Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 9, Issue, 5(D), pp. 26715-26721, May, 2018

ISSN: 0976-3031

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

EFFECT OF SALINE WATER ON CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT WITH SILICA FUME AND FINE AGGREGATE WITH STONE DUST

Satish Kumar Vishwakarma., Anwar Ahmad., Syed Aqeel Ahmad and Rajiv Banerjee*

Department of Civil Engineering Integral University, Lucknow, India

DOI: http://dx.doi.org/10.24327/ijrsr.2018.0905.2110

ARTICLE INFO

Article History:

Received 16th February, 2018
Received in revised form 25th March, 2018
Accepted 23rd April, 2018
Published online 28th May, 2018

Key Words:

Saline Water, Silica Fume, Cement, fine Sand, stone dust.

ABSTRACT

The fresh-fresh water situations occur in building constructed on hinterlands and main lands. The fresh-salt water situations are mainly in structures or building close to lagoon or sea. The salt-fresh water situations are very rare in practice but are well pronounced in areas where there is scarcity of fresh water or the available surface water is salty. The salt-salt water situations are visible mostly in structures built in ocean or sea. In addition, higher concrete cover can be provided when designing the member with increased environmental awareness and its potential hazardous effects, utilization of industrial by products has become an attractive alternative to disposal. Silica fume(SF), which is by product of the smelting process in the silicon and ferrosilicon industry. Silica fume is very effective in the design and development of high performance concrete. This paper presents the results of an experimental investigations carried out to find the suitability of silica fume in High Performance concrete. The incorporation of silica fume into the normal concrete is a routine one in the present days to produce the tailor made high strength and high-performance concrete. The design parameters are increasing with the incorporation of silica fume in conventional concrete and the mix proportioning is becoming complex.

Copyright © Satish Kumar Vishwakarma *et al*, 2018, this is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Concrete is the most widely used construction material all over the world. It is difficult to find out alternate material for construction which is as suitable as that of such material form durability and economic point of view. The quantity of the water plays an important role in the preparation of concrete. Impurities in water may interfere the setting of the cement and may adversely affect the strength properties. The chemical constituents present in water may participate in the chemical reactions and thus affect the setting, hardening and strength development of mixture. The IS: 456(2000) code stipulates the water quality standards for mixing and curing. Nowadays, as development strides increase, lots of engineering construction including high rise building, embankment walls, and bridges are going on along the coastal belt of many countries. In coastal areas, there has always been a deficiency of fresh water as the available water is contaminated by sea salts. But sea water contains large amount of sea salts, which may have adverse effects on the properties of concrete. Sea water has a salinity property because of the quantity of chlorides in the water which tend to cause persistent dampness and efflorescence on concrete. Most sea waters are fairly uniform in chemical composition, which is characterized by the presence of about 3.5% soluble salts by weight. However, from the standpoint of aggressive action to cement hydration product, the pH of seawater varies between 7.4 and 8.4. At exceptional conditions, pH value lower than 7.5 may be encountered and this occurs due to a higher concentration of dissolved CO2, which would make the seawater more aggressive to Portland cement concrete. Portland Cement Concrete production is the second only to the automobiles as the major generator of CO2, which pollutes the atmosphere. In addition to that large amount of energy is also consumed for the concrete production. With an increased global focus on environmental concerns such as global warming, sustainable development and recycling; alternatives to conventional concrete are being researched, such as Ceramic concrete. Pozzolans are siliceous and aluminous material which possess little cementitious properties which will in finely form with the presence of water, react chemically with calcium hydroxide (Cement) at ordinary temperatures to form compounds possessing cementitious properties

Corresponding author:* **Rajiv Banerjee
Department of Civil Engineering Integral University, Lucknow, India

Materials

The details of the materials employed in the experimentation work is presented in the following section. The materials were tested in accordance of Indian Standard Code.

Early Mix Design Methods

When concrete was first adopted as a structural material during the nineteenth century, compressive strength was perhaps the only criterion in the proportioning of in a concrete mix. The concepts of workability, durability and other factors influencing the mix proportions, as they are understood now are of comparatively recent origin. The strength concrete was supposed to increase with the increase in quantity of cement and with better compaction. The role of mixing water was not clearly understood except in so far as it helped concrete to become plastic for easy compaction. It was also realised that use of aggregates having less voids resulted in stronger concrete. Some of the earlier mix design methods are based on the principles of minimum voids and maximum density. Minimum voids method: The principle of this method is to proportion the ingredients so that the resulting concrete is dense with minimum percentage of voids. The void contents of the fine and coarse aggregates are predetermined. The quantity of the aggregate in the mix should be sufficient enough to fill up the voids in the coarse aggregate and similarly the cement content of the mix is governed by the voids in the fine aggregate. The quantity of water should be sufficient enough to render the mix workable .During mixing, the presence of water will apparently increase the void content in the aggregates and method does not yield dense and strong concrete since graded aggregates are not used and there is no control over the water content in the mix in relation to quantity of cement used.(b)Fuller's maximum density method: Fuller advocated the maximum density theory which assumes that, the greater the amount of solid particles that can be packed in a given volume of concrete' the higher its strength. The method implies that the aggregates should be graded so that the mixture has the maximum density. Fuller and Thompson suggested ideal grading curves based on the equation given by

