USE OF INDUSTRIAL WASTE WATER IN CONCRETE

Prof. Pranesh chawhan[1], Akash A.Bhosale[2],Harshal Jamsutkar[3],Amey Jamsutkar[4], Ragini Jadhac[5], Aarti Jadhav[6]
Department of Civil Engineering[123456]
VPS College of Engineering & Technology, Lonavala, Pune[123456].
praneshchawhan@gmail.com[1],akashbhsl@gmail.com[2], hjamsutkar@gmail.com[3], amey.jamsutkar@gmail.com[4],raginijadhav68@gmail.com[5],jadhavrti55@gmail.com[6]

Abstract: Water is a basic need of living beings. So, everyone should be benefited with quality and quantity water. Oceans hold over 97 percent of the world's water, while freshwater makes up only 3 percent. Moreover, freshwater is not distributed equally across land surfaces, and there are some densely populated nations where freshwater is scarce. On other hand, concrete industry consumes large amount of water in mixing of mortar, mixing of concrete and even in curing which otherwise can be used for drinking purpose. Construction industry is second largest industry in India which consumes major amount of water. Waste water gets mixed with the surface water after discharging it from industries. It tends to reduce the quality of surface water which is sometimes get consumed by humans for drinking purpose. Bad quality of water may affect the health of human beings and aquatic life also. Water shortage is becoming a global issue these days. And more efforts should be made to fix this issue. As a result, using waste water released from various types of companies or sites in the building sector may assist to alleviate the problem of water shortage. This project intends to demonstrate how treated waste water may be used in the construction sector while reducing the environmental impact. While building concrete, waste water collected from dairies, car wash centres, sewage treatment plants, and other locations is utilised as a 100 percent substitute. After casting and curing with oil industry water for 7, 14, and 28 days, cubes are intended to be assessed against compression stress.

Keywords: Waste Water, Concrete,

1. Introduction

India is presently dealing with its worst crisis ever. India is dealing with one of the biggest national water problems in the world. It is actually referred to as the water and sanitation crisis. Almost 50% of the population lacks access to clean drinking water, and around 2,000 000 people every year pass away as a result.

An continuous water catastrophe that affects over 1 million people each year in India is water shortage. The huge population of India's rural and urban areas, as well as the environment and agriculture, are all significantly impacted by the country's water crisis. India only contains 4% of the world's fresh water resources while having a population of over 1.3 billion. Due to both an abundant supply of freshwater and the drying up of rivers and their reservoirs in the summer, right before the start of the monsoon season over the whole country, India experiences a severe water scarcity.

Water shortages are not a recent problem in India. Less than 1,700 cubic metres of available water per person are regarded to be in a water-stressed area, while India now has 1,545 cubic metres available per person. According to the Ministry of Water Resources, water availability might reach 1,140 cubic metres by 2050 and drop to 1,341 cubic metres in 2025. The availability of water for each individual in this situation is less than 1,000 cubic metres.

Periodically, severe drought conditions have affected people, agriculture, animals, etc. in various states around the nation.

All Indian sectors have been affected in some manner by the lack of water, including the building sector. For many different uses, the building sector requires a lot of water. To mix cement, sand, and other raw materials for the building project right away, water is required. Using green and sustainable materials is crucial to reducing the country's escalating water issue since the construction sector is the second largest in the nation after agriculture. Surface water quality is decreased by the garbage that is simply added to waste water that is released by various sorts of companies. Surface water is frequently utilised in place of portable water for drinking purposes. The health of people or aquatic life may be impacted by surface water of lower quality. A better way to preserve the quality of surface water is to reuse this industrial waste water. Also, if it is employed in the construction business, it might significantly lessen the requirement for fresh portable water.

2. Literature Survey

As water scarcity is ongoing major crisis, reduction or reuse of water is very important thing. Water which get discharged from industries get mixed with natural streams. Reuse of that water could be possible in general works. As construction industry consumes major amount of potable water, replacing the use of potable water with treated industrial waste water could be better option. Water from dairy, carwash center, sewage treatment plants can be used as replacement with potable water in construction industry. This research is done to check whether treated water from oil industry can be use in concrete or not. If result came positive, then it can help to reduce load on potable water in construction industry.

This author discusses the manufacture of concrete cubes using industrial waste water. For the purpose of examining the impact of sunlight on the chemical characteristics of wastewater and ultimately the compressive strength of concrete, sixteen samples total were prepared: four with potable water, four with fresh, treated wastewater, four exposed to the sun, and four with treated wastewater stored in the shade.

