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# Behavior of Self Curing Concrete with Recycled Coarse Aggregate

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***Abstract: Concrete curing plays an important role in the development of the fine structure of concrete and pore structure, thus improving its durability and performance. Since water has become a scarce item every day, there is an urgent need to undertake research work in the provision of water for the manufacture of concrete. Concrete curing is very important to maintain the moisture content of the concrete in its early stages in order to develop the required properties. Good curing is not always practical in many cases, and the weight of the concrete increases weight on the structure. The design of heavy load structures is therefore not economic. Importantly, an attempt was made to develop self-treated concrete using water soluble polyethylene (PEG 400) as a self-curing agent and replacement of coarse aggregate with recycled coarse aggregate. The main objective of this study is to study the properties of concrete strength (M20 and M25) using water soluble polyethylene (PEG 400) as a self-curing agent and to find the optimal dose required for maximum strength. The self-curing function reduces water evaporation from the concrete and thus increases the water retention capacity of the concrete and absorbs water from the atmosphere.***
***Keywords: Self curing agent (peg400), recycled coarse aggregate***

## I. INTRODUCTION

From the most recent two decades, solid innovation experiencing fast improvement. In the previous couple of decades, inward curing of cement has picked up ubiquity and is consistently advancing from research centre to field of training. Relieving of cement assumes a noteworthy job in building up the quality and hardness of solid, which prompts its improvement in sturdiness and execution. For all intents and purposes great curing isn't at all feasible much of the time due to the non accessibility of good quality water and furthermore because of useful challenges.

Numerous inquires about worried to distinguish powerful self curing specialist to take care of those water issues and sparing of water. Hence, a few looks into are pulled in towards recognizing oneself relieving specialist. One of oneself relieving specialist is polyethylene glycol which diminishes the surface pressure of the water and limits the water dissipation from cement and subsequently builds the water maintenance limit of the solid. It has been discovered that water dissolvable polymers PEG can be utilized as self curing operators in cement. Internal relieving was initially characterized by the American solid organization (ACI) as "providing the all through a naturally set cementations blend utilizing supplies, by means of pre wetted lightweight aggregate, that promptly discharge water as required for hydration or to supplant dampness lost through dissipation or self drying up." In this examination ideal dose of PEG-400 required to get quality properties without including any mineral or synthetic admixtures and how the impact of self curing operator in cement was explored.

The rapid population growth rate in India has forced the construction industry to use building materials at a rapid rate, leading to the depletion of natural resources and also a significant impact on the environment causing many risks either directly or indirectly such as river depletion due to mining on the sand being Alarming and so on.

On the other hand, the rapid growth of industries in India has led to many types of waste. But waste products from these industries pose environmental risks as disposal is a major problem. Over time, waste management has become one of the most complex and challenging problems in India.

In concrete, cement with water is a binding phase, while the overall phase is essentially a filler phase that occupies about 75% of the total concrete volume, which amounts to about 28 to 40% of that volume.

The main source of fine aggregates is typically the river sands that are normally available in the construction of buildings, bridges, dams and solid pavements, as fillers at sub-levels, sub-bases for flexible pavements and in all other important structures in civil engineering.

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Concrete aggregates that occur naturally are a mixture of rocks and minerals. Metal is a solid material that occurs naturally with a structured internal structure and a narrow chemical composition. Rock, classified as a fire, sedimentary or mutation, depending on the origin, consists of several minerals. For example, granite contains quartz, feldspar, mica and some other minerals; most limestone consists of calcite, dolomite and small amounts of quartz, feldspar and clay.

Weathering and rock erosion produce particles of stone, gravel, sand, silt and clay. This formation of concrete aggregates is a natural process involving years of processing due to the disintegration of rocks and rocks in the mountains. Due to the abnormal development of infrastructure in recent years resulting in overheating construction, a huge amount of aggregates is consumed. This has led to a sharp rise in the demand for concrete rubble as construction materials have increased their cost and thus the cost of the capital project.