$P = 100(d/D)^{1/2}$

Where

P = percentage of material smaller than size 'd'

D = maximum particle size

If it is required to grade a mix with 20mm maximum size coarse aggregate and 4.75mm fine aggregate, the value of the percentage of material(p) finer than 4.75mm is given by

$P = 100(4.75/20)^{1/2} = 50$ per cent

Hence the fine aggregates including cement and coarse aggregates are combined in equal proportions and in addition, the quantity of particles of various intermediate sizes should correspond with Fuller's ideal curve. A major drawback of the method is that the ideal curve is based on the assumption that the aggregate is carefully packed to achieve maximum density and the effect of particle interference is ignored. In practice, it was found that the aggregate graded to give maximum density results in a harsh and unworkable mix since workability is improved only when there is excess of paste above that required to fill the voids in the sand and also an excess of mortar above that required to fill the voids in the coarse aggregate. The concept of an ideal grading curve is now discredited and concrete can be made successfully from aggregate having graindg much different from the ideal curve. Talbot-Richart method: The method suggested by Talbot and Richart is based on the experimental investigations in which the compressive strength of concrete was found to depend upon cement space ratio which is given by $\frac{c}{c+v}$

Where,

C = solid volume of cement

V = volume of water plus voids in a unit volume of freshly made concrete

The compressive strength of concrete was also found to depend on the 'Basic Water Content', which represents the volume of water corresponding to the minimum volume of mortar. A relative water content in the range of 1.2 to1.4 which implies 20 to 40 per cent more water than the Basic Water Content is recommended for the mixes. The method requires the computations of cement space ratios for several combinations of cement and sand at the same relative water content. If the resultant mixes are not chosen and the calculation are to be repeated.

Cement

Cement is a finely powered material made up of argillaceous and calcareous compounds. It is made from a mixture of elements that are found in natural materials such as limestone, clay, sand and/or shale. When cement is mixed with water, it can bind sand and gravel into a hard, solid mass called concrete. Cement is manufacture through a closely controlled chemical combination of calcium, silicon, aluminum, iron and other ingredients. Ordinary Portland Cement: Material made by heating a mixture of limestone and clay in a kiln at about 1450 ^{o}C, then grinding to a fine power with a small addition of gypsum. Portland Cement, the main subject of this sites, is the most common type of cement –basic cement, if you like. In particular, ordinary Portland cement include White Portland Cement and Sulfate Resisting Portland Cement (SRPC). The cement used in our study was OPC grade 43. Cement can be defined as the material having cohesive & adhesive properties which makes it capable to unite the different construction materials and for the compacted assembly. Ordinary/Normal Portland cement is one of the most widely used type of Portland Cement. The name Portland cement was given by joseph Aspdin in 1842 due to its similarity in colour and its quality when it hardens likes Portland stone is white grey limestone in island of Portland Dorset.

Sea Water

Water is an amazing solvent. It is able to retain large amount of salts and other materials in solution. When this occurs, the salts change the properties of water. When salt is dissolved in water the freezing point of water is lowered. Thus, fresh water freezes at 0 ^{o}C, where as normal sea water freezes at -1.9 degrees C. As ice forms in salt water, there is no room in the crystal for salt, most of the salt is squeezed out of the ice structure and resulting ice is less salty than when it began to freeze. Sea water has a higher density than fresh water. Sea water contains many dissolved, thereby producing a greater mass per unit volume, or a density, higher than of pure water. The amount of salts dissolved in water is called salinity. Salinity is measured in gm per 1000 ml and a special symbol is used: 0/00 by weight. Open ocean water hasan average salinity of about 35 o/oo (equivalent to 3.5% if one were to use units of one hundred instead of one thousand for the amount of water).

