A Study on Compressive Strength of Concrete By Replacing Mixing & Curing Water With Sewage Water And Fine Aggregate With Demolished Concrete Waste

Modi Musalaiah[1], Bharthavarapu Srikanth[2], Saikam Gopi[3], Katteboina Murali[4]
[1, 2] Asst.Prof, Dept of Civil Engineering
[3, 4] Dept of Civil Engineering
[1, 2] MVR College of Engineering and Technology, Paritala, A.P.

Abstract- *In India too much replacement has been accepted with the introduction of ready mixed concrete and the process has been already accelerated in recent times. Concrete is one of the most durable construction materials. The basic ingredients of concrete include Cement, Fine aggregate, Coarse aggregate and Water. In general, Ordinary Portland cement is used in the construction of civil structures. In this present work fine aggregate is replaced by demolished building concrete powder which is readily available and the water used to cast the cubes and cure the cubes was replaced by sewage water. The principal considerations on the quality of mixing water are related to performance in fresh as well as harden state. The quality of the water plays an important role in the preparation of concrete. Impurities in water may interfere with the setting of the cement and may adversely affect the strength and durability of the concrete also. The chemical constituents present in water may actively participate in the chemical reactions and thus affect the setting, hardening and strength development of concrete. In addition to that, health issues related to the safe handling of such water must be considered. The suitability of water can be identified from past service records or tested to performance limits such as setting times and compressive strength. Limits are specified for mixing water with their constituents such as total alkalis, chloride, sulphate, nitrates & salts etc. The aim of the present study was to know the effect of chemical impurities in mixing water and use of demolished concrete waste as fine aggregate on compressive strength. This work was carried out for a mix of M 25 Grade.*

Keywords- Cement, Fine Aggregates, Coarse Aggregates, Demolished Concrete, Sewage Water and Compressive Strength

I. INTRODUCTION

Water is the key ingredient, which when mixed with cement, forms a paste that binds the aggregate together. The water causes the hardening of concrete through a process called hydration. Hydration is a chemical reaction in which the major compounds in cement form chemical bonds with water molecules and become hydrates or hydration products. Details of the hydration process are explored in the next section. The water needs to be pure, typically drinkable, in order to prevent side reactions from occurring which may weaken the concrete or otherwise interfere with the hydration process. Water Quality is managed and assessed in terms of indicators for levels of bacteria and the resources below are aimed to assist in this regard. River flow objectives are the ideal natural flow conditions that will improve river health and water quality. Water quality is closely linked to the surrounding environment and land use. Other than in its vapour form, water is never pure and is affected by community uses such as agriculture, urban and industrial use, and recreation. The strength of concrete varies due to the presence of Different impurities present in the mixing water. The impurities may be Salts, Suspended Particles, Miscellaneous Inorganic Salts, Chloride Ions, Acidic and Alkali impurities, Algae, Sugar etc. And the impacts vary from water to water, that means if we vary the quality of water the impacts are also changed.

II. MATERIALS AND METHODS

2.1. Materials

The various materials used in to complete the present study are discussed below, Concrete is a composite material which is made up of filler and a binder. Typical concrete is a mixture of fine aggregate (sand), coarse aggregate (rock), cement, and water. Aggregates are chemically inert, solid bodies held together by the cement. Aggregates come in various shapes, sizes, and materials ranging from fine particles

of sand to large, coarse rocks. Because cement is the most expensive ingredient in making concrete, it is desirable to minimize the amount of cement used. 70 to 80% of the volume of concrete is aggregate in order to keep the cost of the concrete low. Water is a transparent and nearly colourless chemical substance that is one of the main constituent of Concrete which available abundantly on Earth's streams, Lake Sand oceans and the fluids of most living organisms. In this present study, fine aggregate was completely replaced by demolished building concrete waste. The water used to prepare the concrete cubes and to cure the casted cubes was completely replaced by sewage water.

2.1.1. Water replaced by Sewage Water

Sewage, or domestic/municipal wastewater, is a type of wastewater that is produced by a community of people. It is characterized by volume or rate of flow, physical condition, chemical and toxic constituents, and its bacteriologic status (which organisms it contains and in what quantities). It consists mostly of grey water (from sinks, bathtubs, showers, dishwashers, and clothes washers), black water (the water used to flush toilets, combined with the human waste that it flushes away); soaps and detergents; and toilet paper (less so in regions where bidets are widely used instead of paper). Sewage usually travels from a building's plumbing either into a sewer, which will carry it elsewhere, or into an onsite sewage facility (of which there are many kinds). Whether it is combined with surface runoff in the sewer depends on the sewer design (sanitary sewer or combined sewer). The reality is that most wastewater produced globally remains untreated, causing widespread water pollution, especially in low-income countries. **The water used to prepare the concrete cubes and to cure the casted cubes was completely replaced by sewage water. Sewage water collected from locally available sewage dumping points.**

