iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** IV **Month of publication:** April 2020

DOI:

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue IV Apr 2020- Available at www.ijraset.com

Effect of Treated Water on Strength of Green Concrete

M. Muthu Narayanan[1], D. Prem Kumar[2], N. Raj Kumar[3], R. Ramesh Raja[4], K. Suganya Devi[5],
[1, 2, 3, 4] *B.E., Student, Department of Civil Engineering, SRM Valliammai Engineering College, SRM Nagar, Kattangulathur-603 203, Tamil Nadu, India.*
[5] *Assistant Professor, Department of Civil Engineering, SRM Valliammai Engineering College, SRM Nagar, Kattangulathur-603 203, Tamil Nadu, India.*

Abstract: ***The natural resources are being consumed in large quantity by construction industry making them inadequate to meet challenges of increasing demand in now day's scenario. Large amount of wastewater is discharged from water that flows down the sink or toilet to runoff that enters storm drainage systems and a huge number of old structures which have stopped serving life are being demolished creating huge amount of waste.***
The aim of this experiment is to access the feasibility of inclusion of Glass Powder, Fly Ash and Recycled coarse aggregate with Treated water based concrete to enhance its quality and secondly to evaluates the effect of Treated water and recycled coarse aggregate on compressive strength and split tensile strength of concrete with the comparison of conventional strength of concrete.
To determine the compressive strength and Split Tensile Strength of concrete specimen using the mix of M25 grade of concrete by varying percentages of recycled aggregate replacing natural aggregate by 50% and 100% by weight. In addition of glass powder and Fly Ash was used as 0% and 20% by weight replacing cement. The Treated water used for both the mixing proportion and curing process.
The Concrete Specimen (Cube and Cylindrical) were casted for the testing of the basic properties of hardened concrete. Regardless of the replacement ratio, recycled aggregate concrete (RAC) had a satisfactory performance. The compressive strength result was found to be increased from 3.86% to 5.68% and Splitting Tensile strength was found to be increased from 7.14% to 8.98%. The Specimen casted and cured with Treated water showed better performance with increase in age of the concrete.
Keywords: Recycled coarse aggregates, Fly ash, Glass powder, Treated water.

I. INTRODUCTION

High consumption of natural resources, production of industrial wastes and environmental pollution are some of the factors that have triggered the field of sustainable development. Coarse aggregate and cement are environmentally relevant.
These two materials constitute major part of concrete.
The construction industry faced scarcity of concrete matrix materials due to rapid growth in residential, industrial and infrastructure development. Large quantity of Cement production and requirement leads to high amount of CO_2 emissions affecting the environment. Over year's amount of Construction and Demolition Waste and Industrial waste also increasing and creating land fill/disposal problems. Almost all country is facing large amount of demand in fresh water. So, many of the Scientists and researchers are currently focusing considerable attention on characterization, strength and durability characteristics of using these waste materials in concrete worldwide.
Use of treated water can be a good replacement to meet the fresh water demand and recycled aggregate from construction and demolition waste is showing prospective application in construction industry. M-Sand has been found to be a potential replacement for fine aggregate i.e., Sand, owing to its economy. They use 100 million tonnes of sand per year and around 6-10 million tones are wasted each year. India is the second largest country in Cement production. From literatures it was found that Fly ash and glass powder can be used as a better substitute material for cement. Fly Ash reduces the permeability of concrete and contributes to durability. Glass powder contains mainly silica and calcium. It provides long term strength and durability and has better insulation.
Coarse aggregate and cement are partially replaced with C&D wastes, fly ash and glass powder in different combinations. The partial replacement of coarse aggregate with Recycled aggregates ranges from 50% to 100%. Glass powder and Fly Ash is also used up to 20% to replace cement. The Treated water is used up for both the Mixing proportions and curing process. Detailed experimental investigations was carried out to produce sustainable concrete and to study strength parameters and durability characteristics of the Treated Water with Recycled Aggregate Concrete with Industrial waste materials.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue IV Apr 2020- Available at www.ijraset.com

II. GREEN CONCRETE

Green concrete is the type of concrete which is much like the conventional concrete but the production of such concrete require minimum amount of energy and cause least harm to environment. It is a concept of using eco-friendly materials in concrete, to make the system more sustainable. As a concrete which uses waste materials as at least one of the components, or its production process does not lead to environment destruction, or it has high performance and life cycle sustainability.
In such way, this study deals with the partial replacement of recycled aggregates, Fly ash, Glass powder and treated water for mixing and curing process. Thus the materials used are tested for standard specification as per Indian Standards.