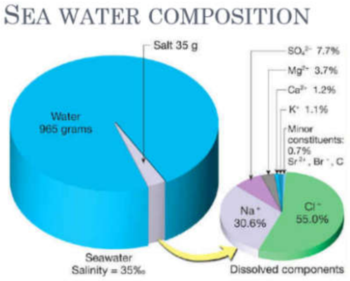


Fig 1

The pH value of the saltwater was tested for and the results are shown in Table

Table 1

S/N	First reading	Second reading	Third reading	Average
pH meter reading	8.93	9.1	9.15	9.15

Aggregates

Aggregates are used in concrete for very specific purposes. The use of croase and fine aggregates in concrete provides significant economic benefits for the final cost of concrete in place, aggregate typically make up about 60 to 70 percent of the volume of a concrete mixture, and as they are as they are the least expensive of the materials used in concrete, the economic impact is measurable. In addition, the use of aggregates provides volume stability to the hardened concrete. The shrinkage potential of a cement paste is quite high when compared to the aggregates. Controlling shrinkage of the concrete material is since shrinkage potential means more cracking when the concrete is restrained from movement by contact with the base material beneath a slab-on-grade, steel reinforcement within structure members, or contact with adjoining concrete in a concrete in a concrete member in a structure.

Fine Aggregate

Good concrete can be made by using different types of aggregates, like rounded and irregular gravel and crushed rock which is mostly angular in shape. The maximum nominal size of the aggregate to be selected for a particular job depends upon the width of selection and the spacing of reinforcement. According to the Indian Standard Code of Practice IS:456[6], the maximum size of the aggregate is restricted to 5mm less than minimum clear distance between the main bars for heavily reinforced concrete members, such as ribs of main beams. It is generally advantageous to use as large a maximum size of aggregate as possible and experimental investigations by Bloem have indicated that the improvement in the properties of concrete with an increase in the size of aggregate does not extend beyond about 40mm.

Table 2

S. No	Property	Result
1	Specific Gravity	2.56
2	Fineness Modulus	2.60
3	Zone	Zone II

Stone Dust

The stone dust used in this investigation obtained from the stone at Bhadarapur uttar Pradesh Stone dust confirms to zone II as per specifications indicated in IS: 383, was used as partial replacement for the concrete preparation. The properties of stone dust are shown in Table

Table 3

S. No	Property	Result
1	Specific Gravity	2.55
2	Fineness Modulus	2.7
3	Zone	Zone - II

Compressive Strength

The usual primary requirement of good concrete is a satisfactory compressive strength in its hardened state. Many of the desirable properties, like durability, impermeability, abrasion resistance, are highly influenced by the strength of concrete. For purposes of mix design, the strength of concrete can be considered to be solely dependent on the water/cement ratio for low and medium strength concrete mixes. In the case of high-strength concrete mixes, the aggregate/cement ratio, workability of the mix and the type and maximum size of aggregate influence the selection of water/cement ratio for a desired strength of concrete. The difference between the design strength and the minimum site strength depends upon the degree of quality control to be exercised. The strength of concrete also depends upon the type of cement used and, the method of curing employed, since the rate of hardening of cement of different types varies considerably. However, the strength of concrete made with different cements is approximately the same after one year according to the investigations of Gonnerman and Lerch. In most of mix design methods, the water/cement ratio required to produce the design compressive strength is determined by curves or tables which are based on the water/cement ratio law developed by Abrams.

Silica Fume

Silica Fume is highly pozzolanic mineral admixture, which is generally used to improve the concrete strength and durability properties. Silica Fume reacts with calcium hydroxide formed hydration of cement which results in the increase in strength and also the Silica Fume fills the voids between cement particles leads to increase in the durability. Silica Fume is procured from SAB ACCELERATORS LLP Kanpur. The properties of Silica Fume are shown in Table

Physical Properties of Silica Fume

Table 4

S. No	Physical Properties	Results
1	Physical	Micronised Powder
2	Odour	Odourless
3	Appearance	White Colour Powder
4	Colour	White
5	Pack Density	0.76 Gm/Cc
6	P^h of 5% Solution	6.90
7	Specific Gravity	2.63
8	Moisture	.058%
9	Oil	55 ml / 100 gms

Chemical Properties of Silica Fume

Table 5

S. No	Component	Results
1	Silica(SiO_2)	99.9%
2	Alumina (Al_2O2)	0.043%
3	Ferric Oxide (Fe_2O_3)	0.040%
4	Titanium Oxide (TiO_2)	0.001%
5	Calcium Oxide (CaO)	0.001%
6	Magnesium Oxide (MgO)	0.000%
7	Potassium Oxide (K_2O)	0.001%
8	Sodium Oxide (Na_2O)	0.003%
9	Loss on Ignition	0.015%