## II. SELF CURING

The ACI-308 code states that "internal processing refers to the process in which the cement moisturization occurs due to the availability of additional internal water that is not part of the mixing water." Internal treatment is often referred to as self-treatment. Self-treated concrete can be achieved by adding self-curing agents. The concept of self-treatment agents is to reduce evaporation of water from concrete and thus increase the water retention capacity on concrete. Water-soluble polymers have been found to be used as self-treatment agents in concrete. Concrete treatment plays a key role in the development of the fine structure of concrete and pore structure, thus improving its durability and performance.

### *A. Priciple of Polyethelyn Glycol-400*

Whenever the self-treatment agent is added to the concrete, it will interact with the water in the concrete and form a hydrogen bond. During the moisturizing process, the self-treatment agent attracts water molecules and will reduce water evaporation from the concrete and increase water retention capacity**.**

### *B. Recycled Aggregate*

The trend of replacement of natural aggregates with various industrial waste is increasing. In fact, growing environmental awareness has contributed significantly to concerns about the disposal of industrial waste. Solid waste management is one of the major environmental concerns in the world. The scarcity of natural aggregates is also one of the main concerns that the use of waste has become an attractive alternative to disposal. Research on the use of waste in concrete is conducted as a partial replacement of natural aggregates. Reuse of huge waste is the best environmental alternative to solve the disposal problem.

The use of recycled aggregates from construction and demolition waste demonstrates the potential application of construction as an alternative to natural aggregates. Maintains natural resources and reduces the area needed for landfill disposal. Any construction activity requires many materials such as concrete, steel, bricks, stone, glass, clay, clay, wood etc. However, concrete cement is still the main building material used in construction industries. For their suitability and adaptability to the changing environment, must be so tangible that resources can be conserved, environmental protection and the economy conducive to the proper use of energy. To achieve this, the use of waste and by-products in cement and concrete used in new construction should be highly concentrated.

The main reasons for increasing the volume of demolition of concrete / construction waste are as follows:

*1)* Many old buildings, concrete pavements, bridges and other buildings have passed through the ages and have been reduced due to structural deterioration after repairs and need to be demolished;
*2)* Structures, even adequate for use, are susceptible to demolition because they do not meet the needs in the current scenario;
*3)* New building to improve economic growth.
*4)* The structures are converted into debris caused by natural disasters such as earthquakes, hurricanes, floods, etc.
*5)* Construction waste resulting from man-made disaster / war.

The following are the objectives of the study:

*a)* Properties to study the properties of concrete strength using water-soluble polyethylene glycol as a self-curing agent.
*b)* To find the optimal dose of PEG-400 required for maximum strength of the concrete.
*c)* strength to study the strength properties of self-curing concrete with the replacement of Normal coarse aggregate with recycled coarse aggregate
*d)* Results Comparison of self-curing concrete results with conventional concrete results.

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Properties of Materials

| S No. | Material | Property | Value |
|---|---|---|---|
| 1 | Cement | Grade | 53 Grade |
| | | Specific Gravity | 3.15 |
| | | Fineness | 3.43 |
| | | Consistency | 32% |
| | | Initial Setting Time | 32 min |
| 2 | Fine Aggregate | Specific Gravity | 2.58 |
| | | Fineness Modulus | 3.2 |
| | | Dry Density | 1677kg/m3 |
| 3 | Recycled Coarse Aggregate | Specific Gravity | 2.67 |
| | | Fineness Modulus | 5.85 |
| | | Dry Density | 1670kg/m3 |
| 4 | PEG-400 | Specific gravity | 1.12 |

## III. RESULTS

### *A. Compressive Stength*

The compressive strength of the concrete samples was determined in 7 days and 28 days. The sample size 150 x 150 x150 mm was used in this study as the largest symbolic size of the total not exceeding 20 mm. The compressive strength of the concrete samples was determined in 7 days and 28 days. It was observed that M25 GRADE of concrete increased PEG content, increased compressive strength by 0.5% and then decreased. The maximum compressive strength at PEG was reached at 0.5% of the weight of the cement. The reason is that 0.5% of PEG was sufficient to fully moisturize to obtain strength and maintain water content in concrete without evaporation. Concrete strength of the PEG ratio was reduced by more than 0.5%. If the PEG is more than 0.5, you can create concrete voids and reduce concrete strength.

