Experimental Investigation on Influence of Water Quality on Compressive Strength of Concrete Cube Mixed By M30

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Abstract- *Concrete is produced by mixing binding materials and inert materials with water. Thus, water and its quality (and also its quantity) plays an important role in determining the quality of concrete. Strength and durability of concrete is to a large extent determined by its water to cementitious materials ratio.Water is required to wet the surface of aggregates to develop adhesive quality as the cement paste binds quickly and satisfactorily to the wet surface of the aggregates than to a dry surface. Also, water is needed to make plastic mixture of the various ingredients so as to impart workability to concrete to facilitate placing it in the desired position. Ultimately, by chemically reacting with cement, water helps to produce the desired properties of the concrete.Usually, quality of the water is the highly neglected subject despite it having a very important role to play in determining the durability of the final product. It is a commonly accepted view that any potable water is suitable to be used in concrete making. It is found that sea water reduces the long-term strength of the cement, though reduction in strength is limited to 15%. Water containing large amount of chlorides tends to cause persistent dampness and surface efflorescence and also corrosion of steel used in concrete.It is always better to check water quality for ensuring good quality concrete.The aim of the present study was to know the effect of chemical impurities in mixing water on compressive strength. To this purpose we considered three different samples from various sampling locations, they are Sea Water (Manginapudi, Machilipatnam), Ground Water (Paritala, Kanchikacherla) and Industrial Effluent Water (Ibrahimpatnam). This work was carried out for a mix of M 30 Grade concrete with to study effect of use of various water samples. From the results it is observed that sea water results in good strength properties in concrete but in reality, some far we are neglecting to use as mix water due to presence of water impurities.*

Keywords- Cement, Fine Aggregates, Coarse Aggregates, Sea Water, Ground Water, Industrial Effluent 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. The role of water is important because the water to cement ratio is the most critical factor in the production of "perfect" concrete. Too much water reduces concrete strength, while too little will make the concrete unworkable. Concrete needs to be workable so that it may be consolidated and shaped into different forms (i.e. walls, domes, etc.). Because concrete must be both strong and workable, a careful balance of the cement to water ratio is required when making concrete. To investigate the influence of water quality on strength of concrete, we were casted and cured the cubes with same water selected from the water available in three different sources and areas. The study area of the present work has done on **Sea Water, Industrial Effluent Water and Ground Water**.

II. MATERIALS AND METHODS

2.1. Materials

The various materials used in to complete the present study are discussed below,

2.1.1. Concrete Materials

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. The selection of an aggregate is determined, in part, by the desired characteristics of the concrete. Cement is a binder, a substance used for construction that sets, hardens and adheres to other materials, binding them together. Cement is seldom used on its own, but rather to bind sand and gravel (aggregate) together. Cement is used with fine aggregate to produce mortar for masonry, or with sand and gravel aggregates to produce concrete.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, lakesand oceans and the fluids of most living organisms.

2.1.2. Water Samples

Three different water samples are selected to investigate the present research work. The samples are 1. Sea, 2. Ground Water and3. Industrial Effluent. The areas of sampling of water are given in Table.1.

Table.1. Water Sampling Stations

S.No.	Type of Sample	Sampling Location
1	Sea Water	Manginapudi, Machilipatnam
2	Ground Water	Paritala, Kanchikacherla
3	Industrial Effluent	Ibrahimpatnam

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 each sample were determined. The sample collection was done in the month of March 2021. The Sampling was done in 500 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.All the three samples are analysed 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.The M30 mix designs for each set having different combinations are carried out by using IS 10262-2009 method. 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 and 28days.

III. RESUTS AND DISCUSSIONS

With reference to the above headings, we conducted experiments on water quality and compressive strengths with the addition of various types of water samples for casting and curing of cubes to determine the impact of water quality on strength of concrete. Water from Sea, Ground and Industrial Effluentare selected as samples. The compressive strengths are determined for each and every specimen casted and cured for 7days, 14days and 28days basis, and are compared to know, the influence of water quality of selected three types of sample. The obtained Water Quality results of all the three samples are presented in Table.2. The obtained Compressive strength results are denoted in Table.3. The obtained water quality results are plotted in Figure.1. And the compressive strengths are shown in Figure.2.

