A Review Paper on Experimental Studies on the Effect of Treated Wastewater on Concrete with the Addition of Different Fibres

[1]Puneeth kumar, [2]Akhilesh Methre
[1,2]*Assistant Professor, Department of Civil Engineering, GNDEC, Bidar, Karnataka*

***Abstract*—Water is an essential resource in the construction industry, particularly for concrete production and curing. Due to increasing water scarcity and uneven distribution of freshwater resources, the utilization of treated wastewater (TWW) has gained attention as a sustainable alternative. This experimental study investigates the feasibility of using treated domestic wastewater as mixing water in concrete, along with the addition of different fibre percentages. Concrete specimens were prepared using potable water and treated wastewater with fibre contents of 1%, 1.5%, and 2%. Fresh and hardened concrete properties such as workability, compressive strength, split tensile strength, and flexural strength were evaluated. The results indicate that concrete prepared using treated wastewater satisfies Indian Standard requirements and exhibits comparable strength characteristics to concrete prepared with potable water. The study concludes that treated wastewater can be effectively reused in concrete production, contributing to sustainable construction practices and conservation of freshwater resources.**

***Keywords*— Treated wastewater, fibre reinforced concrete, compressive strength, sustainability, reuse of water**

I. INTRODUCTION

Water is the basic need of all living beings rather than air, food and shelter. Without water man cannot survive. In early days, water was primarily used for domestic needs like drinking, washing, bathing and cooking etc. But due to modernization, water is also required for industrial, construction purpose and ornamental and sewerage purposes along with domestic needs. Also in construction industry water is used for mixing, aggregate washing, curing of concrete and for washing concrete related mechanical machines. The mixing of water which is fit for drinking purpose is fit for concreting, but about 97 per cent of water is held in the oceans, while only 3 per cent is fresh water of the freshwater, only 1 per cent is easily accessible as ground or surface water, the remains are stored in glaciers and icecaps. Moreover, freshwater is not evenly distributed across land surfaces, and there are a number of heavily populated countries located in arid lands where fresh water is scarce. The ultimate and last option will be treating the waste water and using it. But the humans have not accepted or will never accept the treated waste water for drinking purpose. The waste water from domestic after treating as shown in fig. 1 treated can be used in the construction industry where the large amount of water is used and the freshwater is used. This works aims to explain how treated waste water can be used in construction industry and reduces the load on nature.

Fig1: Discharge of waste water into water body

II. LITERATURE REVIEW

- K. Nirmalkumar and V. Sivk Umar (2008)

Investigated the durability impact of concrete by using recycled waste water. They used the recycled waste water from the tannery industry for the construction purpose, so that the shortage in water can be greatly reduced by making some primary treatment. Then the specimens were also casted by adding the concrete admixture with dosages of 0.5%, 1.0%, 1.5%, 2.0% and 2.5%. The specimens were tested for durability properties for 28 days, 90 days and 365 days.By using this cubes and cylinders were

casted and tested for its durability (sulphate attack, chloride attack and corrosion impact).

- M. Silva and T. R. Naik (2010)

Investigated the sustainable use of resources, such as use of reclaimed water, especially partially processed sewage treatment plant water in concrete. An initial laboratory investigation was conducted samples were collected from the Milwaukee Metropolitan Sewerage District (MMS D) and analysed the Characteristics of reclaimed wastewater. According to their investigation the compressive strength, mortar cubes with sewage treatment plant water has shown improvement in strength during 3 to 28 days and increased by the duration of 91 days.

III. MATERIALS

- Cement
- Fine aggregate
- Coarse aggregate
- Treated waste water
- Different fiber

IV. METHOD

1. Collection of material which is used for preparation of concrete.
2. Testing of those materials.
3. Preparation of the mix design of concrete for different grades.
4. Treated waste water will be collected from waste water treatment plant & domestic waste water.
5. Determine the chemical characteristic of the waste water.
6. Compare the obtain results of treated waste water of each specimen with result of fresh water concrete.
7. Testing of that casted specimen to obtain compressive strength, tensile strength & flexural strength.

