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Effective Internal Curing Using Light Weight Aggregates

[1]Prof. Mrs. A. I. Tamboli, [2]Atul, [3]Harish Kasera, [4]Vivek Mangal, [5]Akriti Zutshi, [6].Ashwin tyagi

[1]*ME Structure, Sinhgad Academy of Engineering, Kondhwa (Bk), Pune- 48*
[2'3'4'5'6] *Students, Sinhgad Academy of Engineering, kondhwa (Bk), Pune- 48*

Abstract: *Our topic deals with the concept of concrete technology which includes the study of advanced internal curing by light weight aggregates. As per conventional method, water is provided externally for curing. In conventional type of curing is extensively done in which large amount of water is wasted, so in accordance to this, new technique of internal curing is introduced in which use of pre wetted light weight aggregates is done which provides sufficient moisture to the hydrating cement throughout the cross section of the concrete. These pre-wetted light weight aggregates assures that water is restored in the concrete which would allow the concrete to use the water as per the need.*

Index Terms: *Conventional curing, internal curing, light weight aggregates, LECA*

I. INTRODUCTION

IN this world of urbanization water plays an important role in the curing process, so this internal curing process heads towards the sustainability of precious natural resources. In conventional method of curing as it produces a curing membrane and for curing purpose large amount of water is consumed and wasted.

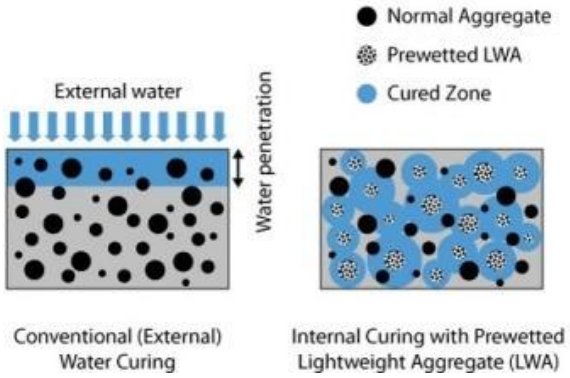
Hence, to stop the overconsumption and maintain the sustainability of water, a modern technique of curing is developed i.e. internal curing of concrete.

Internal curing refers to the use of light weight aggregates to provide sufficient moisture to the hydrating cement throughout the cross section of the concrete. Internal curing is achieved by partial replacement of coarse aggregates to provide sufficient amount of moisture to the hydrating cement and expanded clay aggregates.

The light weight aggregates i.e. clay aggregates and shale aggregates are heated at 1200°C, while using it is soaked into water for almost 24hrs and then mixed with cement and fine aggregates.[1]

The water stored in the pores of light weight clay aggregates are larger than those in a hydrating cement paste, which results in the further movement of water from light weight aggregates to the surrounding cement paste to keep the small pore in saturated condition.

The internal curing process increases the bonding strength between the hydrating cement and light weight aggregates and this process utilizes the cement more efficiently at the time of hydration process.



Internal curing process increases service life or serviceability and improves workability which thus help in reduction in cracks formation due to plastic shrinkage. [2]

The previous work done describes how to optimize the porosity and size of light weight aggregates to achieve the required amount of internal curing, which is expressed by formula

$W = C \times \alpha \times CS$

Where, C is the cement content, α is the heat of hydration and CS is the chemical shrinkage.

It is evaluated that efficiency of light weight aggregates provides internal curing by examining three factors such as-

- Total amount of water in light weight aggregates
- Pore structures of light weight aggregates &
- Spacing [3]

Over here the scientist developed the 3D modeling of microstructure developed in the internal curing phenomenon. [4]
Also, he used similar method to determine the required quantity of light weight aggregates for effective internal curing, also improves the previous work on internal curing.
For internal curing to be effective, no of factors which are need to be considered are mechanical strength, shape and gradation. [4]
This paper explains, the effects of using saturated aggregates in internal curing process and difference in shrinkage between sealed and unsealed condition [5].

II. Material Description

A. ***Review Stage****:- LECA*

LIGHT WEIGHT EXPANDED CLAY AGGREGATES LECA is an acronym term for light weight clay aggregates which is produced in the rotary kiln at 1200°C, leading manufacturers are GBC INDIA Ltd.
Clay aggregates are well known and proven ,high quality and efficient material that can be used anywhere.
Improves the economic, social and environmental performance of a building or infrastructure over its life time.[6]

The environmental aspects of LECA are

- It is recyclable and reusable, there is no problem associated with its disposal and no use of any new material as it is made up of clay,
- Fire resistant property makes the material fully non combustible and has no reaction to fire as it does not emit any type of harm full gases such as CO2, smoke etc.
- Sound insulation as it absorb the noise and suitable in the home as a wall between dwelling and good outside as a barrier between houses and noisy infrastructures.
- Environment protection in terms of leaching from expanded clay, even when in contact with soil, water or rain, it does not emit any type of VOCs (Volatile Organic Compounds) or any type of other dangerous substances.
- Has a never ending life as it is inert in nature, highly resistant towards chemical attack because of its inertness.
- Green concept as it biodegradable and can be used as key element in green building.

B. ***Chemical Properties****:-*

SR.NO.	CHEMICAL PROPERTIES	VALUES
01	Particle shape	Round
02	Specific gravity	1.64
03	Crush resistance	1.79n/mm²
04	Density	772Kg/m³
05	Water absorption	28%

Table 1

C. ***Physical Properties****:-*

- Thermal insulation is about o.09ƛ
- Sound insulation up to 45dB to 46dB
- Lightness means density which varies from 380to 710kg/m³
- Non decomposability
- Water absorption of LECA is about 28% of volume in saturated state during 72 hrs.

III. Application Of Lweca

- Horticulture & Agriculture – helps in retaining the water and supplies that water as and when drought condition arises.
- Water treatment-it is used for waste water facilities for purification of municiple waste water as well as water for drinking purpose.
- Land scaping –it gives an aesthetic look due to its texture eg- rooftop gardens
- Geotechnical fillings – it can reduce earth pressure up to 75% compared with conventional methods, also increasing stability during settlement. [10]

IV. Future Scopes

- As it can reduce the self weight up to 20% it can be preferred in slab casting.
- Prefabricated panels
- Roof casting- reduces dead load
- Pavement design- load compensation on low bearing resistance soil and reduces lateral forces.
- Runways of airport- can be used where there is unstable soil area and it reduces lateral forces to avoid slip, overturning, bearing failure
- Replacement of burnt clay bricks by cellular lightweight concrete blocks
- Drainage- as it provide protection to pipelines[10]

V. Conclusion

- The addition of light weight clay aggregates leads to increase in heat of hydration and thus produce a dense microstructure, which further result in better curing.
- Improved hydration also reduces cracking and as a result lower the shrinkage tendency of concrete with light weight aggregate i.e. clay aggregates used for internal curing process.
- Increase in compressive strength up to 20% as compared to plain concrete.
- Compressive strength results reveal that strength of internal cured specimens at 21 days and 28 days are greater but at the age of 7 days the strength is lower than conventionally cured specimens.[5]

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