Criterion of Flexural Strength

Generally, concrete used in the construction industry should invariably conform to a specification of minimum compressive strength, which is considered as an overall measure of the quality of concrete. However, in specific applications, like roads and airport runways, the flexural strength of concrete is equally important as the compressive strength and in many cases, specifications for concrete used in runways require a minimum flexural strength rather than a minimum compressive strength. The American Concrete Institute Standard ACI617-58[97], which covers the application of concrete pavements for both highways and airports, specifies an average 28 days compressive and flexural strength of concrete of 280 and 45 kg/cm^2 respectively as the minimum criterion of acceptance. These values indicate the importance of flexural strength as the basis of mix design in contrast to that of compressive strength. The effects of shape and texture are particularly significant in influencing the flexural strength in the case of high – strength concrete according to the data of Kaplan the flexural strength is more sensitive to inadequate curing since the effects of non- uniform shrinkage adversely affect the flexural strength more than the compressive strength. However, in the case of rich and strong mixes, air- entrainment lowers the compressive strength more than the flexural strength. Kaplan's data indicate that the effect of incomplete compaction on strength is similar to that of entrained air.

Design of Mix Concrete for M25 Grade

Normal Water + Stone Dust +River Sand

Table 6

Percentage %	Normal Water(kg)	Cement(kg)	River Sand(kg)	Stone Dust(kg)	Aggregate(kg) 20mm	Aggregate(kg) 10mm	Quantity
40	2.93	6.68	8.39	5.59	15.10	12.53	6
50	2.93	6.68	6.995	6.995	15.10	12.53	6
60	2.93	6.68	5.596	8.934	15.10	12.53	6
70	2.93	6.68	4.197	9.793	15.10	12.53	6

Normal Water + Saline Water + River Sand + Stone Dust

Table 7

Percentage %	Saline Water(kg)	Normal Water(kg)	Cement(kg)	River Sand(kg)	Stone Dust(kg)	Aggregate(kg) 20mm	Aggregate(kg) 10mm	Quantity
40	1.2727	1.907	6.68	8.39	5.59	15.10	12.35	6
50	1.59	1.59	6.68	6.995	6.995	15.10	12.35	6
60	1.908	1.272	6.68	5.596	8.394	15.10	12.35	6
70	2.226	0.594	6.68	4.197	9.793	15.10	12.35	6

Normal Water + silica Fume + Cement

Table 8

Percentage %	Normal Water(kg)	Cement(kg)	Silica Fume (kg)	River Sand(kg)	Aggregate(kg) 20mm	Aggregate(kg) 10mm	Quantity
05	2.93	6.348	0.341	12.91	15.10	12.35	6
10	2.93	6.014	0.668	12.91	15.10	12.35	6
15	2.93	5.680	1.002	12.91	15.10	12.35	6
20	2.93	5.350	1.34	12.91	15.10	12.35	6

Normal Water + Saline Water + Silica Fume

Table 9

Percentage %	Saline Water(kg)	Normal Water(kg)	Cement(kg)	Silica Fume (kg)	River Sand(kg)	Aggregate(kg) 20mm	Aggregate(kg) 10mm	Quantity
05	1.272	1.907	6.348	0.341	12.91	15.10	12.10	6
10	1.59	1.59	6.014	0.668	12.91	15.10	12.10	6
15	1.908	1.272	5.680	1.002	12.91	15.10	12.10	6
20	2.226	0.954	5.35	1.34	12.91	15.10	12.10	6

General

Casting three cube which dimension is 150*150*150mm, Casting cube by the comparing different type of material (silica fume, stone dust, saline water)

RESULT AND DISCUSSION

Result for Saline Water + Maurang (7 days)

Calculations

Compressive strength of cube = load at failure surface area of cube

For Badarpur (Maurang):

Mean load= 382.066 KN

Compressive strength of cube = 382.066 x 100022500 = 16.98 N/mm2

Result for Normal Water + Stone Dust (7 days)

Mean load= 425.7 KN

Compressive strength of cube = $\frac{425.7x1000}{22500} = 18.92\ N/mm^2$

Result for Normal Water + Maurang (7 days)

Mean load= 443.8KN

Compressive strength of cube = $\frac{443.8x1000}{22500} = 19.72\ N/mm^2$

Saline water +Maurang (7 days)

Table 10

S. No	Cube Size (mm)	Age of cube (days)	Load at Failure(10^3xN)	Mean Load (10^3xN)	Average Compressive Strength (N/mm^2)
1	150x150	7	400		
2	150x150	7	376	382.066	16.980
3	150x150	7	370.2		

