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# STUDY OF NEW TECHNIQUE OF CURING "DRIP CURING"

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**Abstract**

"It is said in civil engineering field that water worth Rs.1 saves concrete worth Rs.99 it means a concrete worth Rs.99 if not cured with water worth Rs.1, it is worth less." The concrete and other structures in which cement is used like brickwork, plaster, etc. may not get its required strength due to use lack of water for curing over a specified period. Curing is a most essential for any concrete structure is to perform as per its design function for the designing life of the structure. While excessive use of water in short time, which is not essential may lead to the escalation of the construction cost due to excessive water use. As we know for curing is exothermic reaction hence generated heat can be getting away from concrete by using water. At site water for curing is given by a flexible pipe, throwing water at a high speed due to powerful pumps resulting in waste of water. This watering is done twice or thrice a day, which is very costly. And again due to the high speed requirement of construction, sometimes slabs are casted with a span of 12 to 15 days keeping the formwork of the lower floors as it is. In this case it is not possible to take any risk about strength of structure. The overall aim of this paper is to study the already developed new technique Drip curing by Mr. Abhishek Mandalia in 2016 keeping this in mind that a construction based startup from Ahemadabad has come up with an innovative curing method by which we can save water up to 80%. The water saving using this method is considerably more, with easy to use application method.

***Keywords:*** *Drip curing, compressive strength, water conservation, on site application, total cost.*

## 1. INTRODUCTION

### 1.1Concrete Curing and Purpose

"Curing can be described as keeping the concrete moist and warm enough so that the hydration of cement can continue. More elaborately, it can be described as the process of maintaining a satisfactory moisture content and a favorable temperature in concrete during the period immediately following placement, so that hydration of cement may continue until the desired properties are developed to a sufficient degree to meet the requirement of service." If curing is neglected in the early period of hydration, the quality of concrete will experience a sort of irreparable loss. An efficient curing in the early period of hydration can be compared to a good and wholesome feeding given to a new born baby.Curing is the maintenance of a satisfactory moisture content and temperature in concrete for a period of time immediately following placing and finishing so that the desired properties may develop. The need for adequate curing of concrete cannot be overemphasized. Curing has a strong influence on the properties of hardened concrete; proper curing will increase durability, strength, water tightness, abrasion resistance, volume stability, and resistance to freezing and thawing and deicers. Exposed slab surfaces are especially sensitive to curing.

## 2. TYPES ANDBASIC METHOD OF CURING

(Concrete can be cured mostly using three methods)

I. Methods that maintain the presence of mixing water in the concrete during the early hardening period. These include ponding or immersion, spraying or fogging, and saturated wet coverings. These methods afford some cooling through evaporation, which is beneficial in hot weather.

II. Methods that reduce the loss of mixing water from the surface of the concrete. This can be done by covering the concrete with impervious paper or plastic sheets, or by applying membrane-forming curing compounds.

III. Methods that accelerate strength gain by supplying heat and additional moisture to the concrete. This is usually accomplished with live steam, heating coils, or electrically heated forms or pads.

IV. Also there are various other method are to be used for curing concrete.

**2.1Selection of Method with Fitchure**

The selection of concrete curing method is depending upon Type of Construction and Structure and is Requirement.

**I. Curing of Structure on Flat Ground (Ponding)**

On flat surfaces, such as pavements and floors, concrete can be cured by ponding. Earth or sand dikes around the perimeter of the concrete surface can retain a pond of water. Ponding is an ideal method for preventing loss of moisture from the concrete; it is also effective for maintaining a uniform temperature in the concrete. The curing water should not be more than about 11°C (20°F) cooler than the concrete to prevent thermal stresses that could result in cracking. Since ponding requires considerable labor and supervision, the method is generally used only for small jobs. The most thorough method of curing with water consists of total immersion of the finished concrete element. This method is commonly used in the laboratory for curing concrete test specimens. Where appearance of the concrete is important, the water used for curing by ponding or immersion must be free of substances that will stain or discolor the concrete. The material used for dikes may also discolor the concrete.

**Fig-1: Curing by ponding**

**II. Curing where Ambient Temperature is well above the frizzing point and Humidity is low(Fogging)**

Fogging and sprinkling with water are excellent methods of curing when the ambient temperature is well above freezing and the humidity is low. A fine fog mist is frequently applied through a system of nozzles or sprayers to raise the relative humidity of the air over flatwork, thus slowing evaporation from the surface. Fogging is applied to minimize plastic shrinkage cracking until finishing operations are complete. Once the concrete has set sufficiently to prevent water erosion, ordinary lawn sprinklers are effective if good coverage is provided and water runoff is of no concern. Soaker hoses are useful on surfaces that are vertical or nearly so. The cost of sprinkling may be a disadvantage. The method requires an ample water supply and careful supervision. If sprinkling is done at intervals, the concrete must be prevented from drying between applications of water by using burlap or similar materials; otherwise alternate cycles of wetting and drying can cause surface crazing or cracking.