A. Recycled Aggregates

It has been concluded that RCA can be readily used in construction of low rise buildings, concrete paving blocks & tiles, flooring, retaining walls, approach lanes, sewerage structures, sub base course of pavement, drainage layer in highways, dry lean concrete (DLC) etc. in Indian scenario.

B. Fly Ash

Fly ash as obtained from pulverized coal can be used as an SCM for about 20%. It mainly contains Silica, Alumina and Iron. When coal is burned in boiler it leaves behind some ash. The ash which is collected in the bottom is known as bottom ash and that moves to the top is the fly ash. The coal power plant contributes to 38% of the world's power production. It can be used as a supplementary cementitious material. Finely ground fly ash can reduce the water content used in the concrete mixture and prevent bleeding. It reduces the permeability and increases the ultimate strength.

C. Glass Powder

Glass powder is a waste material that is abundant in the industry and not well utilized. Glass can be used as a binder, fine or coarse aggregate depending on its size. But grinding it to a fine powder and using it as a replacement for cement finds its best use, as the alkali silica reaction is suppressed and it contributes to the durability of concrete. We have about to add about 2.5% of the glass powder in the place of cement.

D. Treated Water

Water treatment is any process that improves the quality of water to make it more acceptable for a specific end-use. Water treatment removes contaminants and undesirable components, or reduces their concentration so that the water becomes fit for its desired end-use. Hence the domestic treated water was collected from our campus. The curing of concrete specimens is done nearby the treatment plant itself. The treated water is tested for standard specifications.

E. Mix Proportion

Table1 Mix Proportion

Grade of concrete	Cement	Fine Aggregates	Coarse Aggregates	Water-Cement Ratio
M25	1	1	2	0.45

III. OBJECTIVE OF THE STUDY

The main objective of the project is to identify the suitability of waste materials such as C&D wastes, treated water to develop the sustainable concrete which can be applicable for all structural concretes.
The main objectives of the project are,

A. To study the characteristics of treated wastewater.
B. To study the characteristics of industrial wastes like Fly ash, M-Sand and Glass powder.
C. To study the strength characteristics of recycled Aggregate concrete.
D. To study the strength characteristics of the concrete using normal water and treated water for curing and mixing proportions.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue IV Apr 2020- Available at www.ijraset.com

IV. EXPERIMENTAL STUDY

A. General

In order to study the strength parameters of Green concrete, the specimens of different dosages such as 5%, 10%, and 15% by weight of cement are added and casted. The strength parameters are studied using the following experiments for 7 and 28 days.

B. Basic Test on materials

The basic test on materials are conducted as per the Indian standards to check properties of the materials used in the concrete such as recycled coarse aggregate, cement, M-sand. The test results are reported in table.2.

Table 2 Basic Test on Materials

Test	Results
Specific Gravity of Recycled Coarse Aggregates	2.7
Impact Resistance of Recycled Coarse Aggregates	23.34%
Initial Setting time of Cement	35min
Specific Gravity of Cement	3.06
Specific Gravity of Fine Aggregates (m-sand)	2.33

C. Testing on Treated Water

The treated water is collected from the treatment plant and the laboratory test was conducted for the samples as per the Indian standards and the test values are reported in table.3