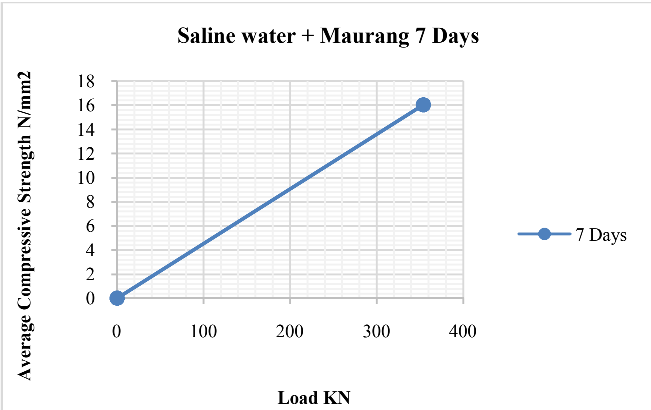
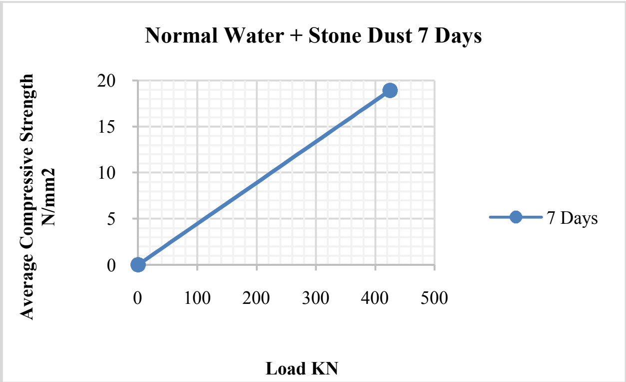


Fig 2

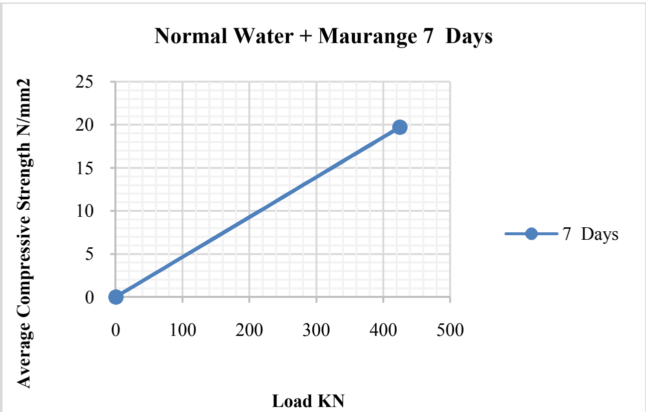
Normal water + Stone Dust For (7days)

S. No	Cube Size (mm)	Age of cube (days)	Load at Failure(10^3xN)	Mean Load (10^3xN)	Average Compressive Strength (N/mm^2)
1	150x150	7	423.6		
2	150x150	7	421.8	425.7	18.92
3	150x150	7	431.7		



Normal water + Maurang for (7days)

S. No	Cube Size (mm)	Age of cube (days)	Load at Failure(10^3xN)	Mean Load (10^3xN)	Average Compressive Strength (N/mm^2)
1	150x150	7	428.9		
2	150x150	7	435.9	443.8	19.72
3	150x150	7	466.6		



Result for Saline Water + Maurang (28 days)
Calculations

$$\text{Compressive strength of cube} = \frac{\text{load at failure}}{\text{surface area of cube}}$$

For Badarpur (Maurang):
Mean load= 697.633 KN

$$\text{Compressive strength of cube} = \frac{697.633\text{x } 1000}{22500} = 31.00 \text{ N/mm}^2$$

Result for Normal Water + Stone Dust (28 days)
Mean load= 752.36 KN

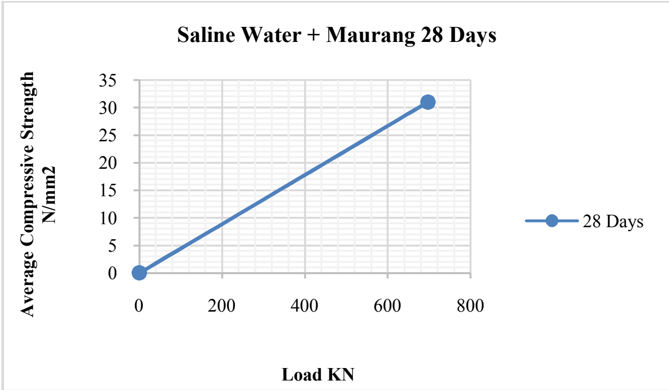
$$\text{Compressive strength of cube} = \frac{752.36\text{x } 1000}{22500} = 33.43\text{N/mm}^2$$

Result for Normal Water + Maurang (28 days)
Mean load= 776.36KN

$$\text{Compressive strength of cube} = \frac{776.36\text{x } 1000}{22500} = 34.50\text{N/mm}^2$$

