

Study the Method of Controlling Bleeding in Concrete using Aluminium Powder

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Abstract – Concrete is the most widely used construction material in the world. It is used in many different structures such as dam, pavement, building frame or bridge. Sometimes when excess amount of water or inappropriate mixture are used then possibility of bleeding in concrete occurs. It is a common problem in the concrete. Bleeding of concrete may be defined as physical migration of water towards the surface of concrete. Due to the migration of water concrete loses its homogeneity and also responsible for permeability of concrete. For preventing of bleeding of concrete it is necessary that to use fine material in excess amount. Bleeding is sometimes referred as water gain in the concrete. It is a particular form of segregation in which water is separated to the concrete and breaks the uniformity of concrete. This type of concrete is very weak in strength. In this investigation Aluminium powder is used for controlling the bleeding of concrete. It is a finer material and it is helpful in controlling the bleeding water of concrete. Aluminium powder is used in concrete as an Percentage addition with cement by weight. With the help of IS 9103 bleeding quantity of water is calculated.

Index Terms – Bleeding, Bleeding rate, Aluminium powder, Fine aggregate, coarse aggregate, slump value, compressive strength.

1. INTRODUCTION

Bleeding in concrete is sometimes referred as water gain. It is a particular form of segregation, in which some of the water from the concrete comes out to the surface of the concrete, being of the lowest specific gravity among all the ingredients of concrete. Bleeding is predominantly observed in a highly wet mix, badly proportioned and insufficiently mixed concrete. In thin members like roof slab or road slabs and when concrete is placed in sunny weather show excessive bleeding.

Due to bleeding, water comes up and accumulates at the surface. Sometimes, along with this water, certain quantity of cement also comes to the surface. When the surface is worked up with the trowel, the aggregate goes down and the cement

and water come up to the top surface. This formation of cement paste at the surface is known as “Laitance”. In such a case, the top surface of slabs and pavements will not have good wearing quality. This laitance formed on roads produces dust in summer and mud in rainy season.

Water while traversing from bottom to top, makes continuous channels. If the water cement ratio used is more than 0.7, the bleeding channels will remain continuous and un segmented. These continuous bleeding channels are often responsible for causing permeability of the concrete structures. While the mixing water is in the process of coming up, it may be intercepted by aggregates. The bleeding water is likely to accumulate below the aggregate. This accumulation of water creates water voids and reduces the bond between the aggregates and the paste. To control bleeding water in the concrete it is necessary to use fine material. In this investigation we use aluminium powder for controlling bleeding water in the concrete. It releases the gases from the concrete and made homogeneity in the concrete.

2. EXPERIMENTAL INVESTIGATION

2.1 MATERIALS

In this investigation Aluminium powder is used for controlling bleeding water of concrete, Aluminium powder is finer material and it has good water absorbing capacity at certain limit. It is also used in the light weight concrete as a foaming agent. Due to the heat generating property of aluminium powder it cannot use in excess amount in the concrete, if it uses in excess amount in the concrete its produce expansion in the concrete and due to this concrete give very weak strength.

Table 1: Mix Composition (kg/m³) of the concrete mix

Cement	Water	Fine aggregate	Coarse aggregate(20 mm)	Coarse aggregate(10 mm)
400	191	785	616	410

2.2 MIX PROPORTIONS

In this investigation concrete grade M25 mix was used and its composition is given in table 1. In this mix per cubic water content of 191 litres was used for investigating the bleeding test it was necessary to used high amount of water. With the help of IS: 9103 bleeding capacity of water was calculated, bleeding test was conducted at different percentage of aluminium powder added by weight of cement. The mix proportioning procedure for this investigation is taken from IS: 10262-2009. For achieving the aim of this dissertation concrete grade M25 were proportioned according to the procedure mentioned in the code (IS: 10262-2009).

In this investigation different percentage of aluminium powder added with total weight of cement. Firstly in the mix M1 we check the bleeding water of concrete at 0% Aluminium powder adding with total weight of cement, after that prepare the mix M2,M3,M4,M5,M6 and adding 0.2%, 0.4%, 0.6%, 0.8%, 01% aluminium powder respectively with total weight of cement . The water cement ratio taken in this investigation is 0.48 for all the mixes. Details of prepare mixes mentioned below table 3.8.

