Case Study of Self-Curing Concrete

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***Abstract*—for Concrete to reach appropriate Strength and durability, it must be properly cured. Conventional curing technique needs constant supervision and use a lot of water. Proper curing becomes challenging in many places, particularly high-rise construction project and water scare areas. By holding onto internal moisture for cement hydration without the need of external curing, self-curing concrete offers a practical alternative. A thorough case study an evaluation of the literature on self-curing concrete with polyethylene glycol (PEG 400) as an internal curing agent is presented in this work. The study focus on self-curing concrete strength, workability, durability, water retention and sustainability. According to Several Studies adding PEG 400 increase hydration efficiency, reduce Shrinkage cracks and improves compressive strength. Depending on the grade of the concrete the ideal PEG 400 dosage typically Range from 0.5% to 1.5% by weight of cement. Self-curing concrete reduce water consumption and improve construction Quality in difficult environment condition. This paper conclude that self-curing concrete is an economical and sustainable alternative to conventional curing method in modern construction practices**

***Index Terms*—Self-Curing concrete, PEG 400, internal curing, compressive strength, water retention**

I. INTRODUCTION

Concrete has outstanding our standing compressive strength, durability and adaptability make it the most used building material. Proper curing of concrete is essential for maintaining moisture or ensuring complete hydration of cement. Conventional curing method requires large quantity of water and continuous maintenance. Improper curing needs to reduce strength, shrinkage cracks and poor durability. Lack of labour and shortage of water are major barriers to good healing in many developing areas. Self-curing concrete is also known as internal curing concrete, has emerged as an innovative solution to overcome these problems. Self-curing concrete uses internal water retaining agents that provide moisture continuously during hydration.

One of the most frequently used self-curing substances is polyethylene glycol (PEG 400). PEG increases hydration efficiency and lower evaporation losses. Researchers found that self-curing concrete works well in hot weather and in remote structural area.

II. OBJECTIVE OF STUDY

1. To study the idea of self-curing concrete.
2. To examine the effect of PEG 400 on concrete properties.
3. To contrast ordinary concrete with self-curing concrete
4. To determine practical applications and future scope

III. NEED FOR SELF-CUEING CONCRETE

The following issues made self-curing concrete even more in demand

- Water Scarcity in construction industry.
- Improper curing practices
- Difficulty in curing high-rise structures.
- Lack of labour availability.
- Rapid evaporation in hot weather.
- Shrinkage and cracking problem.

Self-curing concrete minimizes relying on outside healing water and improves hydration efficiency.

IV. MATERIALS USED

4.1 Materials

A. Cement

Ordinary Portland Cement (OPC 53) grade.

B. Fine Aggregate
Natural river sand passing through 4.75mm sieve.

C. Coarse Aggregate
Crushed angular aggregate of 20 mm maximum size

D. Water
Impurity-free portable water.

E. Self-Curing Agent
PEG 400 is commonly used due to

- Water retention capability.
- Non – toxicity.
- High Solubility.
- Improved hydration properties

V. MECHANISM OF SELF-CURING CONCRETE

The idea behind self-curing concrete is internal moisture retention. PEG 400 reduces water evaporation and stores water within the concrete matrix. During the hydration, internally retained water becomes available for cement hydration.
The hydration reaction can be represented as:
$2C_3S + 6H \rightarrow C_3S_2H_3 + 3Ca(OH)_2$
Proper hydration increases strength and reduces permeability

VI. METHODOLOGY

The methodology adapted for case study included:

1. Collection of research papers from journals.
2. Study of self-curing mechanism.
3. Comparison of concrete properties.
4. Analysis of compressive Strength data
5. Evaluation of durability performance.

Concrete mixes containing different PEG 400 percentage such as:
0%, 0.5%, 1%, 1.5%, 2%

TABLE I Compressive Strength Values of M40 With PEG 400

M40	0%	0.5%	1%	1.5%	2%
Day 7	28.67	30.09	30.23	31.64	30.46
Day 14	39.61	40.19	41.69	43.00	40.00
Day 28	49.98	51.78	53.20	56.88	50.21

Were compared with conventional concrete.

VII. RESULT AND DISCUSSION

A. Workability
Because of lubricating effect, adding PEG 400 somewhat enhance workability

B. Compressive Strength
Research findings indicate that optimum PEG dosage improves compressive strength.
Typical Compressive strength relation:

$Fc = P/A$
Where:

- Fc = Compressive Strength
- P = Failure Load
- A = Loaded Area

Maximum Strength improvement observed:

- 10% to 18% increases compared to conventional concrete. [1]

C. Durability
Self-curing concrete shows:

- Lower water absorption
- Reduced permeability
- Fewer shrinkage cracks
- Better sulphate resistance

D. Water Conservation
Self-curing concrete significantly reduces external water usage during curing process.

VIII. ADVANTAGES OF SELF-CURING CONCRETE

1. Lower the need for curing of water.
2. Improves hydration process.
3. Minimizes Shrinkage cracks.
4. Suitable for hot weather.
5. Enhances durability.
6. Reduces labour requirement.
7. Eco-friendly construction method.

IX. LIMITATIONS

1. The extra expense for self-curing substances.
2. Limited awareness among contractors.
3. Proper dosage selection required.

4. Availability of admixture may vary.

X. APPLICATIONS

Self-curing concrete can be used in:

- High rise buildings
- Bridge decks
- Pavements
- Water scarcity regions
- Remote construction project
- Industrial structures

XI. FUTURE SCOPE

Future research can focus on:

- Nano-material based self -curing agent
- Hybrid self -curing system
- Use of industrial waste material
- Smart concrete technology

XII. CONCLUSIONS

Self-curing concrete is an inventive and sustainable solution to conventional curing problem. The use of PEG 400 improves internal hydration and improves mechanical durability properties of concrete. Most studies reported optimum performance of PEG dosage between 0.5% to 1.5%. Self-curing concrete minimizes water usage, reduces shrinkage cracking and improves long term performance. It is particularly helpful in areas with limited water resources and complex curing situations. Therefore, self-curing concrete can play a major role in sustainable infrastructure development.

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