**Fig-2: Curing by Fogging**

**III. Using Impervious paper or plastic sheet**

Impervious paper for curing concrete consists of two sheets of kraft paper cemented together by a bituminous adhesive with fiber reinforcement. Such paper, conforming to, is an efficient means of curing horizontal surfaces and structural concrete of relatively simple shapes. An important advantage of this method is that periodic additions of water are not required. Curing with impervious paper enhances the hydration of cement by preventing loss of moisture from the concrete. As soon as the concrete has hardened sufficiently to prevent surface damage, it should be thoroughly wetted and the widest paper available applied. Edges of adjacent sheets should be overlapped about 150 mm (6 in.) and tightly sealed with sand, wood planks, pressure-sensitive tape, mastic, or glue. The sheets must be weighted to maintain close contact with the concrete surface during the entire curing period. Impervious paper can be reused if it effectively retains moisture. Tears and holes can easily be repaired with.

**Fig-3: Curing by impervious paper**

**3. BEST AMONG ALL THE CURING DRIP CURING**

As we take information or knowledge from above given description about various different methods of concrete curing like Concrete Curing by ponding, Concrete Curing by Fogging, Concrete curing by Using impervious paper sheet. This technics of curing are old and not Economical for Construction due to its high requirement. And also in some methods such as Use of Gunny Bags and Sprinkling Water which are commonly

use in country like India. Consuming a lot of water and water goes drain. Kipping this in mind the Construction-based startup from the Ahmadabad has come up with innovative curing method that can save up to 80% of water by **Mr. Abhishek Mandalia** employ a unique method known as **Drip Curing** (Curing by drip irrigation).

**3.1 About Drip Curing**

The method takes inspiration from Drip Irrigation System that is used for the agricultural purposes the flow of water controlled so that only the necessary amount of water hence saving large quantity of water. We all notice that there is lot of water wasted during the Curing process witch was not limited up to India, but the country in the middle-east and Africa as well, where the water comes at a price. As we know "It take about half an hour to fill the 1000liter tank with water all witch use to sprinkle continuously over a concrete structure 2 to 3 times in a day. This is story of about small sites but what about in large scale.

There is very much problem of about water for drinking and all other daily need in all country. Very little quantity of water is present on the earth for drinking and we have to save water by using these technique.

**3.2 Working Procedure**

It includes a multi-layared sheet comprising water pocket,

Gunny Bags(Made from jute)and PVC(polyvinyl chloride)

That are tightly bond to each other. Through the PVC film, only the required water trickle down to the concrete while the jute required to cool temperature."Filling the pockets only once in 24 hours, the process is carried forward throughout the day with the water being dripped down through the film. A cubic meter of concrete column requires about 20 litres of water through this method, which equals one bucket and takes only half a minute to fill, compared to the 1000 litre tank,"The sheet can be easily attached to the concrete surface.

Once filled with water, these automatically start with their curing action on concrete. Since the amount of water that is dripped is optimal for curing, the quality and strength of concrete stays perfect.

**Fig-4: Curing by Drip**

**Fig-5: Curing by Drip**

**3.3 Advantages**

I. This method not only save the water but also save energy, labour, time and cost.
II. Saving about five times electricity that is used for pumping water and about 4to5 times labor work.
III. This method also allow for the re-usability, multiple time through the sheet unlikely the Gunny bag that go out off the service after amount is use.
IV. By this simple curing method the strength of concrete increases by almost 30-40% than the normal strength achieved by traditional method of curing.
V. Due to increase in strength, factor of safety implied to the concrete design can be reduced and hence final design of structure can be done with reduced cross-sectional areas of structural members, ultimately saving on the cost of construction.
VI. In water scared areas, water can be used in a very controlled manner avoiding the excess fruitless spraying of water.
VII. At the same time with minimum quantity of water maximum strength can be achieved.

**4. CONCLUSION**

I. The immersion method showed the highest compression strength. But we cannot keep concrete structure immerged in the water bath so the second best method i.e. Drip curing is feasible to be used.
II. Practically drip curing is the most effective method of curing. It produced the highest level of compressive strength practically at site. This is due

to nonstop supply of required water to cool down the exothermic reaction of concrete, resulting from greater degree of cement hydration reaction uniformly.

III. As in the drip curing the water spreads over the area giving the concrete to absorb water and fulfill its water requirement.

IV. As in case of sprinkling of water the water rushes over the block and the contact time with concrete is very less. Total 3010 liters per day water can be saved by using drip curing method for curing.

V. The amount required for a project of 180sq.m plinth area considering this system will be re used for all 5 floors of the same project and also considering that whole system can be used for one more project, the one-time installing expenses of drip curing is used for 10 times the slab area, since the expenses for 1 floor is calculated as Rs855/-.

VI. The amount saved by saving water is Rs375/- per day. In the cities where there is water scarcity, without compromising with the quality and strength of concrete we can achieve the results with very less quantity of water.

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