The addition of excess water is similar to concrete. We know whether the water content increases the strength of concrete will reduce. Compared with conventional concrete, self-treated concrete gives a 5.8% greater strength for 28 days.

And for the M20 concrete, the higher the PEG content, the compressive increased by 0.75% and then decreased. Compared with conventional concrete, self-treated concrete gives 1.48% greater strength for 28 days.

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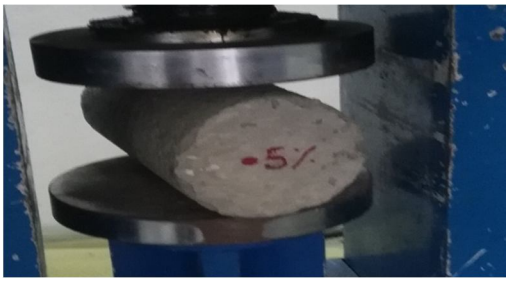
### *B. Split Tensile Stength*

The tensile strength tests were performed on 150 mm diameter, 300 mm height in 7 days and 28 days. The tensile strength of concrete samples was determined after 7 to 28 days. It was observed that for M25 of concrete, the higher the PEG content, the tensile strength of the tensile force increased to 0.5% and then decreased. The maximum tensile force in PEG was achieved at 0.5% of the weight of the cement. The reason is 0. 5% of the PEG was sufficient to completely moisten to obtain strength and maintain the water content in the concrete without evaporation. Concrete strength of the PEG ratio was reduced by more than 0.5%. If the PEG is more than 0.5, you can create concrete blanks and reduce concrete strength.

The addition of excess water is similar to concrete. We know whether the water content increases the strength of concrete will reduce. Compared to conventional concrete, self-treated concrete gives 3% greater strength for 28 days.

And for the M20 grade concrete, the higher the PEG content, the pressure increased by 0.75% and then decreased. Compared to conventional concrete, self-treated concrete gives a greater strength of 5.45% for 28 days.




### *C. Flexural Strength*

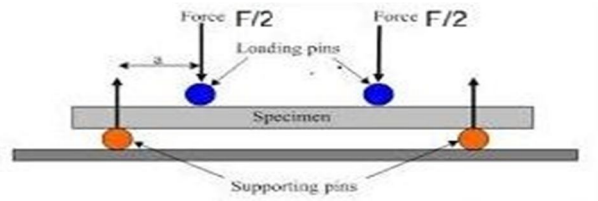
The bending strength of self-curing concrete beams was obtained by bending test on 100x100 x 500 mm samples by two-point loading method. The bending strength of the concrete samples was determined after 7 to 28 days. It was observed that for M25 grade of concrete the higher the PEG content, increase the flexural strength PEG by 0.5% and decreased. The maximum bending strength of PEG was achieved by 0.5% of the weight of the cement. The reason is that 0.5% of PEG was sufficient to fully hydrate to obtain strength and maintain the water content in the concrete without evaporation. Concrete strength of the PEG ratio was reduced by more than 0.5%. If the PEG is more than 0.5, you can create concrete blanks and reduce concrete strength. The addition of excess water is similar to concrete.

We know whether the water content increases the strength of concrete will reduce. Compared with conventional concrete, self-treated concrete gives **6.1%** more strength for 28 days.

