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EXPERIMENTAL STUDY ON DOMESTIC EFFLUENT USED IN CONCRETE

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Abstract - *The Scarcity of water is becoming a critical environmental issue worldwide. Any effort targeted at the conservation of these limited resources, preventing environmental degradation and thereby reducing water shortage, is worth While. The research, therefore, focuses on the salvage of treated wastewater effluent in place of normal water in plain concrete protection. The sample was analyzed for pH, alkalinity, BOD, COD, chloride, acidity, total dissolved solids, turbidity grade M20 concrete was adopted in the study. plain cement concrete mixtures were prepared using ordinary Portland cement in all 9 concrete cubes and cylinders were cast and cured for 7, 14, and 28 days. Efficient water use is one of the most vital requirements of cleaner production and the use of wastewater in concrete production important means to this end. In the M20 concrete mix, the potable water was replaced with the treated wastewater in different dilutions partially then fully replaced with 25%, 50%, 75% & 100% of various Mix proportions. This paper's objectives are to assess the quality of concrete wastewater and to suggest procedures for its treatment for non-potable applications the type of water used for the mixing didn't affect the concrete slump and density. Because of the scarcity of potable water, it's very important to use this treated wastewater in concrete in our project.*

Key Words: Freshwater, Treated wastewater, Compressive strength, Split tensile strength, Chloride, Acidity, Alkalinity.

1. INTRODUCTION

Water is one of the most important factors for all living & nonliving things. It makes a shape of Earth's surface about 71% of Earth is covered by water in that 97% of water belongs to the ocean, 3% of water fits freshwater, and 1% are in ice procedures. Freshwater is in the procedure of a lake, river, stream, pond, etc. Freshwater is categorized as surface water, sub-surface water, and groundwater. An increase in industries and changes in human lifestyle causes pollution in water. The study of WHO says 80% of diseases are caused by water pollution. Currently, groundwater is wearing in a fast method and a lot of currency is mandatory and spent for the search of water in the locality of the water source so the water can be recycled and used for industrial activities like construction purposes if the water is found to be suitable. The partly treated water involves TDS which distress water so much. The wastewater event if it is stored unexploited also it is a major pollution problem to the environment. The concrete industry has therefore serious impact on the environment regarding the consumption of water. Thus, there is a need to study alternatives to freshwater for mixing and curing concrete. The domestic effluent water contains impurities it began mixing with concrete is change the setting time and various properties set on chlorides, sulphates, alkalis, solids in mixing water test can be performed to determine the effects that impurity can have various properties, so an attempt is made to utilize the polluted water for construction purposes by making primary treatments.

1.1 DOMESTIC WASTE WATER

Wastewater induced due to human activities in residential & commercial is known as domestic wastewater. That is wastewater from the kitchen, shower, washbasin, toilet, and laundry. The changes and compositions of individual uses of domestic wastages increased day by day is in habits and lifestyle. The main reason is the variation in water usage in households. The developed countries are using more household waste comparatively developing countries.

Domestic wastewater is usually characterized by a Color of grey and musty grey (ash), 0.1 percentage of solid content present in the domestic waste. Domestic waste is induced by human beings who mostly used household purposes like food waste, toilet waste, oils, and some minerals. From a physical point of view, suspended solids can lead to the development of sludge deposits and anaerobic conditions when discharged into the receiving environment.

Organic compounds consist primarily of carbohydrates (25 %), proteins (65 %), and fats (10 %), which reflect the diet of the people. Inorganic components are Sulphur, nitrogen, phosphorus, heavy metals, pH, chlorides, alkalinity, some toxic compounds, etc. However, since wastewater contains a higher portion of dissolved solids than suspended, about 85 to 90% of the total inorganic component is dissolved and about 55 to 60% of the total organic component is dissolved. Gases commonly dissolved in wastewater are hydrogen sulfide, methane, ammonia, oxygen, carbon dioxide, and nitrogen.

2.0 MATERIALS AND METHODS

2.1 CEMENT

Cement is a good binding material to bond with the Fine aggregate & coarse aggregate to react with water, a substance used in construction. It has several types of cement, In this

paper, we are used ordinary Portland cement of 43 grades, available in the locality. This cement tested all types of testing in the same batch. The cement used has been tested by the code of as per IS:4031-1988 .