The ratio of cement, fine aggregate, coarse aggregate and water for concrete grade M25 calculated 1:1.96:2.56.

2.4 BLEEDING TEST OF CONCRETE

2.4.1 PROCEDURE

The container of 0.01m³ volumes shall be filled with concrete as soon as practicable after mixing to a height of 250±3mm. The concrete shall be filled into the measure in layers approximately 50 mm deep and each layer shall be compacted by hand. The number of strokes per layer required to produce the specified condition will vary according to the type of concrete, but in no case shall the concrete be subjected to less than 60 strokes per layer for the 0.01 m³ measure.

Water accumulated at the top shall be drawn off by means of a pipette, at 10 min intervals during the first 40 min and at 30 min intervals subsequently till bleeding ceases. The water shall be transferred to graduated jar and accumulated quantity of water shall be recorded after each transfer.

2.4.2 EXPERIMENT RESULT

Accumulated bleeding water expressed as a percentage of the net mixing water shall be calculated as follows:

$$\text{Percentage of bleeding water} = \frac{V_w}{W} \times 100$$

Where

V = total mass of the bleeding water, kg;

W = net mass of water in the batch, kg;

W = total mass of the batch, kg; and

s = the mass of sample, kg

In this investigation concrete bleeding test was conducted at addition of aluminium powder with cement by weight at the percentage of 0.2%, 0.4%, 0.6%, 0.8%, and 1.0%. The results of this experiment are shown below in the table.

Table 2 Observed % Bleeding water of concrete

Mix No.	% of Aluminium powder adding by weight of cement	Quantity of bleeding water(ml)	% of Bleeding water
M1	0	110.5	5.76
M2	0.2	49.7	2.59
M3	0.4	48	2.51
M4	0.6	55.25	2.60
M5	0.8	60	2.92
M6	1.0	63.5	3.314

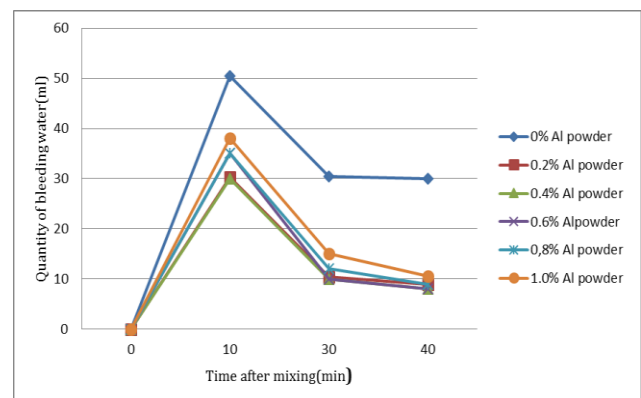


Fig. 1 Effect of Aluminium powder on bleeding capacity of concrete

2.5 EFFECT OF ALUMINIUM POWDER ON COMPRESSIVE STRENGTH OF CONCRETE

The result shows that the compressive strength of concrete is increased by adding Aluminium powder with total weight of cement. Aluminium powder firstly increased the compressive strength, when it added 0.2 to 0.4 percent with cement. With

the increasing amount of aluminium powder with cement the strength of concrete going to be decreases. Due to producing heat by the Aluminium powder the concrete are expand and cement with water are comes at the surface of concrete and its makes concrete weak that gives the decreasing value of compressive strength. The water comes at surface of concrete with cement is called laitance.

