EFFECT OF DAIRY INDUSTRIAL EFFLUENT AND KITCHEN WASTE WATER AS MIXING WATER ON THE PROPERTIES OF CONCRETE

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Abstract - Water resources are the greatest blessing that nature has bestowed upon mankind. This non-renewable resource is becoming scarcer day by the day, and predictions say that the third world war for water could break out. So there is a lot of scope for the conservation of water and recycle of wastewater. As per the literature review an attempt can be made to divert the wastewater into the construction industry as mixing and curing water for concrete. With this attempt one can save consumption of potable water in the construction industry, reduce the cost of treatment of wastewater and minimize the wastewater disposal problems. Construction industry uses plenty of water for all its construction purposes. Hence an attempt can be made to use industrial effluents and domestic effluents in mixing of concrete and there by save potable water resources. The main objective of this research is to study the effects of using the domestic effluents and industrial effluents as mixing water on the properties of concrete and thereby saving the potable water in construction industry. The effect will be studied on the workability characteristics of concrete with domestic effluent and industrial effluent, as mixing water.

***Key Words*:** workability characteristics, setting time characteristics, domestic effluent and industrial effluent, mixing water.

1. INTRODUCTION

Improper treated effluents from various industries are the main reason for water pollution in industrial areas. Release of hazardous materials from industries have been increased and are of major concern as they may cause health hazards to living beings.[2]

Release of such wastes into nearby water bodies will decrease the quality of receiving water and make them unfit for agriculture and drinking purposes. Wastewater is a liquid that has been polluted and cannot be used for any purpose.[3]

Water resources are the greatest boon given to mankind by ecosystem. This non renewable resource of ecosystem is getting depleted day by day and the predictions say that the third world war may arise for water. So there is a lot of scope for the conservation of water and recycle of wastewater. As per the literature review an attempt can be made to divert the wastewater into the construction industry as mixing and curing water for concrete. With this attempt one can save consumption of potable water in the construction industry, reduce the cost of treatment of wastewater and minimize the wastewater disposal problems. Now a days construction is one industry that uses plenty of water for all its construction purposes and it's mainly due to the rapid growth of urbanization. Hence attempt can be made to use industrial effluents and domestic effluents in mixing of concrete and there by save potable water resources.

2. LITERATURE REVIEW

Pavita.,(2002), in her paper entitled "Effect of copper slag waste water on the mechanical properties of concrete", studied the effect of copper slag wastewater when used for curing concrete by 40% replacement with wastewater. It reported that the compressive and flexural strength increases, but the tensile strength decreases, and the setting time is also above the limit. The workability and durability of the concrete gave a better result. [20]

Tay, et al., (1987), in their paper entitled " Use of waste water in concrete mix", have made an attempt to use sewage water in the concrete mix instead of potable water, and they mixed the sewage water in different proportions such as 0%, 25%, 50% and 100% to pour the cubes in the mixing ratio of 1:2: 4. After 28 days, they found that the compressive strength was 1.5% higher than using potable water. [21]

Suresh, et al., (2001), in their paper entitled "Use of domestic waste water as curing water", have used domestic wastewater as curing water for M20 grade concrete for periods of 7, 14, and 28 days. After curing for 14 and 28 days, a slight increase in compressive strength, splitting tensile strength, and flexural strength was observed. However, at a curing time of 7 days, a decrease of 1.12% in compressive strength, 5.32% in splitting tensile strength and 6.52% in flexural strength was observed. [22]

Pritam, et al., (2015), in their paper entitled "To study the effect of untreated algae, kitchen and garage wastewater on strength characteristics of concrete as curing water's" This study will motivate and help for utilization of Kitchen wastewater and Algae wastewater in the construction industry as a curing water's effectively. Hence we can reduce the water scarcity problems and also

reduce the usage of Potable water in the construction industry.

3. MATERIALS AND METHODOLOGY

Materials used:

This deals with various materials used in the experimentation and their properties. It also gives brief description about the methodology or procedure adopted in conducting various experiments as per relevant IS Codes.