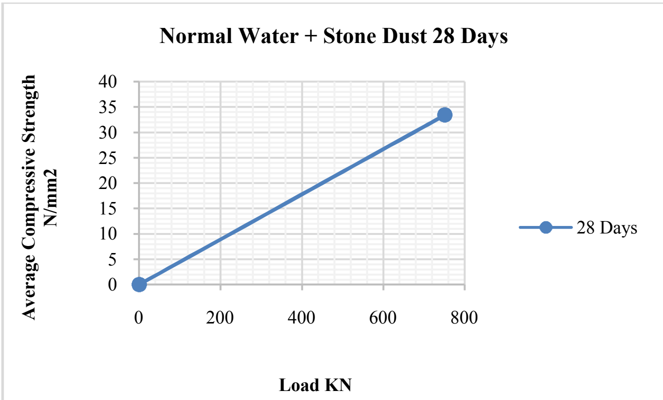
Saline Water + Maurang for (28 days)

S. No	Cube Size (mm)	Age of cube (days)	Load at Failure(10^3xN)	Mean Load (10^3xN)	Average Compressive Strength (N/mm^2)
1	150x150	28	695.3		
2	150x150	28	699.1	697.633	31.00
3	150x150	28	698.5		



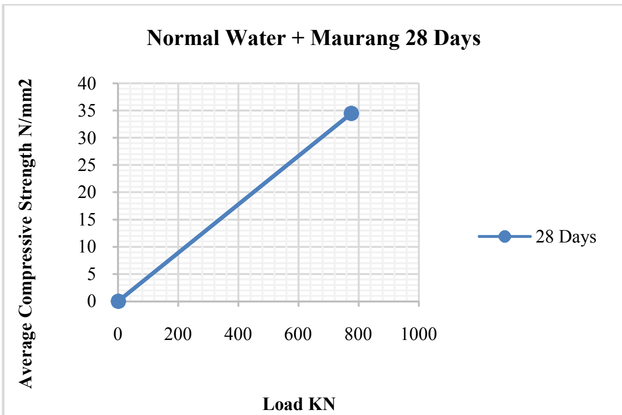
Normal water + Stone Dust For (28 days)

S. No	Cube Size (mm)	Age of cube (days)	Load at Failure(10^3xN)	Mean Load (10^3xN)	Average Compressive Strength (N/mm^2)
1	150x150	28	751.3		
2	150x150	28	755.0	752.36	33.43
3	150x150	28	750.8		



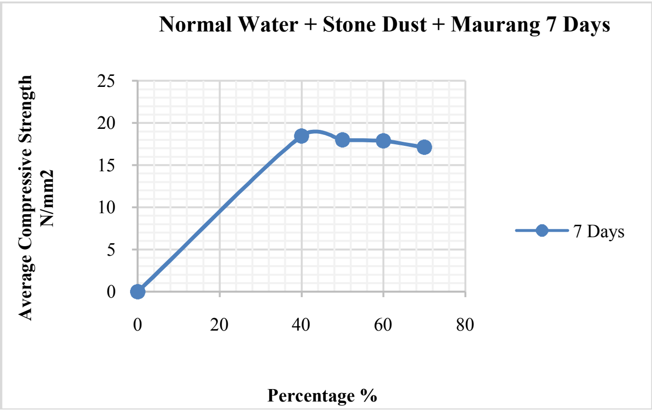
Normal water + Maurang for (28 days)

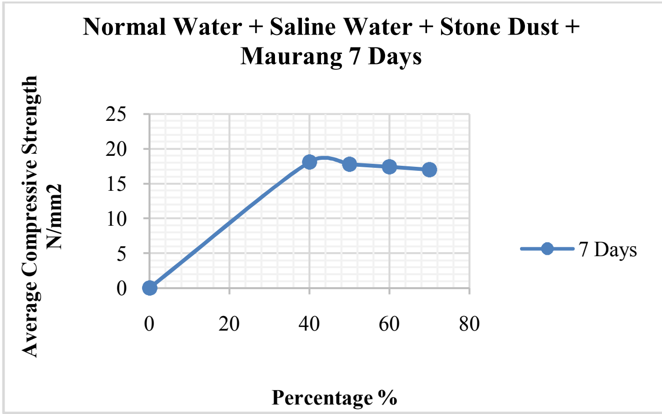
S. No	Cube Size (mm)	Age of cube (days)	Load at Failure(10^3xN)	Mean Load (10^3xN)	Average Compressive Strength (N/mm^2)
1	150x150	28	770.5		
2	150x150	28	778.4	776.36	34.50
3	150x150	28	780.2		



Normal water +Maurang+ Stone Dust (7 Days)