Table 3 Compressive Strength of Concrete

Mix No.	% of Aluminium powder by weight of cement	Compressive strength of concrete(mpa)	
		7 day cube strength (mpa)	28day cube strength (mpa)
M1	0	22.22	31.11
M2	0.2	24.44	33.78
M3	0.4	25.33	35.55
M4	0.6	23.88	31.23
M5	0.8	20.22	28.88
M6	1.0	19.11	26.66

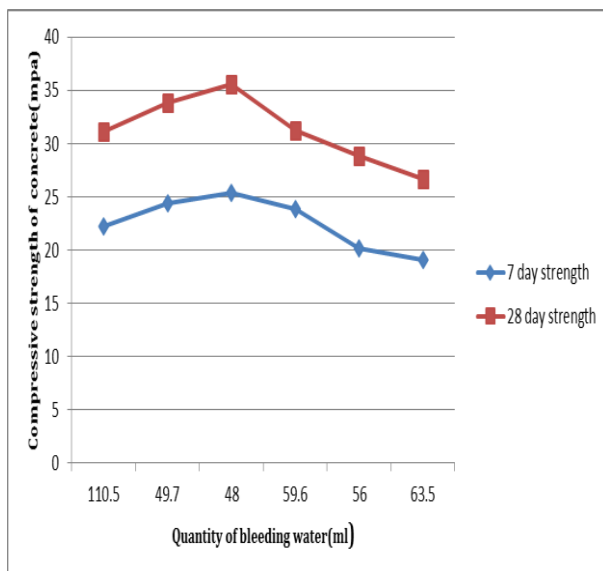


Fig. 2 Effect of Aluminium powder on compressive strength of concrete

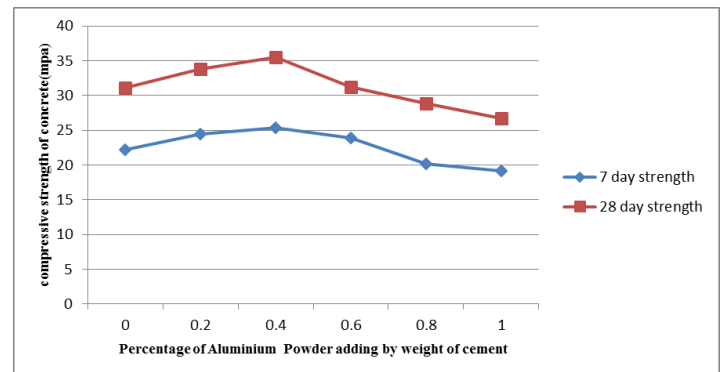


Fig. 3 Relationship b/w compressive strength and percentage of aluminium powder Adding by weight of cement

3. CONCLUSION

Based on the experimental studies on the topic “study the various methods for controlling bleeding of concrete” following conclusion could be made-

- The use of aluminum powder in the concrete helps in reducing the quantity of bleeding water at the surface of concrete and also increase the compressive strength of concrete.
- Bleeding capacity of concrete is decrease when aluminum powder is added with cement by weight is 0.2 to 0.4%.
- Due to the heating property of aluminum powder the bleeding capacity of concrete is increased at addition of aluminum powder 0.6 to 1% with weight of cement.
- Large adding of aluminum powder (10-15%), gives the high expansion in concrete and due to this cement is migrated at the surface of concrete.
- Migration of water with cement at the surface of concrete is called laitance, due to this concrete loses its homogeneity and concrete gives very weak strength.
- It is very necessary for controlling bleeding water of concrete; the use of aluminum in the concrete is very less.
- After seeing the properties of aluminum powder we observed that if this investigation is done at low temperature then it will give good result in the respect of concrete bleeding.

3.1. SCOPE OF WORK

The research work on “study the methods of controlling bleeding of concrete” is still limited. But it promises a great

scope for future studies. Following aspects are considered for future study and investigation.

- Further studies can be done for different variation of Aluminium powder and apply by replacing coarse sand dust or any other fine aggregate.
- For controlling bleeding of concrete if we use other material such as fly ash with Aluminum powder then maybe it will give better results.
- Research on “study the method of controlling bleeding in concrete using Aluminium powder” with percentage cement addition material, by which we can minimize the cost and at the same time achieve the durability and strength for the production of High Performance Concrete.
- Bleeding of concrete is occurs due to the access water present in the concrete so it is necessary for future we made rich mix concrete.
- For controlling bleeding of concrete using Aluminum powder by weight of concrete may give good result if it is investigate at lower temperature.
- It requires a proper mixing proportions for the development of high strength, high performance concrete which may not be possible manually. So it needs some global optimization techniques to develop the desire result with greater accuracy and time saving.

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