3.1 Cement:

The cement used in this study was OPC of 53 grade cement. This cement confirms to IS 12269 - 1987. Tests were conducted to determine the physical properties of cement.

Table 3.1: Physical properties of cement

Sl. No.	Material properties	Cement	
		Obtained values	Requirement as per IS 12269
1.	Initial setting time	45 mins	Not < 30 mins
2.	Final setting time	300 mins	Not > 600 mins
3.	Specific gravity	2.86	-

3.2 Fine aggregates :

Fine aggregate used in this study was brought from local supplier from market. Sand was subjected to tests and the test results are being mentioned in table below.

Table 3.2: Physical properties of fine aggregates

Properties	Obtained values
Specific gravity	2.63
Water absorption	1%
Fineness modulus	2.76
Zone	II

3.3 Coarse aggregates :

The requirements of coarse aggregates were fulfilled by using stones of 20 mm in this work. This material was procured from a local vendor and was brought from a nearby stone crushing unit. The properties are given in the following table.

Table 3.3: Physical properties of coarse aggregates

Properties	Obtained values
Specific gravity	2.87
Water absorption	0.5%
Fineness modulus	5.65

3.4 Domestic effluent:

To carry out the research work the kitchen wastewater as domestic effluent is selected. The untreated kitchen wastewater is collected from canteen of Visvesvaraya Technological University, Jnana Sangama, Belagavi – 590 018, Karnataka State, India. campus Belagavi. Kitchen wastewater samples were tested immediately after the sample arrived to the laboratory.

3.5 Dairy industry effluent :

To carry out the research work the dairy industry wastewater as an industrial effluent is selected. Wastewater samples were collected from Karnataka Milk Federation (KMF) -Belagavi plant, Anjaneya Nagar Main Rd, Mahantesh Nagar, Belagavi, Karnataka 590016., Belagavi. Composite sampling procedure was used for the collection of untreated dairy wastewater at KMF plant. The examination of wastewater was done initially to know the physical and chemical composition. The procedure for analysis of wastewater was carried out as per standards.

3.6 Mix design for M30 grade concrete:

M 30 grade of concrete is designed as per IS code 10262

- **Mix proportions**

  Cement = 383.16 kg/m^3

  Fine aggregate = 660.083 kg/m^3

  Coarse aggregate = 1003.289 kg/m^3

  Water = 191.58 liters

  Water/Cement ratio = 0.5

  Mix proportion = 1 :1.72: 2.168

4.. TESTING METHODS :

4.1 Slump cone test :

Slump test was conducted using slump cone of height 300 mm and top and bottom diameter 100 mm and 200 mm respectively with standard procedure as given in IS : 1199

4.2 Compact factor test :

Compaction factor test is conducted as per IS : 1199. Compaction factor is calculated as follows.

Compaction factor = Weight of partially compacted concrete / Weight of fully compacted concrete

4.3 Vee Bee test :

Vee bee consistometer test is covered by IS: 1199 – 1959. In this test, we measure the relative effort led by concrete to change from one definite shape to another definite shape by imparting vibration (Conical to cylindrical). This effort is known as remolding effort, and it is measured in 't' secs. (time) or called as Vee bee Secs. or Vee bee degree.

4.4 Flow test

Flow test is conducted as per the guidelines given in IS :1199-1959 on flow table.

5. TEST RESULTS:

5.1 Workability test results

Table 5.1 give the workability of concrete produced by using normal water, untreated domestic effluent, untreated dairy industry effluent, treated domestic effluent and treated dairy industry effluent. The workability is measured from slump, compaction factor, Vee Bee degree and percentage flow.

Figure 5.1, 5.2, 5.3, 5.4 give the variation of workability as measured by slump, compaction factor, V B degree and percentage flow.