Table 3 Basic Test on Treated and Normal Water

Test	Normal Water	Treated Water	Standards
pH	7.17	7.63	> 7 considered basic
Chloride (in mg/l)	170.4	440.2	200-500mg/l (Fair Quality Water)
Hardness (in mg/l)	140	430	> 300 (Very hard)
Sulphates (in mg/l)	37	82	Max. Permissible level is 400mg/l
Total Solids (in mg/l)	4000	4000	>2000mg/l, requires treatment before disposal.
Total Dissolved Solids (in mg/l)	2000	2000	
Suspended Solids (in mg/l)	2000	2000	

D. Casting of Specimens

Casting of specimens was done after completing the basic test on materials. The specimens was casted using M25 grade of concrete and the curing of specimens was done for 7 days and 28 days using both tap water and treated water. The details of the specimens casted are listed in Table.4

Table 4 Details of the Specimens Casted

Specimen ID	Specimen Description	Curing
GN1	50% - RA, 50% - NA, Normal water mixing	Normal water
GN2	100% - RA, Normal water mixing	Normal water
GN3	50% - RA, 50% - NA, Normal water mixing	Treated water
GN4	100% - RA, Normal water mixing	Treated water
GT1	50% - RA, 50% - NA, Treated water mixing	Normal water
GT2	100% - RA, Treated water mixing	Normal water
GT3	50% - RA, 50% - NA, Treated water mixing	Treated water
GT4	100% - RA, Treated water mixing	Treated water

V. TEST RESULTS

A. Compression Strength Test

Compressive strength of the casted specimens after 7days and 28 days curing was tested in compression testing machine with 2000 kN capacity. The effect of Treated water and normal water in Green concrete for M25 grade of concrete in 7 days and 28 days Compressive Strength is shown in Table 5 and Table 6 and Fig.1 and 2 respectively. The Compression Test is carried out in the cube specimen of size 150x150x150mm.

Table 5 Test Results of 7 days Compressive Strength Test

Specimen ID	Result (N/mm^2)
GN1	15.83
GN2	21.46
GN3	17.05
GN4	20.63
GT1	13.54
GT2	18.42
GT3	18.11
GT4	20.78

Table 6 Test Results of 28 days Compressive Strength Test

Specimen ID	Result (N/mm^2)
GN1	26.48
GN2	28.21
GN3	26.93
GN4	29.89
GT1	25.78
GT2	28.95
GT3	26.65
GT4	29.91

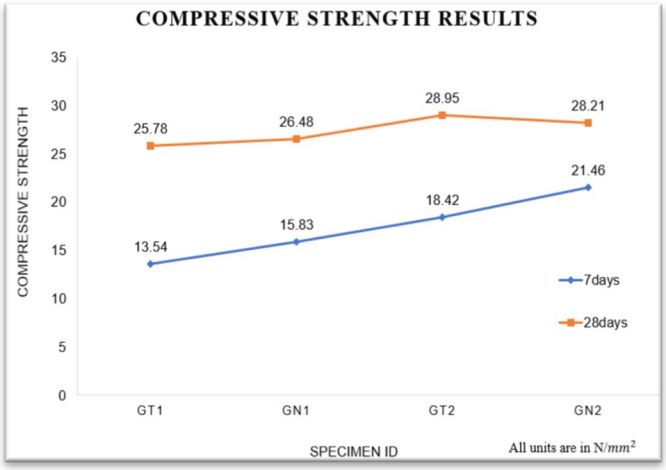


Fig.1 Result of 7 Days and 28 Days Compressive Strength (Results of Normal water curing)

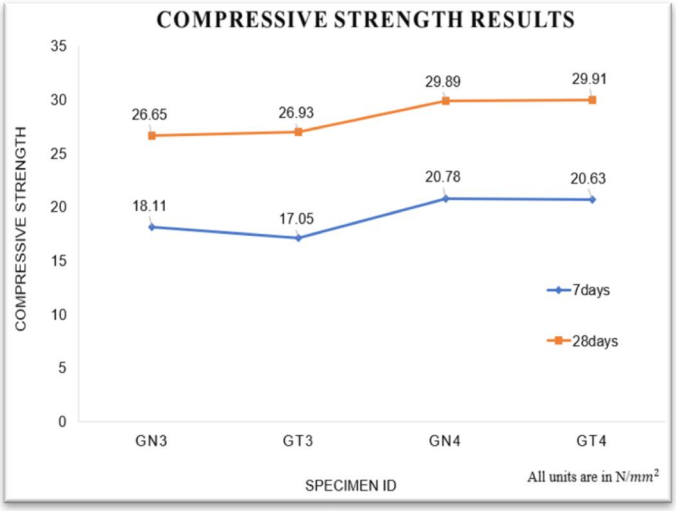


Fig.2 Result of 7 Days and 28 Days Compressive Strength (Results of Treated water curing)

