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Experimental Study on Mechanical Properties of SilicaGelIncorporated Concrete

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ABSTRACT:
Outer water relieving is perhaps the most ordinary and notable applied to restore technique to moderate theautogenous shrinkage anyway once the slender pores depreciate, giving satisfactory outside water to curing willbe more troublesome. So scientists moved their regard for inside relieving, another restoring strategy that mayextraordinarily upgrade the restoring impact on concrete. Inward relieving infers the presence of a restoringspecialist into substantial that will give this additional dampness. Inside restoring has been demonstrated as asuccessful strategy for alleviating the early age compound shrinkage for the explanation that they step by stepdelivered the assimilated water and augment the hydration interaction. The principal objective of this study is
toinspectacoupleofmechanicalpropertiesbyinteriorrestoringasasupplementtooutsiderelievingintraditionalcement.Inwardrestoringwasaccomplishedbyreallyretentivepolymer(SAP)andthetrialboundary was the level of SAP replacement to solidify. Sodium silicate (SAP) was utilized as self relievingspecialistandsupplantedbyvolumeofwateras0%,2.5%,5%,7.5%and10%.Theconsequences ofcompressive strength following 28 days of restoring demonstrated an expansion in the strength. SAP trap thedampnessinside theconstructionand keepitfrom vanishingwhichhappensbecause ofthehydration.
KEYWORDS: Inwardrelieving,Retentivepolymer,SodiumSilicate,Dampness,Shrinkage.

I. INTRODUCTION

Concretecuringdeterminesthelongevity,strengthandbehaviourthroughoutitslifeprocess.Optimizing the arrangement of pores in concrete by reducing the pore is a necessary measure for increasing thestrength and durability of concrete. If the water cement ratio is relative low, the inner structure of concrete has afiniteporosity.Thehydratingproductsabsorbssomerangeofwaterwhichischemicallybondedduringhydration, further amount of water get adsorbed at the surface of hydrating product when the rest of waterremains in micro pores. The unhydrated cement present in concrete has consequences of decrease in internalmoisture with increase in autogenous shrinkage of concrete. If the autogenous shrinkage is not mitigated, theinternal tensile stress occurs at early stage which maximizes the tensile strength of concrete. Excessive selfdesiccationleadto prematurecracks,therebyreducingthe durabilityofconcretestructure.

In order to compensate for loss of moisture during hydration, the most common method applied tomaintain adequate moisture is external curing. But once depercolation occurs in the micro pores, it complicatesthe regular hydration process, thereby opening up a new way for the introduction of internal curing of concrete.Thisinternalrelievingcanbeachievedbyusageofsaturatedlightweightaggregateorsuperabsorbentpolymers. In this study inward relieving is achieved by using super absorbent polymer(SAP) which trapsmoisture inside the structure and releases when required throughout the hydration process therefore mitigatingthe autogenous shrinkage. The foremost objective of this experiment is to analyse the mechanical (physical)properties of concrete incorporated with sodium silicate as a super absorbent polymer to entrap and release freewater.

A. LITERATUREREVIEW

LangheGetal,studiedthephysicalandMechanicalpropertiesofsuperabsorbentpolymerincorporated concrete at 7,14 and 28 days of curing.They concluded that concrete with added SAP showedincrease in strength depending on amount of SAP added. Increase in strength was found at 0.5% to 1% additionofSAP.

Dadaji B. Jadhav et al, conducted workability and compressive strength tests on concrete which is incorporatedwith Poly ethylene glycol 4000 as a selfcuring agent and made comparative studies with plain concrete. DesireddosageofPEG 4000isfoundtobe0.1%.
Ravindra D. Warkhade et al, concluded that concrete with dosage of SAP Showed desirable variation in strengthwhileconductingcompressive and flexuralstrengthtestsandcomparedwithnormallycured concrete.
Mohammad Sameer etal, replaced by PEG 400 and sodium silicate as self curing agents atvarious dosagelevels and conducted different tests such as compressive, flexural and split tensile tests.Concrete dosed withcuringagentsshowed increaseinstrength whenresultswere studiedwithconventionalconcrete.