Table 5.1: Workability test results of concrete produced by using normal water, untreated domestic effluent, untreated dairy industry effluent, treated domestic effluent and treated dairy industry effluent.

Sl. No	Description of concrete	Slump (mm)	Compaction factor	V.B degree (sec)	% flow
1	Concrete produced by using normal water (Ref mix)	90	0.92	23	15%
2	Concrete produced by using untreated domestic effluent	95	0.96	19	18%
3	Concrete produced by using untreated dairy industry effluent	98	0.98	15	21%
4	Concrete produced by using treated domestic effluent	85	0.88	32	10%
5	Concrete produced by using treated dairy industry effluent	82	0.87	38	7%

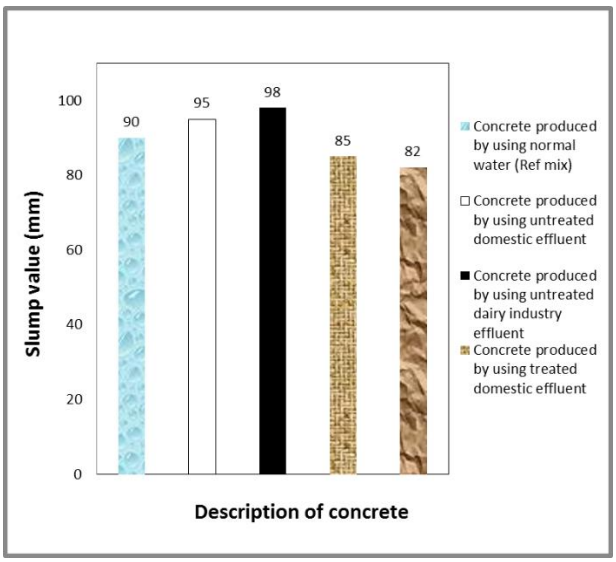

Fig. 5.1: Variation of slump values

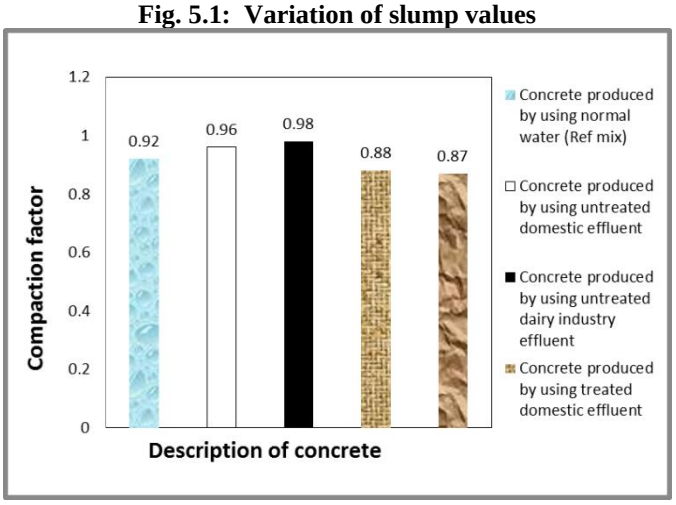

Fig. 5.2: Variation of compaction factor

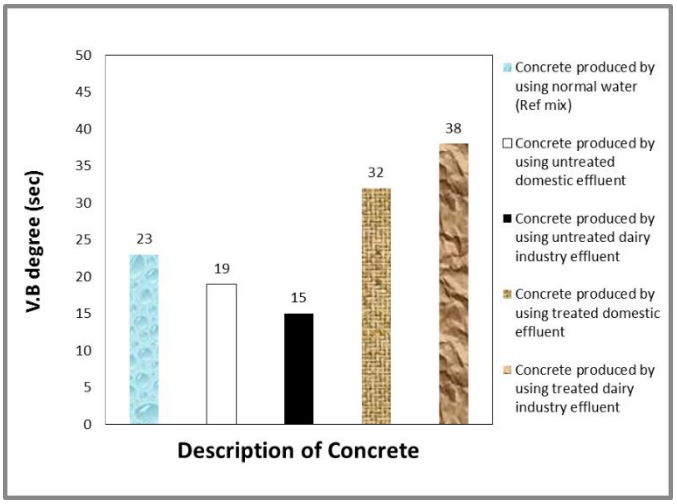

Fig. 5.3: Variation of V.B degree

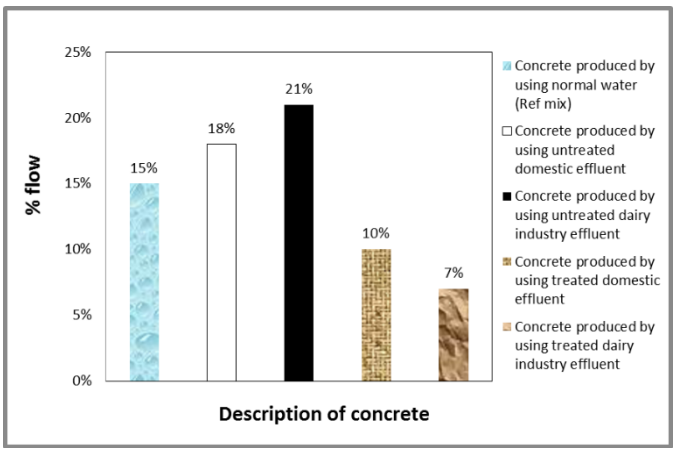

Fig. 5.4: Variation of % flow

6. OBSERVATIONS AND DISCUSSIONS:

After the Workability test results of concrete produced by using normal water, untreated domestic effluent, untreated dairy industry effluent, treated domestic effluent and treated dairy industry effluent. Following observations were made .

1. Slump value of concrete produced by using normal water (Ref mix) is 90mm, concrete produced by using untreated domestic effluent is 95mm, concrete produced by using untreated dairy industry effluent is 98mm, concrete produced by using treated domestic effluent is 85mm, and concrete produced by using treated dairy industry effluent is 82mm respectively. With this it is clearly observed that concrete produced by using untreated dairy industry effluent gives highest slump value and concrete produced by using treated dairy industry effluent gives lowest slump value.