2.1.2. Fine Aggregate replaced by Demolished Concrete Waste

Construction materials are increasingly judged by their ecological characteristics. Concrete recycling gains importance because it protects natural resources and eliminates the need for disposal by using the readily available concrete as an aggregate source for new concrete or other applications. Recycling of concrete is a relatively simple process. It involves breaking, removing, and crushing existing concrete into a material with a specified size and quality. The crushing characteristics of hardened concrete are similar to those of natural rock and are not significantly affected by the grade or quality of the original concrete. **Here, fine aggregate was completely replaced by demolished building concrete waste.**

2.2. Methods

2.2.1. Water Quality Tests

Sampling is to collect representative sample. Representative sample by means a sample in which relative proportions or concentration of all pertinent components will be the same as in the material being sampled. The parameters include various physical and chemical constituents in sample were determined. The Sampling was done in 200 Lit drums to cast and cure the cubes and for testing taken in polythene bottles. The capacity of each bottle was 1L. Before sample was collected the bottles were rinsed with the corresponding water that is being taken into the container. After the completion of sampling, the containers were stored in a cool and dark place. The parameters include various physical and chemical constituents in each sample were determined. The parameters were analyzed in the laboratory according to lab procedures, and those are Electrical Conductivity, Turbidity, p^H, Total Dissolved Solids, Total Hardness, Calcium Hardness Magnesium, Iron, Fluorites, Chlorides, Nitrites, Nitrates and Sulphates. The sewage sample is analyzed with the help of APHA, 1985 procedures in laboratory.

2.2.2. Concrete Tests

Various Concrete mixes was prepared with the help of various water samples by varying type of water sample used in each time. Before that various physical properties of cement, Fine Aggregates and Coarse Aggregates are tested and the Sieve analysis of Fine Aggregates and Coarse Aggregates are also estimated. Mix designs for each set having different combinations are carried out by using IS 10262-2009 method. The mix proportions obtained for normal M25 grade concrete is 1: 2.08:3.70 with a water cement ratio 0.45. The concrete tests are divided into two categories, one is Workability and second one is Compressive Strength analysis. With reference to the above mentioned mix design we prepared specimens (Cubes) to test at an age of 7days, 14days, 21days and 28days.

III. RESUTS AND DISCUSSIONS

With reference to the above chapters, we conducted experiments on water quality and compressive strengths. The compressive strengths are determined for each and every specimen casted and cured for 7days, 14days, 21days and 28days basis. The obtained Water Quality results of the samples are presented in Table.1. The obtained Compressive strength results are denoted in Table.2. The obtained water

quality results are plotted in Figure.1. And the compressive strengths are shown in Figure.2.

Table.1. Water Quality Analysis of Sewage Water

Parameter	Unit	Value	Parameter	Unit	Value
Turbidity	NTU	6.5	Chloride	mg/lit	45
P^H	---	7.9	Alkalinity	mg/lit	95
Electrical Conductivity	mho/lit	295	Iron	mg/lit	0.11
Total Dissolved Solids	mg/lit	321	Fluoride	mg/lit	0.35
Total Hardness	mg/lit	112	Nitrate	mg/lit	20.1
Calcium Hardness	mg/lit	45	Nitrite	mg/lit	0
Sulphate	mg/lit	21	Magnesium	mg/lit	16.1
Remarks			Brackish Water		