And for the M20 grade of concrete, the higher the PEG content, the pressure increased by 0.75% and then decreased. Compared to conventional concrete, self-treated concrete gives 4.9% greater strength for 28 days

M20 Grade of Concrete

| S.NO | PEG-400(%)with RCA | SLUMP(mm) | Compressive strength(MPA) | | Split tensile strength MPA) | | Flexural strength (MPA) | |
|---|---|---|---|---|---|---|---|---|
| | | | 7 days | 28 days | 7 days | 28 days | 7 days | 28 days |
| 1 | 0 | 90 | 16 | 27 | 1.4 | 2.2 | 2.3 | 3.03 |
| 2 | 0.5 | 97 | 16.3 | 28.7 | 1.5 | 2.23 | 2.4 | 3.1 |
| 3 | 0.75 | 105 | 15.8 | 27.4 | 1.7 | 2.32 | 2.55 | 3.18 |
| 4 | 1 | 110 | 15.66 | 25.3 | 1.45 | 2.3 | 2.23 | 2.9 |

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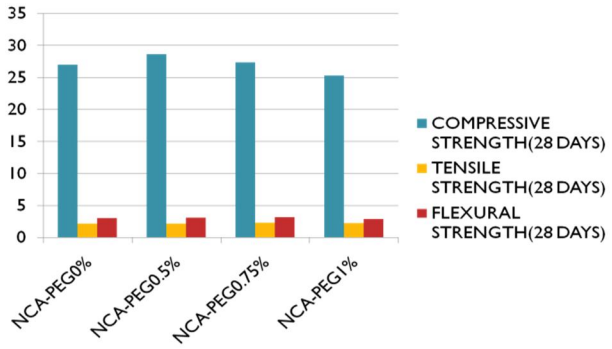
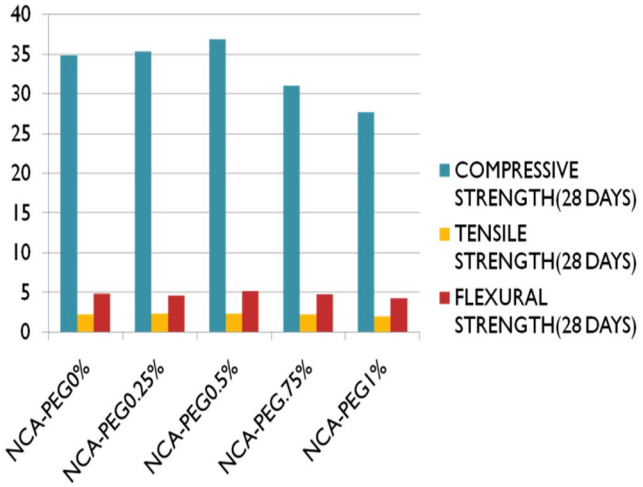



M25 Grade of Concrete

| S.NO | PEG-400(%) | SLUMP(mm) | Compressive strength(mpa) | | Split tensile strength(mpa) | | Flexural strength (mpa) | |
|---|---|---|---|---|---|---|---|---|
| | | | 7 days | 28 days | 7 days | 28 days | 7 days | 28 days |
| 1 | 0 | 75 | 21.26 | 34.9 | 1.81 | 2.3 | 3.8 | 4.9 |
| 2 | 0.25 | 84 | 20.99 | 35.37 | 1.83 | 2.32 | 3.5 | 4.6 |
| 3 | 0.5 | 100 | 20.03 | 36.95 | 1.85 | 2.37 | 4.3 | 5.2 |
| 4 | 0.75 | 105 | 19.2 | 31.06 | 1.79 | 2.28 | 3.4 | 4.8 |
| 5 | 1 | 115 | 16.23 | 27.76 | 1.66 | 2.01 | 3.2 | 4.3 |




## IV. CONCLUSION

*A.* The optimum dose of PEG-400 was found to obtain maximum compressive strength, tensile strength and bending strength of 0.5% of cement weight to the M25 level of concrete.

*B.* The optimal dose of PEG-400 was found to obtain the maximum compressive strength, tensile strength and bending strength of 0.75% of the cement weight to the M20 level of concrete.

*C.* The strength of self-curing concrete is better than conventional concrete.

*D.* The replacement of Normal coarse aggregate with recycled coarse aggregate leads to a decrease in the weight of concrete by 4.36%.

*E.* When compared to conventional concrete, self-curing concrete results in better wetting over time in drying conditions.