Therefore, from the above results of the compressive strength test the efficiency of the M25 grade of green concrete is 3.86% and 5.68% increased in specimens made by treated water with 100% replaced recycled aggregate when compared to specimens with normal water in 7days to 28days respectively. Therefore compressive strength was found to be increased with increase in age of concrete.

B. Splitting Tensile Strength Test

A method of determining the tensile strength of concrete using a cylinder which splits across the vertical diameter. It is an indirect method of testing tensile strength of concrete. The effect of Treated water and normal water in Green concrete for M25 grade of concrete in 7 days Splitting Tensile Strength is shown in Table 5 and 6 then Fig 3 and 4. A cylinder of diameter 150mm and 300mm length.

Table 7 Test Results of 7 days Splitting Tensile Strength Test

Specimen ID	Result (N/mm^2)
GN1	1.51
GN2	3.24
GN3	1.72
GN4	2.50
GT1	1.96
GT2	2.26
GT3	2.21
GT4	3.12

Table 8 Test Results of 28 days Splitting Tensile Strength Test

Specimen ID	Result (N/mm^2)
GN1	2.8
GN2	3.36
GN3	2.75
GN4	3.38
GT1	2.83
GT2	3.3
GT3	2.92
GT4	3.56

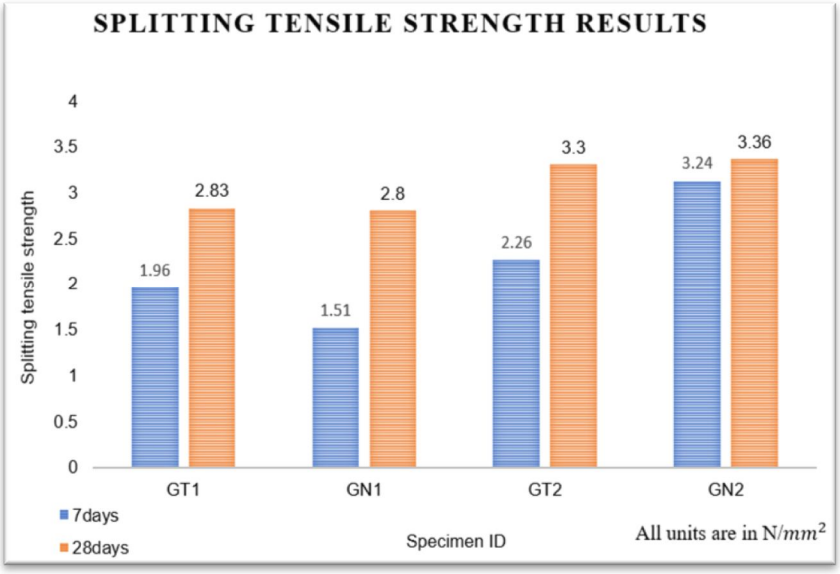


Fig 3 Result of 7 Days and 28 Days Splitting Tensile Strength (Results of Normal water curing)