A. MATERIALS

1) Bindingmaterial:

In this experiment the commonly provided ordinary Portland cement 53 is used. According to the confirming IS269:2015,thespecific gravityofcementwastestedwhichhaveobtainedvalueof3.15.

TABLEIPropertiesofCement

1.	Specificgravity	3.15
2.	Fineness	7%
3.	Consistency	31.25%
4.	Initialsettingtime	30minutes
5.	Finalsettingtime	10hours

2) Aggregate:

Thefineaggregatewhichisusedinthisstudyisfoundrysand.AccordingtoIS383-1970theaggregateinfiltrating 4.75 mm sieve and retaining of 150 micron have the specific gravity and fineness modulus of 2.47and 3.19respectively.

TABLEIISieveAnalysisofFoundrySand

SI.No	SizeofSieve	Weightretained[ings]	Cumulativeweight retained	%Retained	% Passing
1.	4.75mm	3.88	0	0.194	99.806
2.	2.36mm	1.95	5.83	0.2915	99.70
3.	1.18mm	8.72	14.55	0.7275	99.27
4.	600µ	16	30.55	1.5275	98.473
5.	300µ	560	590.55	29.52	70.48
6.	150µ	1220	1810.55	90.52	9.48
7.	75µ	146	1956.55	97.82	2.18
8.	Pan	22.6	1979.15	98.95	1.05

TABLEIIIPropertiesofFoundrySand

1.	specificgravity	2.47
2.	finenessmodulus	3.19
3.	Bulkdensity	1.48
4.	Moisturecontent	1.62

Asforthecoarseaggregate,the20mmsizeisusedandtestedasperIS2386-1963part3hasthespecificgravityof2.69andfinenessmodulusof5.8respectively.

TABLEIVPropertiesofCoarseAggregates

1.	sizeofaggregate	20mm
2.	specificgravity	2.69
3.	finenessmodulus	5.8
4.	waterabsorption%	0.56%
5.	Moisturecontent%	0.23%
6.	Bulkdensity	1.65