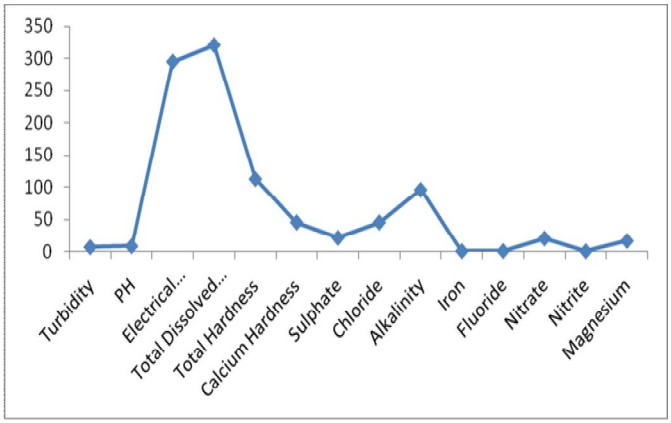

Figure.1. Sewage Water Analysis Results

Table.2. Compressive Strength Results

Compressive Strength, N/mm^2			
7days	21.1	21days	29.7
14days	24.1	28days	33.5

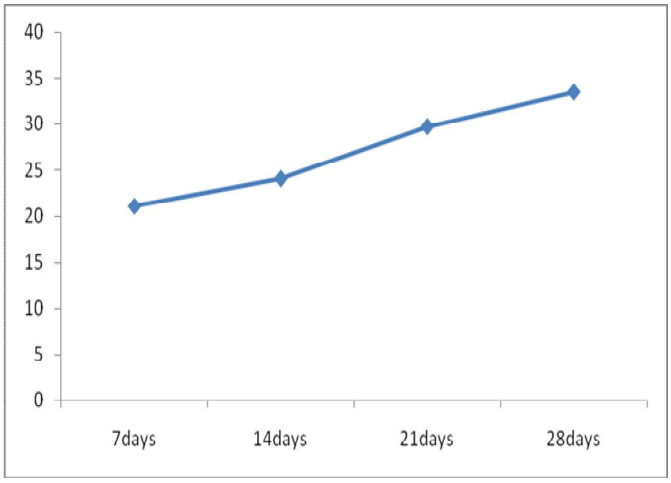

Figure.2. Compressive Strengths

From the graph it is clear that the replacement of water with sewage water and fine aggregate with demolished concrete waste attains good compressive strength results as similar to the conventional concrete.

IV. CONCLUSIONS

Series of experiments were conducted on M-25 grade (1:1.08:2.70) concrete. Cubes were casted and cured in sewage water as per the relevant IS code of practice. The cubes were tested at different ages i.e. 7, 14, 21 and 28 days. The obtained result shows that the compressive strength at an age of 28days is **33.5 N/mm^2 which is similar to conventional concrete which is prepared by M25. In order to attain more compressive strength than the conventional strength values it's better to go with partial replacement of the fine aggregate.**

REFERENCES

[1] G Reddy Babu, B Madhusudana Reddy, N V Ramana and B Sudharshan Reddy (2017), Experimental Study on Feasibility of Non Potable Water with Lime on Properties of PPC, Conference Series in Materials Science and Engineering

[2] Obi Lawrence E (2016), Empirical Investigation of the Effects of Water Quality on Concrete Compressive Strength, International Journal of Constructive Research in Civil Engineering, Vol.2, Iss.5

[3] Obam and Ogah (2016), Effect of Curing Methods on the Compressive Strength of Concrete, International Journal of Engineering and Computer Science, Vol.5, Iss.7

[4] Kamlesh Saini, Vijay Chaudhary ,Ankush Bisnohi, Harshit Agarwal, Meghalal Ram and Sandeep Saraswat (2016), Effect on strength properties of concrete by using waste wood powder as partial replacement of cement, International Journal of Civil Engineering, Vol.13,Iss.3

[5] Ramkar A P and Ansari U S (2016), Effect of Treated Waste Water on Strength of Concrete, Journal of Mechanical and Civil Engineering, Vol.13, Iss.6

[6] Ghada Mourtada Rabie (2016), Using of Wastewater Dry and Wet Sludge in Concrete Mix, Civil and Environmental Research, Vol.5, Iss.2

[7] H Sudarsana Rao,V Venkateswara ReddyandS G Vaishali (2004), Effects of Acidity Present in Water on Strength and Setting Properties of Concrete,Conference On Our World In Concrete & Structures, Vol.1, Iss. 2

[8] Sherwood P.T, "Alternative Materials In Road Construction", Thomas Telford, London, 1995.

[9] Desmyster J, Et Al, "Use Of Recycled Materials As Aggregates In Construction Industry", Proceedings Of The 1st Etnrecy, Net/Rielm Workshop, Etnrecy, Paris, 2000.

[10] Khatib J.M., "Properties Of Concrete Incorporating Fine Recycled Aggregate", Cement And Concrete Research, Volume 35, Number 4,

[11] Amnon Katz, "Properties Of Concrete Made With Fine Recycled Aggregate From Partially Hydrated Old Concrete", Cement And Concrete Research, Volume 33, Number 5, Pg No 703-711, May 2003.Pg No 763-769, April 2005.
[12] Salomon M. Levy, Et Al, "Durability Of Recycled Aggregates Concrete: A Safe Way To Sustainable Development", Cement And Concrete Research, Volume 34, Number 11, Pg No 1975-1980, November 2004.