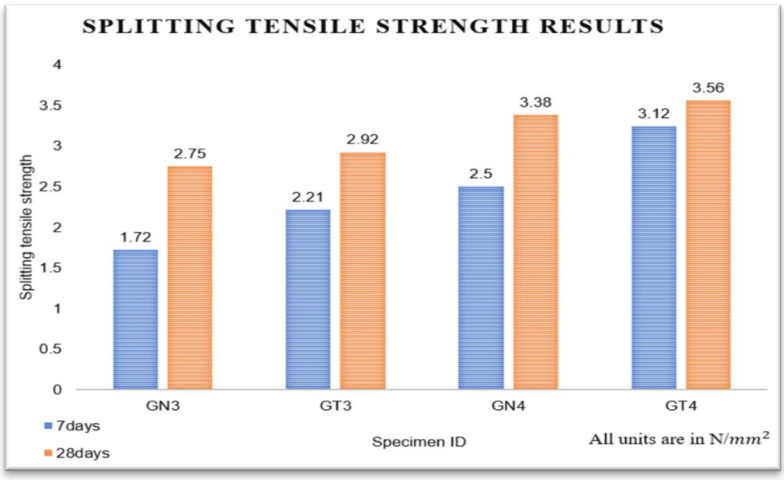


Fig 4 Result of 7 Days and 28 Days Splitting Tensile Strength (Results of Treated water curing)

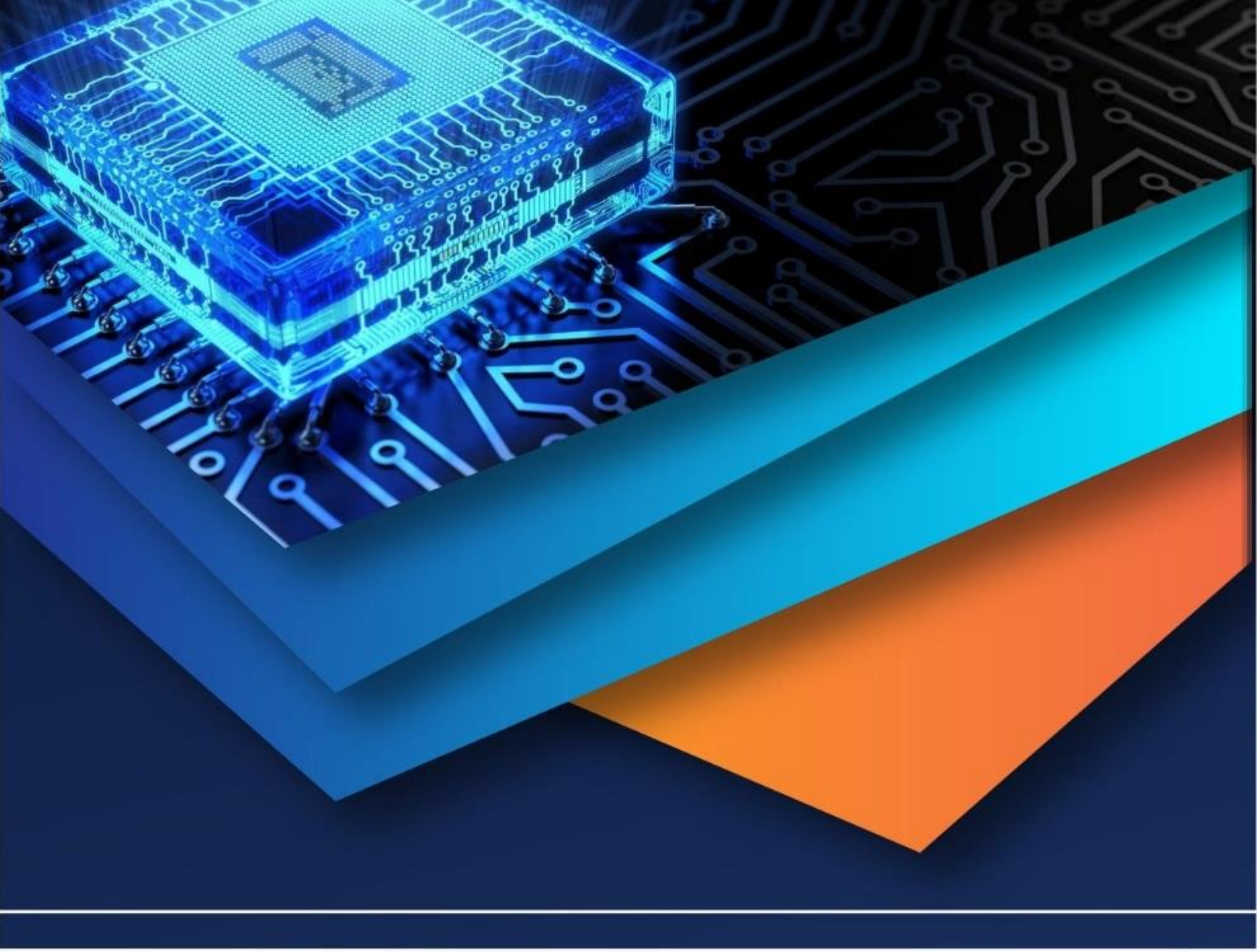
Therefore, from the above results of the splitting tensile strength test the efficiency of the M25 grade of green concrete is 7.14% and 8.98% increased in specimens made by treated water with 100% replaced recycled aggregate when compared to specimens with normal water in 7 days to 28days respectively.