2.2 FINE AGGREGATE

The fine aggregate used in natural sand and locally available river sand is used as fine aggregate in the present investigation. The sand is sieved to remove all pebbles the cleaned fine aggregate is chosen and tested for various properties such as specific gravity, fineness modulus, bulk density, etc. the sieve size used is 4.75 mm and the sand must be sieved by 2.36mm sieve. m

2.3 COARSE AGGREGATE

Crushed gravel stones obtained by obtained of gravel or hard stone are used as coarse aggregate. The cleaned & dried coarse aggregate is selected for various properties such as specific gravity, fineness, Flakiness index etc. The maximum size of aggregates is generally limited to 12.5 mm. The aggregates serve as reinforcement to add strength to the overall composition.

2.4 WATER

Water is the major important ingredient to concrete as it actively reacted with cement. Since it's improved the strength with adding of water in the mixture of concrete is formed the gel formation. The quality of water are very important its not contain impurities in that. (portable or drinking water are used). It is required for the grounding of mortar, is utilized in the hydration of cement to form the binding matrix in which the inert aggregates are held in suspension until the matrix is hardened and the remaining water serves as a lubricant between the fine and coarse aggregate and make concrete workable. Besides, potable water available on our campus is used.

3. CHARACTERISTICS OF WASTEWATER SAMPLE PHYSICAL CHARACTERISTICS

3.1 COLOUR

Physically, domestic wastewater is usually characterized by a grey color musty odour and has a solids content of about 0.1%. The solid particles are a mixture of waste materials like soap, detergents, waste foods, toilet paper, etc.

3.2 ODOUR

It was found that hydrogen sulphide H2S, organic Sulphur composites, and aldehydes are the key odorants in sewer emissions. The odor emission from different treatment units of a waste water treatment process is discrete from each other. The primary treatment odour is similar to that from the sewer with a high level of hydrogen sulphide.

3.3 TEMPERATURE

The temperature of Effluent is moreover dependent on the season and climate, here the observed sewage temperature at the point of discharge is 31^0 C which is within the permissible limits.

CHEMICAL CHARACTERISTIC

3.4 pH

pH is a measure of the acidity or base, alkalinity of concentrated the experimental test on our campus, PH values of Effluent range from 3.1 to 9.3. The samples at the changing stations we analyzed and one station shows extreme acidity Yet the other station also shows excess alkalinity. The average value of PH Comes out to be 7.32.

3.5 TOTAL SOLIDS

Total solids can be found by evaporating water and weighing the dry residue on the filter paper. The total permissible number of solids in water is generally limited to 500 ppm. Total solids range from 200 -3000 mg/lit. Our sample shows a great presence of total solids and also it exceeds the limit of suspended solids with values of 1300 mg/lit & 600 mg /lit respectively.

3.6 BOD

Biochemical oxygen demands the amount of dissolved oxygen queried by aerobic biological organisms to damage the organic material existing in a water body at a certain temperature over a definite period. It is widely used as an indication of the organic quality of water and thus represents the pollution load. It is usually articulated in milligrams of oxygen expended per litre of the sample during 5 days (BOD5) of incubation at 25°C. finally, the matter becomes oxidized. The harder the bacteria work, the additional oxygen will be used up generous a high measure of BOD, leaving less oxygen for their life in the water. The values of five days BOD at 200 C should be below 350 for public sewer, higher values of BOD indicate more load of organic matter. At the sample test we had a great load with BOD values 370.45, 450.32 & 422.80 respectively.

BIOLOGICAL CHARACTERISTIC

3.7 MICROBIAL TEST

The microbiological analysis covers the use of biological, biochemical, or chemical methods for the detection, identification, or enumeration of microorganisms. It is often applied to disease to disease-causing and spoilage microorganisms.

3.8 MICROBIOLOGICAL CULTURE

Microbial cultures based on their consistency & ingredients are solid, liquid, and semi-solid consistency, the ingredients are simple, complex synthetic special media.

The medium is the term used for the growth & cultivation of microbial bacteria is combined with the supporting ingredients in essential nutrients.