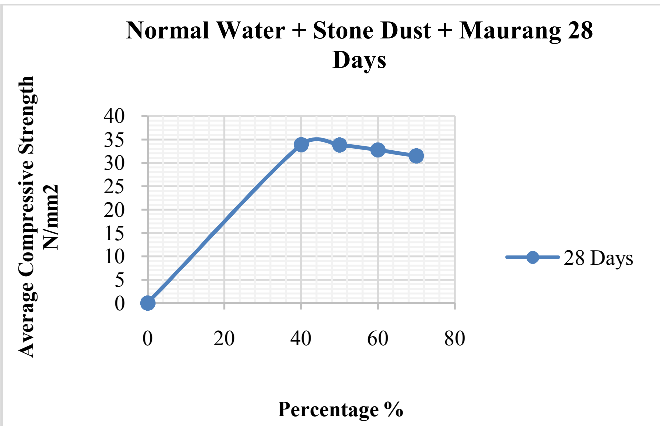
Percentage 40% (Stone dust)		Avg. Comp. Stren. (N/mm^2) in 7 days	Percentage 50% (Stone dust)		Avg. Comp. Stren. (N/mm^2) in 7 days	Percentage 60% (Stone dust)		Avg. Comp. Stren. (N/mm^2) in 7 days	Percentage 70% (Stone dust)		Avg. Comp. Stren. (N/mm^2) in 7 days
Load (KN)	Compr-Strength (N/mm^2)		Load (KN)	Compr-Strength (N/mm^2)		Load (KN)	Compr-strength (N/mm^2)		Load (KN)	Compr-Strength (N/mm^2)	
388	17.24		391	17.38		395	17.56		378	16.80	
420	18.67	18.44	405	18.00	17.99	400	17.78	17.87	395	17.56	17.10
437	19.42		418	18.58		411	18.27		381	16.93	





Normal Water + Maurang+ Stone Dust (28 Days)

Percentage 40% (Stone dust)		Avg. Comp. Stren. (N/mm^2) in 28 days	Percentage 50% (Stone dust)		Avg. Comp. Stren. (N/mm^2) in 28 days	Percentage 60% (Stone dust)		Avg. Comp. Stren. (N/mm^2) in 28 days	Percentage 70% (Stone dust)		Avg. Comp. Stren. (N/mm^2) in28days
Load (KN)	Compr-Strength (N/mm^2)		Load (KN)	Compr-Strength (N/mm^2)		Load (KN)	Compr-strength (N/mm^2)		Load (KN)	Compr-Strength (N/mm^2)	
741	32.93		735	32.67		745	33.11		711	31.60	
760	33.78	33.87	790	35.11	33.78	705	31.33	32.74	670	29.78	31.47
785	34.89		755	33.56		760	33.78		743	33.02	



Normal Water +Saline Water + Stone Dust + Maurang (7 Days)

Percentage 40% (Stone dust)		Avg. Comp. Stren. (N/mm^2) in 7 days	Percentage 50% (Stone dust)		Avg. Comp. Stren. (N/mm^2) in 7 days	Percentage 60% (Stone dust)		Avg. Comp. Stren. (N/mm^2) in 7 days	Percentage 70% (Stone dust)		Avg. Comp. Stren. (N/mm^2) in 7 days
Load (KN)	Compr-Strength (N/mm^2)		Load (KN)	Compr-Strength (N/mm^2)		Load (KN)	Compr-strength (N/mm^2)		Load (KN)	Compr-Strength (N/mm^2)	
400	17.78		398	17.69		385	17.11		400	17.78	
397	17.64	18.10	400	17.78	17.78	400	17.78	17.39	376	16.71	16.98
425	18.89		405	18.00		389	17.29		370	16.44	

Normal Water +Saline Water + Stone Dust + Maurang (28 Days

CONCLUSION

It is concluded that the performance of silica fume concrete with respect to the cube and cylinder compressive strength is superior when the percentage replacement of cement with silica is 5%, 10%, 15%, 20%. The compressive strength attained in 7 days was 33% of its maximum strength attained in 28 days. The use of salt water should be welcome and not feared for casting and curing of concrete during construction most especially in coastal environment. Water/Cement ratio that will give the minimum value of slump with adequate workability as well as minimum cement content should be used with maximum aggregate size in order to minimize the shrinkage cracking.