Concrete's compressive strength decreased when treated industrial wastewater was exposed to the sun for seven days compared to samples made with the same water and left in the shade. Yet, the strength of the concrete in both situations (made with potable water and wastewater left in the sun and shade) was greater[1].

NMAM IT Nitte Campus potable water, treated home sewage water, service station water (garage), and dairy water were the four sources from which water samples were taken. The samples' pH, total dissolved solids (TDS), chloride, hardness, alkalinity, and sulphates levels were all measured. In the investigation, concrete of grade M20 was used. Specific gravity, water absorption, and sieve analysis are a few of the physical tests that are performed on the aggregates used in the concrete mix. Regular Portland Cement, graded aggregates, and 100% treated wastewater replacement were used to create plain cement concrete mixes. 12 concrete cubes were cast in total and given 3, 7, and 28 days to cure. Using the Standard laboratory technique of IS: 10262–2009, the mix ratios and compressive strengths of the cubes were calculated[2].

By employing recovered waste water, K. Nirmalk Umar and V. Sivk Umar (2008) [1] studied the durability influence of concrete. In order to considerably alleviate the water deficit by doing some initial treatment, they utilised recycled waste water from the tannery business for building purposes. The concare admixture was then added to the specimens at doses of 0.5%, 1.0%, 1.5%, 2.0%, and 2.5%. The samples' durability was examined over the course of 28, 90, and 365 days. Using this, cubes and cylinders were cast and put through sulphate attack, chloride attack, and corrosion impact tests to determine their durability[3].

R. A. Taha (2010) [4] looked at the viability of using production (oily) and ground (brackish) water in building as opposed to tap water. Four P DO (Petroleum Development O man) asset locations provided samples of non-fresh water. TDS, pH, chloride, hardness, alkalinity, and sulphates were all measured in nine water samples, including regulated drinkable (tap) water. In addition, pure drinkable water was used to produce cement pastes, mortars, and simple concrete mixes. N ine mixes were created and allowed to cure for up to 1.5 years. Initial setting times, compressive strength, and flexural strength of mixtures were examined.

3. Proposed work

3.1 Tests on Cement

There are just four steps in the particular gravity test process. The four stages for performing a specific gravity test on cement are as follows:

Calculation:

$W1 = 133.8$ gm

$W2 = 189.8$ gm

$W3 = 396.1$ gm

$W = 347.7$ gm

$Sg=W2-W1/(W2-W1) -(W3-W4) \times 0.79$

$Sg=189.8-133.8/ (189.8-133.8) -(396.1-347.7) \times 0.79$

$Sg=3.15$

Conclusion :Specific Gravity of Cement is 3.15.

Fig 3.1 Cement

Fig 3.2 Passing Weight of Crushed Aggregate

3.2 Impact Test

Fig 3.3 Impact test

Observations:

- Size of the aggregate = 12.5 passing
- Number of blows applied = 25

Table 1: Impact Value

Sr.No	Details	Sample 1	Sample 2	Average Impact Value
1	Weight of aggregate sample in the cylindrical measure, wl gm (excluding empty weight of cylindrical measure)	250 gm	260gm	19.615%
2	Weight fo crushed aggregate after passing through 2.36 mm sieve w2 gm	50gm	50gm	
3	Aggregate Impact Value = w2/w1*100	20%	19.23%	

3.3 Crushing Test

Fig 3.4 Crushing

Table 2: Crushing Value

Sr.No	**Details**	**Sample 1**	**Sample 2**	**Average Crushing Value**
1	Weight of aggregate sample in the cylindrical measure, wl gm (excluding empty weight of cylindrical measure)	2857 gm	2857 gm	22.19%
2	Weight of crushed aggregates after passing through 2.36 mm sieve, w2 g	635.1gm	632.2gm	
3	Aggregate crushing value = w2wl * 100	22.23%	22.15%	

3.4 Shape Test

Table 3: Shape test values

Size of Aggregate thickness (mm)		**Thickness Gauge * Thickness Gauge Size (mm) Length Gauge** Length Gauge Size (mm)**	
Passing through IS Sieve	**Retained on IS Sieve**		
63	50	33.90	-
50	40	27.00	81.0
40	25	19.50	58.5
31.5	25	16.95	-
25	20	13.50	40.5
20	16	10.80	32.4
16	12.5	8.55	25.6
12.5	10	6.75	20.2
10.0	6.3	4.89	14.7

Fig 3.5 Coarse Aggregates for Water absorption Test

Percentage Water Absorption of Coarse Aggregate Sample{I} = 2.00 % Percentage Water Absorption of Coarse Aggregate Sample{II} = 1.31 %