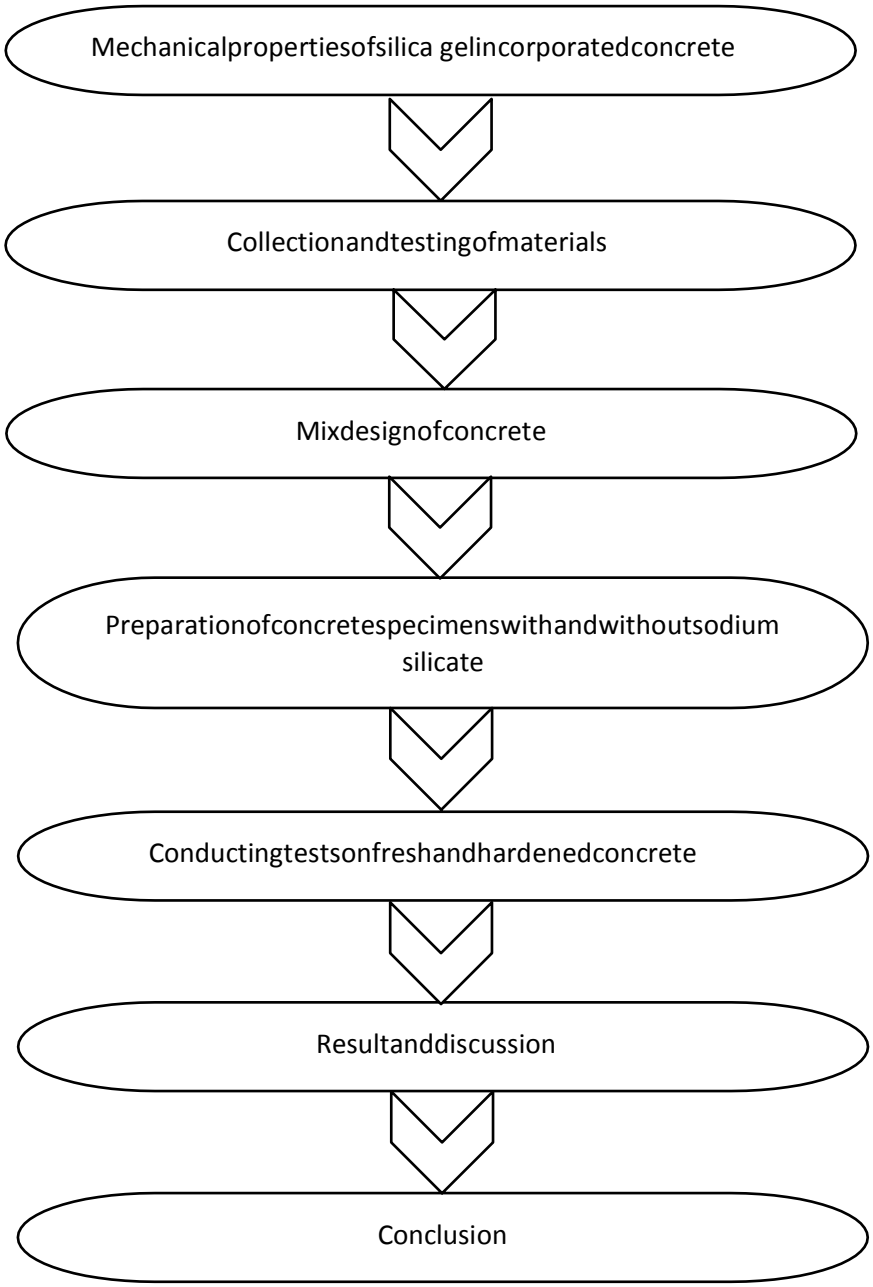
3) **Water:**

Ordinarywaterwasusedformixingofconcrete.

4) **Superabsorbentpolymer:**

Sodiumsilicatewasused.

B. **METHODOLOGY**



C. **MIXDESIGN**

1) Stipulationsforproportioning:

A. GradeDesignation M25
B. Typeofcement OPC 53
C. Sizeofaggregate 20mm
D. MaximumW/Cratio 0.50(Table5-IS456)
E. Workability 75mm(Slump)
F. MixRatio 1:1.84:3

TABLEVMixProportion

SI.No.	**MATERIALS**	**QUANTITY**
1	Cement	380kg/m^3
2	FineAggregate	700kg/m^3
3	CoarseAggregate(20mm)	1149kg/m^3
4	water	190 L/m^3

.TABLEVIMixDesignforModifiedGradeofconcrete

MixID	**Cementinkg**	**FineAggregateinkg**	**CoarseAggregateinkg**	**WaterinLitre**	**% ofSodiumSilicateadded**	**SodiumSilicate**
M0	380	700	1149	190	0	0
M1	380	700	1149	142.5	2.5	47.5
M2	380	700	1149	95	5	95
M3	380	700	1149	47.5	7.5	142.5
M4	380	700	1149	0	10	190

II. RESULTS AND DISCUSSION

TableVIIandTableVIIIbelowshowstheaveragecompressivestrengthsandsplittensilestrengthsfordifferent%additionofsodiumsilicateat7and28daysrespectively.Resultsshowsthatthereisvariationincompressiveand split tensile strengthat2.5%, 5%, 7.5% and10%replacementascomparedwith0%replacementwithandwithoutcuring. Maximumcompressiveandsplittensilestrengthwasobservedat5%afterfurtheradditionthestrengthwasfoundreduced.