*F.* Economically effective concrete of traditional concrete.

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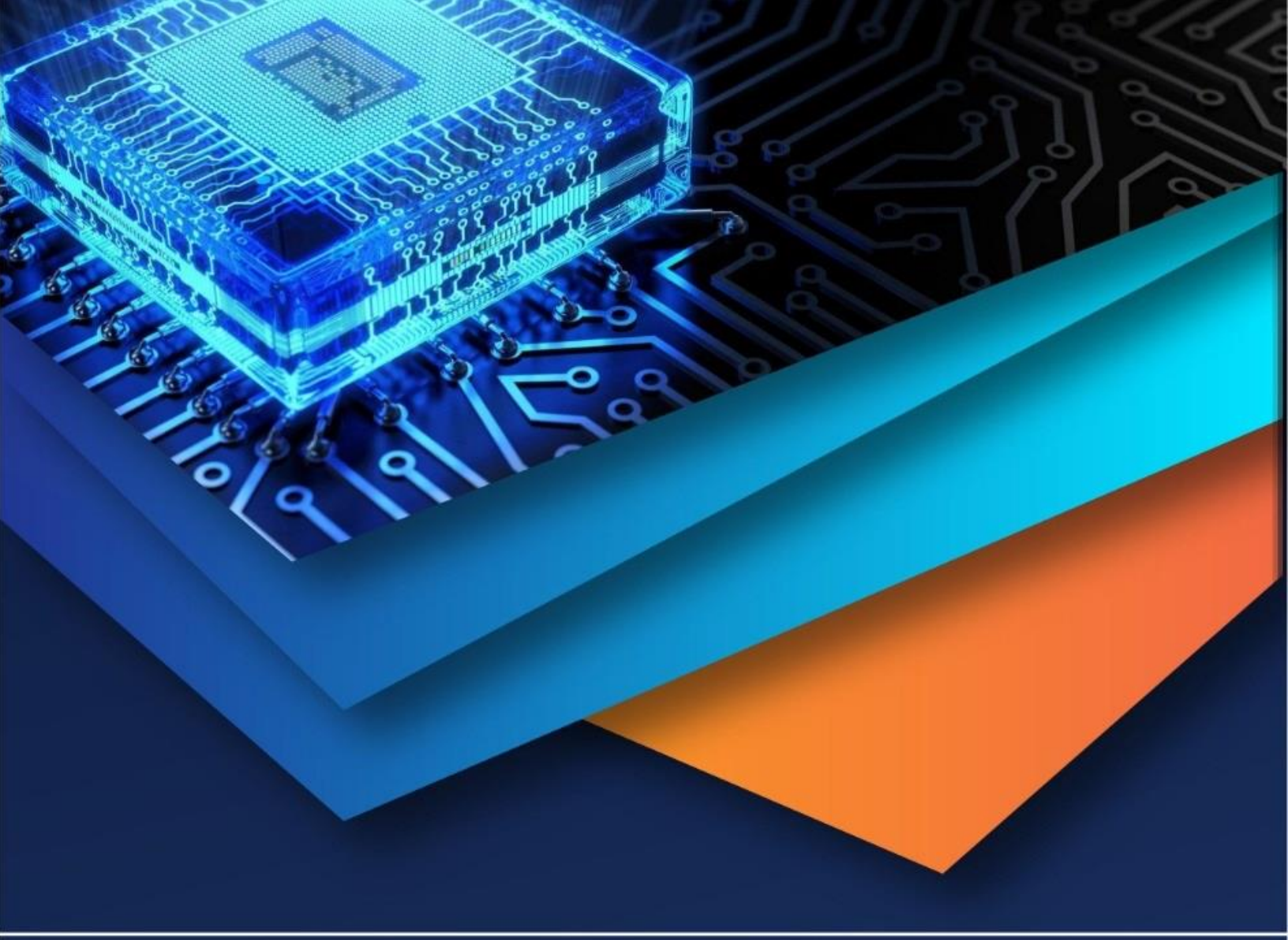

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