2. Compaction factor of concrete produced by using normal water (Ref mix) is 0.92, concrete produced by using untreated domestic effluent is 0.96, concrete produced by using untreated dairy industry effluent is 0.98, concrete produced by using treated domestic effluent is 0.88, and concrete produced by using treated dairy industry effluent is 0.87 respectively. With this it is clearly observed that Concrete produced by using untreated dairy industry effluent gives highest compaction factor and concrete produced by using treated dairy industry effluent gives lowest compaction factor.
3. V.B degree (sec) of concrete produced by using normal water (Ref mix) is 23, concrete produced by using untreated domestic effluent is 19, concrete produced by using untreated dairy industry effluent is 15, concrete produced by using treated domestic effluent is 32, and concrete produced by using treated dairy industry

effluent is 38 respectively. With this it is clearly observed that concrete produced by using treated dairy industry effluent gives highest V.B degree (sec) value and concrete produced by using untreated dairy industry effluent gives lowest V.B degree (sec) value.

4. % Flow of concrete produced by using normal water (Ref mix) is 15%, concrete produced by using untreated domestic effluent is 18%, concrete produced by using untreated dairy industry effluent is 21%, concrete produced by using treated domestic effluent is 10%, and concrete produced by using treated dairy industry effluent is 7% respectively. With this it is clearly observed that concrete produced by using untreated dairy industry effluent gives highest % flow value and concrete produced by using treated dairy industry effluent gives lowest % flow value.

7.CONCLUSIONS

1. Concrete produced by using normal water, treated domestic effluent and treated dairy industry effluent does not produce any adverse effect on the workability characteristics of concrete.
2. It is recommended to use treated domestic effluent and treated dairy industry effluent as substitute for normal water for preparing (mixing) of concrete, to save potable water.

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