VI. CONCLUSION

The Glass Powder and Fly ash as a replacement material up to 10-20%. The efficiency of the compressive strength test of the M25 grade of green concrete is 3.86% increased in specimens made by treated water with 100% replaced recycled aggregate when compared to specimens with normal water in 7days. The efficiency of the compressive strength test of the M25 grade of green concrete is 5.68% increased in specimens made by treated water with 100% replaced recycled aggregate when compared to specimens with normal water in 28days. The efficiency of the splitting tensile strength test of the M25 grade of green concrete is 7.14% increased in specimens made by treated water with 100% replaced recycled aggregate when compared to specimens with normal water in 7days. The efficiency of the splitting tensile strength test of the M25 grade of green concrete is 8.98% increased in specimens made by treated water with 100% replaced recycled aggregate when compared to specimens with normal water in 28days. The Workability of concrete is found to be low for recycled aggregate 7days of compression strength and splitting tensile strength are comparatively low for treated water, when compare to specimen with normal water. But 28days of compression strength and splitting tensile strength are comparatively high for treated water, when compare to specimen with normal water.

REFERENCES

[1] Islam G.M.S., Rahman M.H., &Kazi N. “Waste glass powder as partial replacement of cement for sustainable concrete practice” International Journal of Sustainable Built Environment (2017) 6, 37–44.
[2] IS 456:2000 “Plain and Reinforced Concrete- Code of Practice”, Bureau of Indian standards, New Delhi.
[3] IS 2386 (Part-3):1963 “Methods of Test for Aggregates for Concrete” (specific gravity, density, voids, absorption and bulking), Bureau of Indian standards, New Delhi.
[4] IS 2386 (Part-4):1963 “Methods of Test for Aggregates for Concrete” (mechanical properties), Bureau of Indian standards, New Delhi.
[5] IS4031 (part-5):1988 “Methods of Physical Tests for Hydraulic Cement” (determination of initial and final setting times), Bureau of Indian standards, New Delhi.
[6] IS 10262-Mix design code book.
[7] Jostin P., & Priya B. “Use of Glass Powder as Fine Aggregate in High Strength Concrete” International Journal of Science and Engineering Research (IJ0SER) Vol 2 Issue7.
[8] Kirar A., Porwal V., & Qureshi S. A. (2018) “Studies of Recycled Aggregate Concrete with Glass Powder” International Journal of Innovative Research in Science, Engineering and Technology Vol.7, Issue 5.
[9] Ramkar A. P., & Ansari U. S. (2016). “Effect of Treated Waste Water on Strength of Concrete”. IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) Volume 13, Issue 6 Ver. II, PP41-45.
[10] Raju. S., & Kumar. P. R. (2014). “Effect of Using Glass Powder in Concrete”. International Conference on Innovations & Advances In Science, Engineering And Technology [IC – IASET] Volume 3, Special Issue 5.
[11] Thomas, B. M., Ph, D., Eng, P., Engineering, C., & Brunswick, N.(n.d.).“Optimizing the Use of Fly Ash in Concrete”.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY