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Influence of River Water and Treated Industrial Sewage Water Quality on Compressive Strength of Concrete with Sawdust Ash as Partial Replacement of Cement

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ABSTRACT

The study centered on the effect of different qualities of water on concrete compressive strength. The concrete mix of M25 grade with water cement ratio of 0.45 was investigated. Water samples, such as portable water, river water, and treated industrial sewage water were collected from Hassan city and were used to cast 150x150x150mm concrete cubes. The cured cubes were crushed on 7, 14, 21 & 28 days for compressive strength estimation. The results showed that the compressive strength of the concrete cubes made with portable water, river water and treated industrial sewage water increased with days & not having much variation in their compressive strength The optimum replacement ratio was about 12% were satisfactory. This may be considered a solution not only to the problem of the environment but also to the problem of economics in the design of buildings.the combination of treated wastewater and saw dust ash greatly influses the compression strength of the concrete. The aim of the present study was to know the effect of chemical impurities in mixing different types of water on compressive strength of concrete.

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1. INTRODUCTION

With the passage of time, concrete has proved itself as the most suitable material for construction. It is a very strong and versatile construction material. However, concrete has an excellent resistance to compression (crushing), yet it is very poor in tension (stretching). To give it a good load bearing capability in tension also, it must be reinforced with steel bars (rebar), polymer strands or fiber. Sawdust (wooden shavings) is a by-product or waste product of woodworking operations such as sawing, milling, planning, routing, drilling and sanding. Not many people realize it, but there are hundreds of ways that sawdust can be used as a by-product in the modern world. Globally, the only substance people use the most in massive volume more than cement is water. This is because cement is an excellent building material, being inexpensive, pourable, and also hardens as rock overtime. The only problem is that cement is dirty as it pollutes the environment [1] This is because the main constituent of cement is limestone which is the main contributor to the pollution caused by the manufacture and use of cement. Now this time we strongly recommended to use the treated industrial sewage water because Of the total available water on earth, 97.5% is salty and is not usable as such; of the remaining 2.5% of fresh water, only a marginal part, ~ 1%, is available for human consumption. Since 1950, the world population has doubled, and water consumption has increased sixfold; industrial water consumption has also grown rapidly. To a great extent, recently, parts of the world have already started feeling the "water crunch." It is believed that by 2025, India, China, and select countries of Europe and Africa will face water scarcity. A recent UN report indicates that by 2025, two-thirds of the population of the world could face water stress. The scarcity of water could be in the form of physical scarcity, where water availability is limited and demands are not met, or it could be in the form of economic scarcity, where although water is available, there are no means/infrastructure to provide water of the quantity and quality needed. As far as the global water scenario is concerned, as a whole, there may not be water scarcity. However, since the distribution of water across the globe is not uniform, parts of world are increasingly facing water scarcity, so this are all reasons are taken as major consideration now this time to decrease the water scarcity by use the treated industrial sewage water as the use construction purpose. The use of treated industrial sewage water is economical than the use of conventional water and help in conserving the portable fresh water [2]. The main objective of the study was to analyze the properties of the saw dust ash concrete as compared to Portland cement concrete. To test some of the properties of saw dust ash. To approximate the reduction of carbon emissions that would result from the use of saw dust ash as a partial replacement to cement. To wet the surface of aggregates to develop adhesion because the cement paste adheres quickly and satisfactory to the wet surface of the aggregates than to a dry surface. • To prepare a plastic mixture of the various ingredients and to impart workability to concrete to facilitate placing in the desired position and Water is also needed for the hydration of the cementing materials to set and harden during the period of curing. The quantity of water in the mix plays a vital role on the strength of the concrete. Some water which has adverse effect on hardened concrete. Sometimes may not be harmless or even beneficial during mixing, so clear distinction should be made between the effect on hardened concrete and the quality of mixing water. The use of treated industrial sewage water is economical than the use of conventional water and help in conserving the portable fresh water for other life giving rather than the construction water encourages the authorities to set up more sewage treatment plants to achieve the capacity of water recycling the objective of sustainable development can be achieved through the use of industrial sewage treatment plants [3]. The water serves the following purpose to wet the surface of aggregates to develop adhesion because the cement paste adheres quickly and satisfactory to the wet surface of the aggregates than to a dry surface. To prepare a plastic mixture of the various ingredients and to impart workability to concrete to facilitate placing in the desired position and Water is also needed for the hydration of the cementing materials to set and harden during the period of curing. The quantity of water in the mix plays a vital role on the strength of the concrete. Some water which has adverse effect on hardened concrete. Sometimes may not be harmless or even beneficial during mixing, so clear distinction should be made between the effect on hardened concrete and the quality of mixing water [4]. The use of treated industrial sewage water is economical than the use of conventional water and help in conserving the portable fresh water for other life giving rather than the construction water encourages the authorities to set up more sewage treatment plants to achieve the capacity of water recycling the objective of sustainable development can be achieved through the use of industrial sewage treatment plants Due to increase of water scarcity (Fresh water) we strongly recommended to the water used in the construction purpose are recycled water like treated industrial sewage water and the cost of treated water is also less compare to the conventional water. Usage of this type of water it decreases the environmental pollution [5]. And helps to increases the sewage treatment plants. Cement industry is one of the major environmental pollution sources as it consumes a lot of energy in the production. It releases CO2 which leads to global warming and other pollutions so to minimize the pollution to some extent new method was proposed i.e., replacement of cement with wood byproducts like Saw dust ash.[6] To replace this cement with saw dust ash various tests are performed on the quality and various strengths like compression strength, flexural strength, split tensile strength of the replaced product. The cement is replaced with sawdust ash of about 12% the replacement the test results were compared conventional concrete [7]. The sawdust ash concrete was found to be economical, ecofriendly material than Portland cement concrete in the proportion of cement replaced [8].

2. MATERIALS AND MTHEODOLOGY

Portable water, River water and treated industrial sewage water was Collected. Portable water, also known as drinking water, comes from surface and ground sources and is treated to levels that that meet state and federal standards for consumption [9]. Water from natural sources is treated for microorganisms, bacteria, toxic chemicals, viruses and fecal matter. We are collected the portable water from Navkis college of Engineering, Hassan.

Figure 1. Portable Water

Figure 2. River Water

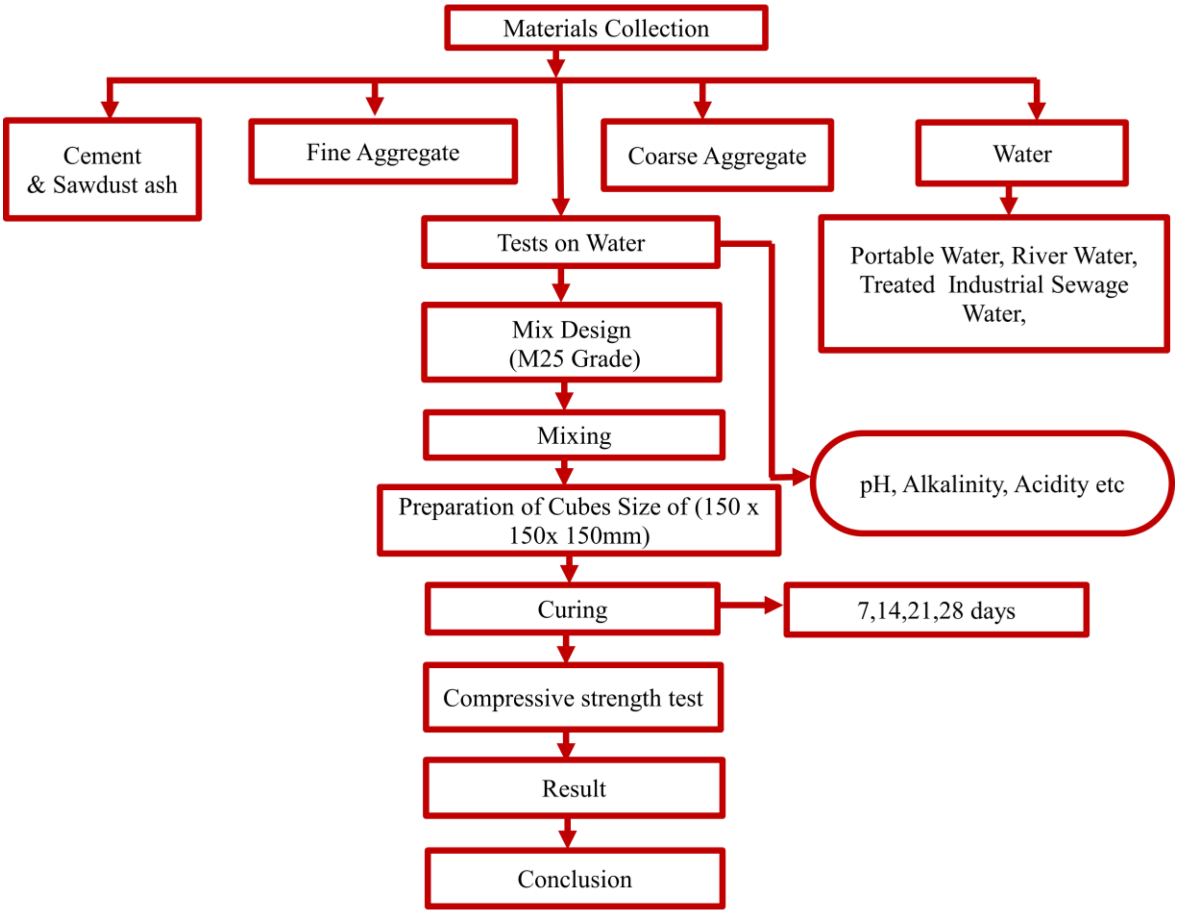
The above figure shows the river water we are collected Yagachi river water in Hassan to complete our project work. Sewage treatment.” Nature has an amazing ability to cope with small amounts of water wastes and pollution, but it would be overwhelmed if we didn’t treat the billions of gallons of wastewater and sewage produced every day before releasing it back to the environment[10]. we are collected Treated Industrial sewage water in **Himmat Singh Hassan** to complete our project work.

Figure 3. Treated Sewage Water

2.1 Composition of Saw Dust Ash

Oxide	Percentage (%)
SiO_2	65.30
Al_2O_3	4.0
Fe_2O_3	2.23
CaO	9.6
MgO	5.8
MnO	0.01
Na_2O	0.07
K_2O	0.11
P_2O_5	0.43
SO_2	0.45

According to International Journal of Engineering Research and Development (volume 1)



2.1 Coarse Aggregate

The fractions from 20mm to 4.75mm are used as coarse aggregate. Angular granite materialof 20mm nominal size from the local source available was used. The coarse aggregate chosen for concrete was typically angular in shape, well graded and smaller than maximum size suited for conventional concrete. The physical Properties of coarse aggregate were investigated in accordancewith IS 383-1963[11,15]

Figure 4. Coarse Aggregate

2.2 Water

Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement. Since, it gives the strength to cement concrete, the quantity and quality of water are required to be looked in to very carefully. Water should be selected according to IS 456- 2000[12,13]

2.3 Sawdust Ash

It is a by-product of cutting, grinding, drilling, sanding, or otherwise pulverizing wood witha saw or other tool. It is composed of fine particles of wood. The saw dust obtained for this study was collected from nearby sawmill. Samples were carefully collected to avoid mixing with sand by collecting the newly produced ones with shovel and packing into bags. The saw dust collected was sundried for 10 daysto aid the burning process. The saw dust samples collected were burnt into ashes by open. Following cooling, the ash was grounded. Sawdust ash obtained is sieved through IS sieve of 90 micron and the retained material obtained is used for experimentation purposes.[17]

3. RESULTS AND DISCUSSIONS

SL.NO	PARTICULARS	TEST RESULT
1)	Specific Gravity of Cement	3.15
2)	Specific Gravity of Sawdust	1.18
3)	Specific Gravity of Coarse Aggregates	2.75
4)	Specific Gravity of Fine Aggregates	2.63
5)	Initial and Final Setting time of cement	Initial :48 min, Final :10hr 40min
6)	Aggregate impact test	14.6%
7)	Water absorption test	Coarse Aggregates 0.5% Fine Aggregates 1.0%

TABLE 1: Tests conducted in Laboratory for Aggregates

SL NO:	PARTICULARS	TEST RESULT
Physical Examination of Water		
1)	Temperature test	22`c

SL NO:	PARTICULARS	TEST RESULT		
	Chemical Examination of Water	Fresh water	River water	Treated sewagewater
1)	pH value test	7.46	7.96	8.12
2)	Acidity test	38.33mg/l	17mg/l	15.33mg/l
3)	Alkalinity test	46.67mg/l	30mg/l	49.3mg/l
4)	Chlorides test	57.3mg/l	120mg/l	100mg/l
5)	Total Hardness test	90.2mg/l	111mg/l	158.33mg/l
6)	Bod	50 mg/l	64mg/l	210mg/l
7)	Suspended solids	0mg/l	6mg/l	3mg/l
8)	Fluoride	4 mg/l	6mg/l	11mg/l
9)	Dissolved oxygen	5mg/l	42mg/l	94mg/l
10)	Nitrate	49mg/l	49mg/l	35mg/l

Table2: Tests Conducted in Laboratory for Water

Test details	**Compressive strength of concrete Cubes.**		
Sample no.	1	2	3
Specimen	Portable Water	River Water	Treated Industrial Sewage Water
No of sample prepared	9	9	9

Table3: Test details

Type of water	**Average compressive Strength (N/mm2)**
Portable Water	21.91
River Water	23.34
Treated Industrial Sewage Water	25.63

Table 4: 7 days Compressive strength of cubes size 150x150x150mm

The above table shows the variations of 7 days compressive strength of different types of water samples, with partial replacement of cement by saw dust ash 12% for M25 grade concrete.

Type of water	Average compressive Strength (N/mm2)
Portable Water	24.95
River Water	26.60
Treated Industrial Sewage Water	29.20

Table 5: 14 days Compressive strength of cubes size 150x150x150mm

The above table shows the variations of 14 days compressive strengthof different types of water samples, with partial replacement of cement by sawdust ash 12% for M25 grade concrete

Type of water	Average compressive Strength (N/mm2)
Portable Water	27.99
River Water	29.87
Treated Industrial Sewage Water	32.77

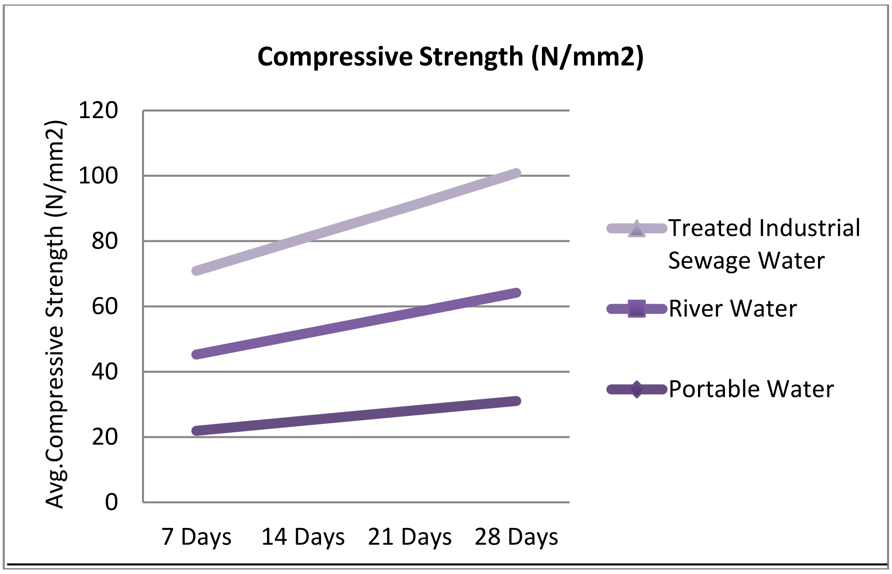
Table 6: 21 days Compressive strength of cubes size 150x150x150mm

The above table shows the variations of 21days compressive strength of different types of water samples, with partial replacement of cement by saw dust ash 12% for M25 grade concrete.

Type of water	**Average compressive Strength (N/mm2)**
Portable Water	31.04
River Water	33.14
Treated Industrial Sewage Water	36.64

Table 7: 28 days Compressive strength of cubes size 150x150x150mm

The above table shows the variations of 28days compressive strength ofdifferent types of water samples, with partial replacement of cement by saw dustash 12% for M25 grade concrete.



Graph1: Test Results for Compression Strength of Concrete

The above graph shows the variations of 7, 14, 21,28days compressive strength ofdifferent types of water samples, with partial replacement of cement by saw dustash 12% for M25 grade concrete. From this experiment is concluded that STWW 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. The compressive strength of concrete is increased by mixing TWW at the end of 28 days. By this it is clearly visible that treated industrial sewage water has great influence on strength with saw dust as replacement for M25 grade concrete strength getting was 37N/mm2.

4. CONCLUSION

From the results of this study, the properties of sewage treated water is achieved the higher compressive strength for concrete cube with compared to the concrete cube of River water and Portable water. It was revealed that, the concrete made with sewage treated water and partial replacement of cement by saw dust ash 12% with constant water – cement ratio of 0.8, has more compressive strength for 28 days compared to reference specimen. The cost of the SDAC was found to be lower than the cost of the PCC. This is because saw dust concrete utilizes a waste product (saw dust) and converts it into economic and sustainable use. Therefore, the replacement of cement with saw dust ash would be beneficial to lo income areas which may not afford to keep up with the rising costs of cement.The reduction in carbon emissions was found to be positively correlated with the proportion of cement replaced. Therefore, the more the proportion of cement replaced, the more would be the reduction in carbon emissions.The study therefore recommends the use of sewage treated water with acceptable physico- chemical properties.

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