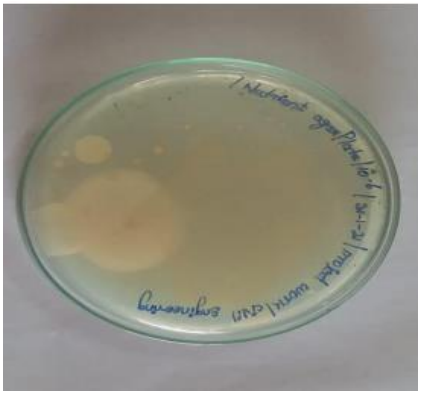

Fig -1: Nutrient agar plate

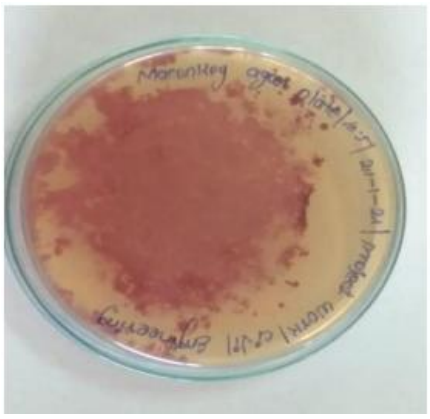

Fig -2: Maconkey agar plate

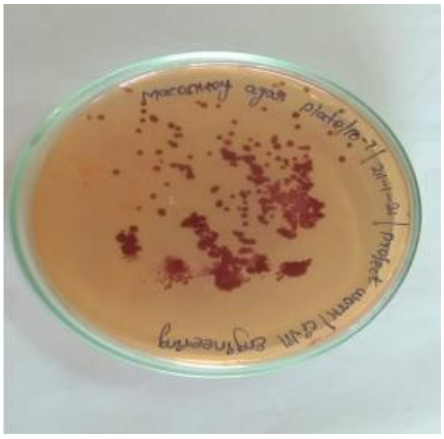

Fig -3: Growth of Microorganisms

Table -1: Properties of Domestic Effluent

Test Parameter	Units	Results	Tolerable Limits
PH value	-----	7.32	6-8
TSS	mg/l	1300	2000
Total alkalinity	mg/l	315	250
BOD	mg/l	450	-
COD	mg/l	2260	-
Chloride	mg/l	144	2000-3000
Acidity	mg/l	<1	50

4.0 MIX DESIGN

A concrete mix of M20 grade was designed by compatible with IS 10262-1982 method. The concrete with a nominal strength of 20MPa was prepared using a nominal mix of 1:1.5:3. The w/c ratio was kept to 0.45 as Per IS Standard.

4.1 MIXING OF SAMPLE WATER & MIX PROPORTION

Effluent samples were taken from the domestic treatment plant. The wastewater samples are well treated by the treatment plant. The samples collected were inspected for impurities that may distress the concrete properties. The sample is mixed into the concrete in various ratios are tabulated.

Table -2: Mix ratio of sample water

Mix code	Portable water	Effluent water
M0	100%	0%
M1	75%	25%
M2	50%	50%
M3	25%	75%
M4	0%	100%

Table -3: Mix Proportion

Description	Cement	Fine aggregate	Coarse aggregate	Water cement ratio
Ratio	1	1.91	3.02	0.45
Mass Kg/m^3	370.55	705.25	1117.60	123

4.2 CASTING & CURING OF SAMPLE

After Ready to Prepare the mix proportion to Mixing Ingredients & Materials for casting & Curing of Concrete Cubes & Cylinder's, then the Procedure to Prepare the cement, coarse aggregate, fine aggregate, and water for the different concrete mixes. Take the correct measurements of materials as per mix Proportion. All ingredients are first raw mixing the adding water step by step. Mixing the concrete with using the mixing machine or trowel to use mix equally. Vibrators are used for compaction or use 25 nos of tapered in Tapping rod to compact the mixture, Specimens are kept for drying for 24 hours and then specimens were demoulded. Specimens are then kept for curing. It is done 7 & 28 days.

Fig -4: Casting of Cubes & Cylinders

5.0 COMPRESSIVE STRENGTH TESTS FOR CUBE & CYLINDER

Compressive strength is the finding of the strength and durability of materials. The compressive strength is measured in a Universal Testing Machine (UTM). Then it placed the testing specimen of cube or cylinder. Applied load to find the compressive strength of the concrete specimen. In the study finding the tensile strength, compressive strength, and shear strength can be analyzed independently.