V. RESULT & DISCUSSION

➢ Cement: Cement is a binder, a substance used for construction that sets and hardens to other materials to bind them together. Cement is a binder material, a substance used for construction that sets, harden and adheres to other material to bind them together. Based tests conducted on cement

- Specific gravity
- Fineness cement
- Normal consistency of cement
- Setting time of cement

➢ Fine the aggregate: Aggregate is the granular material used to produce concrete or mortar and when the particles of granular material are so fine that they pass through a 4.75mm sieve is called fine aggregate.

Based tests conducted on fine aggregate.

- Specific gravity
- Sieve analyses
- Water absorption
- Silt content

➢ Coarse aggregates: Coarse aggregate is a granular material used to produce concrete and when the particles of the granular material are retain on 4.75mm sieve is called coarse aggregate .Based tests conducted on coarse aggregate.

- Specific gravity
- Sieve analyses
- Impact test
- Crushing test
- Flakiness and elongation

➢ Waste Water

Basic tests conducted on waste water

- pH test
- Alkalinity
- Hardness

➢ Fibres : Fibers are usually used in concrete to control cracking due to plastic shrinkage and to drying shrinkage. They also reduce the permeability of concrete and thus reduce bleeding of water.

Different types of steel fiber

- Straight fiber
- Crimped fiber
- Standard fiber
- Hooked fiber
- Twisted fiber

➢ Mixing of the concrete

Mixing concrete is simply defined as the complete blending of the material which are required for the production of a homogeneous concrete.

- Types of mixing
- Hand mixing
- Machine mixing

➢ Tests On Concrete

Fresh concrete

Workability: Workability is the ability of a fresh (plastic) concrete mix to fill the form/mold properly with the desired work (vibration) and without reducing the concrete homogeneity.

Different tests methods for workability measurement

- Slump tests
- Compaction factor tests
- vee-bee consist meter

Slump tests: the slump test is a means of assenting the consistency of fresh concrete. It is used, indirectly, as a means of checking that the correct amount of water has been added to the mix.

Curing of concrete

The concrete are surface kept wet for a certain period after placing of concrete so as to promote the hardening of cement. The process of applying the water on the concrete is known as curing.

➢ Tests Conducted On Hardened Concrete

•Compressive Test

•Split Tensile Test

Compressive strength: Compressive strength of concrete is strength of hardened concrete measured by compression tests. The compression strength of concrete is measure of the concretes ability to resists load which tends to compress it. It is measure by crushing of concrete cube specimen in compression testing machine.

Split tensile strength

This property for concrete relates to its tension strength. This is obtained by performing split tensile test on concrete specimen. The concrete specimen in this test is taken as cylindrical in shape. Tensile strength for concrete specimen is defined as the tensile stresses developed due to application of the compressive load at which the concrete specimen may crack.

Type of water used in concrete	1% of fiber Compressive strength N/mm^2	1.5% of fiber Compressive strength N/mm^2	2% of fiber Compressive strength N/mm^2
Potable water for 7 days	21.45	21.71	21.93
PW for 14 days	24.80	24.98	25.2
PW for 28 days	28.43	28.69	29.1
Treated waste water for 7 days	19.45	19.63	19.90
TW for 14 days	23.96	24.15	24.92
TW for 28 days	27.46	27.75	28.3

V. CONCLUSION

- The study aids to effective reutilize the waste water into a consumable constructional material.
- From this experiment we conclude that TWW contains less impurities and is fit as per IS provision.
- The consistency, initial and final setting time of cement paste by mixing TWW is within the IS limit.
- The compressive strength of mortar is increased by mixing TWW at the end of 28 day.
- Compressive strength of concrete is prepared with TWW gives same strength of concrete of potable water at 28 days.
- There is no any significant difference in tensile strength and flexural strength is improved by using TWW

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