Fig 3.6 Fine Aggregates for Water absorption Test

Percentage Water Absorption of Fine Aggregate Sample = 6.34%

Fig 3.7 Fineness Modulus Test

Fig 3.8 Slump Cone Test

Fig 3.9 Oiling of Mould

Fig 3.10 Casting of Cubes

Fig 3.11 Removal of Cubes

Fig 3.12 Curing

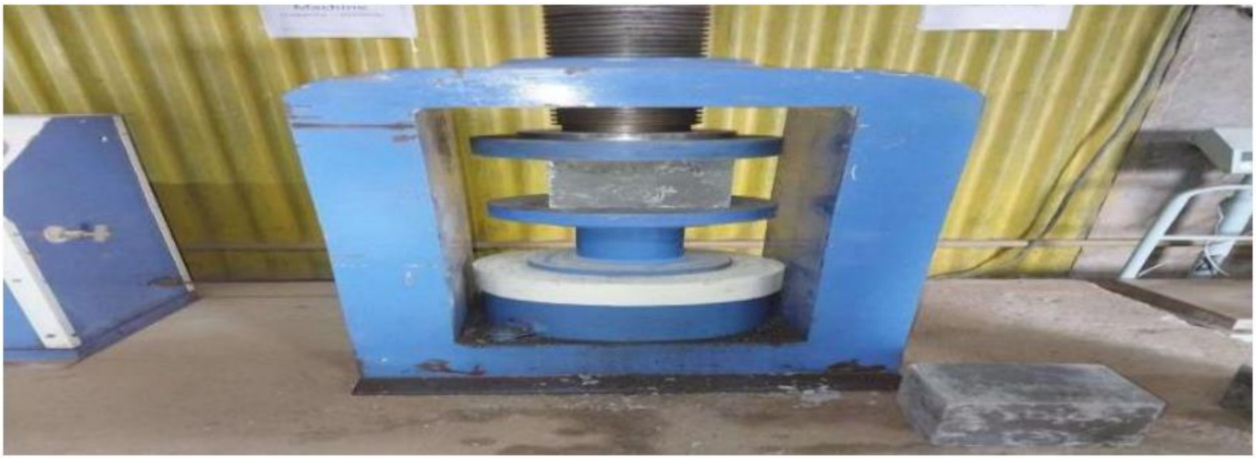

Fig 3.13 Compressive Test

4. Result Analysis

4.1 Water Analysis

The result of tests on water was enough satisfied in both cases of potable water as well as treated waste water of oil industrial. Basically, the pH value of potable water and treated industrial waste water was within the standard limits. As per BIS, pH of water to be used in construction should not be less than 6 and pH test shows that potable water and treated waste water have pH as 7.1 and 7.2 respectively. Some other tests of waste water like turbidity, hardness, alkalinity, etc. gives results as per norms given by the government. Result values of pH and Chlorides fits within the standards given in BIS regarding water used in concrete.

4.2 Water Analysis

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4.3 Compressive Strength Analysis

The design and casting of grade M20 cubes was done with the aid of industrial waste water. Nine cubes in all were cast. out of those nine. Three out of nine were tested to determine the compressive strength after 7, 14, and 28 days. Cubes poured in accordance with the mix design intended to reach the specified 26.6 MPa compressive strength. The average compressive strength of the cubes cast using industrial waste water was 36.26N/mm2 at day 28, exceeding both the intended mean strength and the characteristic strength.

Table 1: Compressive Strength Test Results

Cube No	Water Type	Testing Day	Compressive Strength (MPa)/{N/mm2}	Average Compressive Strength (Mpa)/{N/mm2}
1	Industrial	7	22.00	22.22
2	Industrial	7	22.44	
3	Industrial	7	22.22	
4	Industrial	14	28.40	27.55
5	Industrial	14	28.40	
6	Industrial	14	26.97	
7	Industrial	28	35.40	36.23
8	Industrial	28	36.50	
9	Industrial	28	36.50	

5. Conclusion

In order to reach the appropriate strength, according to BIS, concrete should only be mixed with drinkable water. Yet, several investigations revealed that treated wastewater from a variety of sectors provides concrete with the desired goal strength. According to the literature review, concrete cast using potable water doesn't have as much strength as concrete cast with treated waste water from places like car wash centres, dairies, and sewage treatment plants.

This study examines whether oil industry waste water can be used to make concrete or not. Concrete that has been cast and cured with potable water has strength that exceeds the desired mean strength. Contrarily, concrete that was cast and dried using industrial waste water produced strength above the desired mean strength.

Results indicate that the concrete cube's strength exceeds the required mean strength, indicating that industrial waste water may be utilised in place of the concrete's original water source.

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