Percentage 40% (Stone dust)		Avg. Comp. Stren. (N/mm²) in 28 days	Percentage 50% (Stone dust)		Avg. Comp. Stren. (N/mm²) in 28 days	Percentage 60% (Stone dust)		Avg. Comp. Stren. (N/mm²) in 28 days	Percentage 70% (Stone dust)		Avg. Comp. Stren. (N/mm²) in 28 days
Load (KN)	Compr-Strength (N/mm²)		Load (KN)	Compr-Strength (N/mm²)		Load (KN)	Compr-strength (N/mm²)		Load (KN)	Compr-Strength (N/mm²)	
721	32.04		715	31.78		736	32.71		658	29.24	
753	33.47	33.02	754	33.51	32.30	701	31.16	31.96	720	32.00	31.39
743	33.02		711	31.60		721	32.00		741	32.93	

It is concluded that the performance of silica fume concrete with respect to the cube and cylinder compressive strength is superior when the percentage replacement of cement with silica fume is 13%. The compressive strength attained in 7 days was 44.4% of its maximum strength attained in 28 days.

Acknowledgement

The satisfaction and euphoria on the successful completion of any task would be incomplete without the mention of the people who made it possible, whose constant guidance and encouragement crowned my effort with success.

I would also like to take this opportunity to express heard felt gratitude for my dissertation guide Mr. Anwar Ahmad Associate Professor Department of Civil Engineering, Integral University, Lucknow for his guidance, who provided me with valuable inputs at each and every moment and also at critical stages of this dissertation.

I would like to thanks Dr. Syed Aqeel Ahmad, Prof. & H.O.D, Department of Civil Engineering, Integral University, Lucknow for his support, valuable suggestions and providing the lab facilities required for the project work.I would also like to thank the whole Civil Engineering Department, Integral University, Lucknow, for providing proper environment and encouragement for carrying out the project.

References

1. Building research Station (1956), Analysis of water encountered in construction, *Digest* No. 90, London, H.M.S.O.
2. Osei, Y. A. (2000). Neutralization, New School Chemistry" African First Publisher Onitsha Nigeria.
3. Water Encyclopaedia. (2012). Earth: The water Planet, (Ed). Earth Sylvia. Retrieved fromwww.watercyclopedia.com/ Da-En/ Earth- The water-planet.html # b.
4. Adebakin, H. I. (2003). Effect of Salinity on Compressive Strength on Concrete.
5. Akinkurolere O.O. *et.al.* (2007), *Journal of Engineering and Applied Sciences* 2(2). *Medwell Journals*, p 412-415.
6. Abrams Duff (1924), Am Concr Inst, 20, p 422.
7. Lea F M (1956), The chemistry of cement and concrete, (Edward Arnold Publ. Ltd.).
8. Michael A.T. and Adam Kuwairi, 1978. Effect of ocean salts on the compressive strength of concrete andconcrete Res., Pergamon Press Inc.(USA) pp:491-500.
9. Oyenuga, V. O. (2004). Design and Construction of Foundations (A practical approach) 1st Edition by Asros Ltd. Lagos Nigeria.
10. Bella, M., & Fabuss, T. (1989). Properties of Seawater. 1st Edition Academic Press Boston,p 766-771.
11. Bryant, M. (1964). Effects of Seawater on Concrete. Miscellaneous paper no 690, U.S. Army Engineers,
12. Sensale GR., Strength development of concrete with rice husk ash, Cement and Concrete Composites,28(2), 2006, 158-160.
13. Mohammad IqbalKhana and RafatSiddiqueb, Utilization of silica fume in concrete: Review of durability properties, Resources, Conservation and Recycling, 2011, 57, 30-35
14. Igarashi S, Watanabe A and Kawamura M., Evaluation of capillary pore size characteristics in high-strength concrete at early ages. Cement and Concrete Research, 35(3), 2005, 513- 519.
15. Bhanja,S. and Sengupta,B.(2002)."Investigations on the composite structure of silica fume concrete using statistical methods", Cement and Concrete Research, Vol.32, pp.1391-1394.
16. Aitcin, P.C., and Laplante, P. (1990),"Long-term compressive strength of silica fume concrete", *Journal of Materials in Civil Engineering,* Vol. 2, No. 3, pp. 164-170.
17. Feldman, R.F., Cheng-yi, H. (1985),"Properties of Portland cement silica fumepastes. II mechanical properties", *Cement and Concrete Research*, Vol. 15 No.6, pp.943.
18. Yogendran V, Langan BW, Haque M and Ward MA. Silica on high strength concrete, *ACI Material Journal,* No. 2, 84(1987) 124-129.

How to cite this article:

Satish Kumar Vishwakarma *et al.*2018, Effect of Saline Water on Concrete With Partial Replacement of Cement With Silica Fume And Fine Aggregate With Stone Dust. *Int J Recent Sci Res.* 9(5), pp. 26715-26721.
DOI: http://dx.doi.org/10.24327/ijrsr.2018.0905.2110

****