Table.2. Water Quality Analysis of All Samples

Parameter	Sea Water	Ground Water	Industrial Effluent
Turbidity	37	2.5	6.2
P^H	7.8	7.6	7.9
Electrical Conductivity	1275	160	250
Total Dissolved Solids	1476	154	216
Total Hardness	340	56	58
Calcium Hardness	210	32	25
Sulphate	340	18	12
Chloride	1358	21	45
Alkalinity	960	41	38
Iron	0.23	0.01	0.11
Fluoride	0.25	0.35	0.27
Nitrate	32.8	10.4	18.2
Nitrite	0	0	0
Magnesium	65	8	10
Remarks	**Brackish**	**Potable**	**Excess Turbidity**

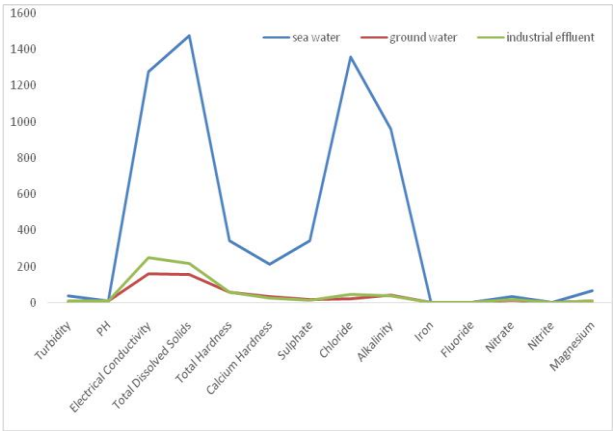

Figure.1. Water Analysis Results

Sea sample: The parameters are analysed in Sea Sample with the standard procedures. In this sample maximum number of parameters are beyond the limits and it is remarked as brackish water.

Ground Water: The parameters are analysed in Ground Sample with the standard procedures. In the Ground Water maximum number of parameters are within the limits and it is remarked as potable water.

Industrial Effluent: The parameters are analysed in Industrial Effluent with the standard procedures. In the Industrial Effluent sample, some of the parameters beyond the limits and some of the parameters with in the limit.

Table.3. Compressive Strengths of all Samples

S.NO	Samples	Compressive Strength, N/mm²		
		7days	14days	28days
1	Ground	9.17	17.22	36.12
2	Industrial Effluent	9.48	18.21	35.33
3	Sea	10.69	19.4	38.11

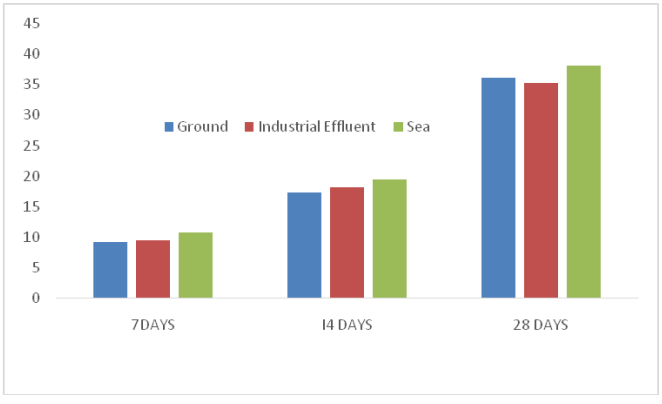

Figure.2. Compressive Strengths

From the graph it is clear that the sea sample giving highest compression value among all the remaining samples. And also, all the three selected samples, were favorable and best for construction works

IV. CONCLUSIONS

Series of experiments were conducted on M-30 grade concrete. Cubes were casted and cured in three different water samples as per the relevant IS code of practice. The cubes were tested at different ages i.e. 7, 14 and 28 days. The choice of selection of water sample is based on quality of water, as per this statement the Ground Water is favourable for all construction works, some far Industrial Effluent water may also be used.

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