greatly influenced by curing since it has a remarkable effect on the hydration of the cement. The advancements in the construction and chemical industry have paved way for the development of the new curing techniques and construction chemicals such as Membrane curing compounds, Self-curing agents, Wrapped curing, Accelerators, Water proofing compounds etc. With the growing scale of the project conventional curing methods have proven to be a costly affair as there are many practical issues and they have been replaced by Membrane curing compounds and Self-curing agents up to some extent as they can be used in inaccessible areas, Vertical structures, Water scarce areas etc .It is most practical and widely used curing method. In this review paper effort has been made to understand the working and efficiency of curing methods which are generally adopted in the construction industry and compared with the conventional water curing method.

T. James (2011) Different curing methods are usually adopted to evaluate the compressive strength of concrete. This study reports the laboratory results of the effect of curing methods on the compressive strength as well as the density of concrete. A total of 72 cubes of mix ratio 1:2:4 were investigated after subjecting them to various curing conditions, with the aim of finding which of the curing method is best. The cubes were cured in the laboratory at an average temperature of 28°C (82.4°F). The results obtained showed that the average compressive strength values for 7, 14, 21 and 28 days, vary with curing methods. The results show that ponding had the highest compressive strength and density, followed by wet covering, sprinkling,then uncured for two days, with the totally uncured cubes having the least compressive strength and density as well as highest shrinkage limit. Ponding method of curing was recommended to be the best of all the curing methods.

K. Vijai (2010) In order to address environmental effects associated with Portland cement, there is need to develop alternative binders to make concrete. An effort in this regard is the development of geopolymer concrete, synthesized from the materials of geological origin or by product materials such as fly ash, which are rich in silicon and aluminum. This paper presents results of an experimental study on the density and compressive strength of geopolymer concrete. The experiments were conducted on fly ash based geopolymer concrete by varying the types of curing namely ambient curing and hot curing. The ratio of alkaline liquid to fly ash was

fixed as 0.4. For all the samples the rest period was kept as 5 days. For hot curing, the temperature was maintained at 60oC for 24 h in hot air oven. The compressive strength test was conducted for each sample and the results showed that there is an increase in compressive strength with the increase in age for ambient cured specimens. For hot cured samples the increase in compressive strength with age was very less as compared to that of specimens subjected to ambient curing. The density of geopolymer concrete was around 2400 kg/m3 which is equivalent to that of conventional concrete.

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