Compressive strengths are calculated by taking an average of Five Proportion samples for each type of mix at different ages. M0, M1, M2, M3, and M4 have been plotted

Fig -5: Compressive Testing for Sample of Cylinder

Fig -6: Compressive Testing for Sample of Cube

Table -4: Shows the average compressive strength at various proportions in cube

S.I NO	MIX CODE	COMPRESSIVE STRENGTH IN (N/mm²)	
		7 DAYS	28 DAYS
1	M0	13.52	21.20
2	M1	13.92	21.80
3	M2	14.62	23.52
4	M3	15.88	24.02
5	M4	16.88	24.84

Table -5: Shows the average compressive strength at various proportions in Cylinder.

S.I NO	MIX CODE	COMPRESSIVE STRENGTH IN (N/mm²)	
		7 DAYS	28 DAYS
1	M0	12.83	19.92
2	M1	13.26	20.20
3	M2	13.79	20.97
4	M3	14.87	23.20
5	M4	15.91	24.23

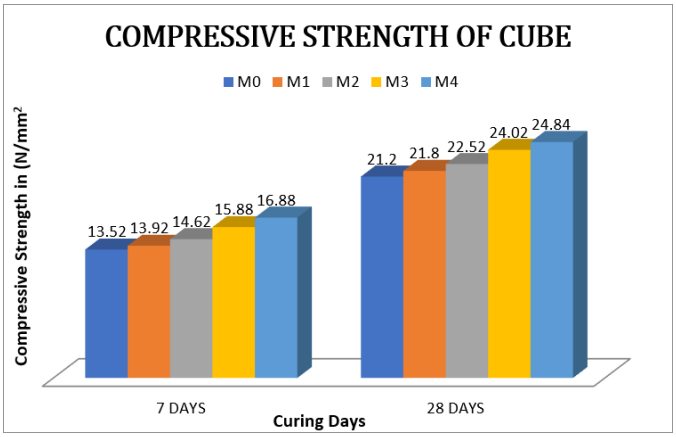

Fig -7: Average compressive strength for various proportions of Cube

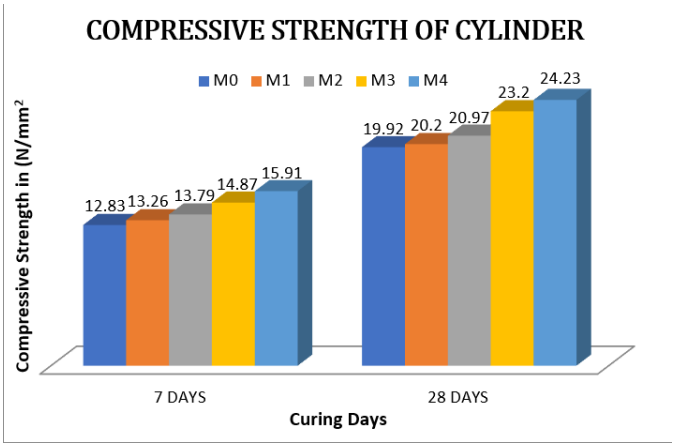

Fig -8: Average compressive strength for various proportions of Cylinder

6.0 RESULT & DISCUSSIONS

After this study, the following points were concluded

1. The domestic treated effluent has been gradually replaced with potable water by 25%, 50%, 75%, 100%. the Domestic treated effluent achieves better strength and then durability during the concrete. And also increasing the strength. with the comparison of potable water concrete and treated wastewater concrete gradually increases its Compressive Strength of sample both cubes & cylinder Analysis Results are Simultaneously the Same.

2. In this paper we concluded that the Various proportions of domestic effluent treated wastewater are added with the portable freshwater to mixing to tested the concrete cubes and cylinder, it increased to change the chemical & physical characteristics of concrete and improved the strength compared to conventional concrete and dairy wastewater has no noticeable any side effect on the strength of concrete produced from them.

3. Nowadays wastage of water is increased at the same time there is so much scarcity of water. Therefore there is a need to arrange another source of water for concrete or the construction of building units. This treated wastewater

4. Further investigations should be carried out on the effects of effluents on the durability of both plain and reinforced concrete structures.

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