TABLEVIICompressiveStrengthResults

%ofsodiumsilicate	**7Days(N/mm^2)**	**28Days(N/mm^2)**
0%withcuring	18.58	28.84
0%withoutcuring	16.25	25.82
2.5%	18.18	28.30
5%	20.89	31.15
7.5%	19.08	28.73
10%	18.15	27.70

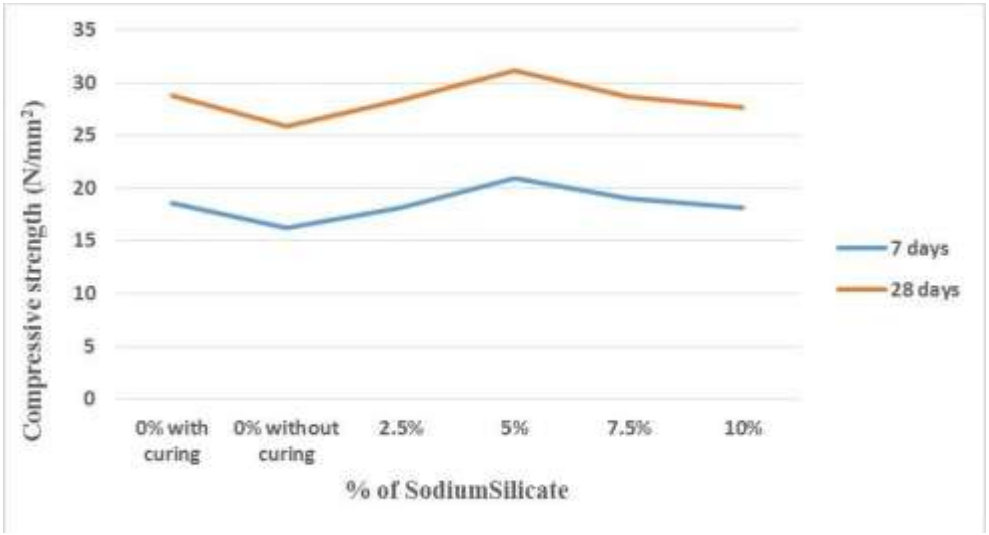


Fig.1 Compression test results for specimens with different % of Sodium SilicateTABLEVIIISplit Tensile Test Results

%ofsodiumsilicate	**7Days(N/mm²)**	**28Days(N/mm²)**
0%withcuring	2.58	3.39
0%withoutcuring	1.49	2.81
2.5%	2.23	3.19
5%	2.80	3.98
7.5%	1.80	2.88
10%	1.03	2.22

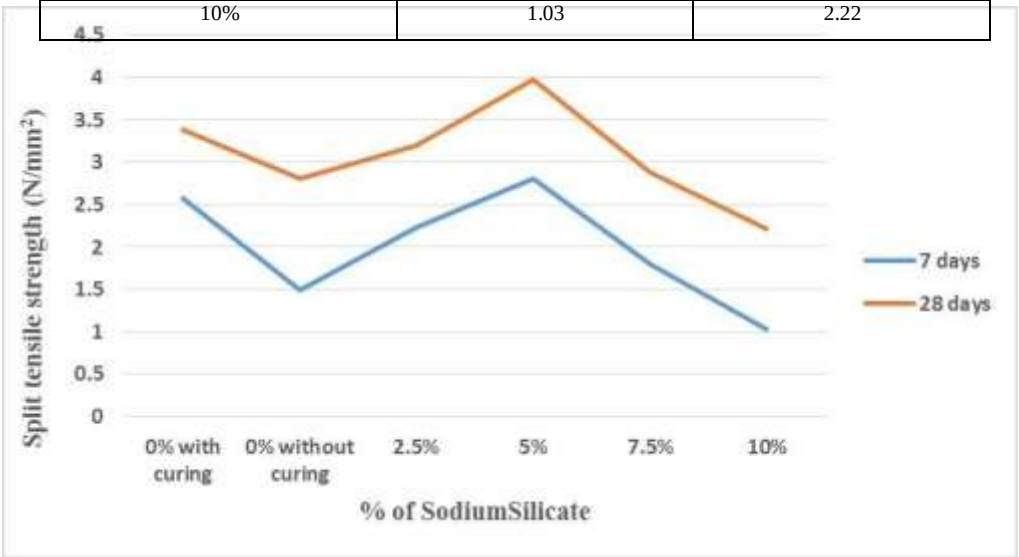


Fig.2SplitTensileTestresultsforspecimens withdifferent%ofSodiumSilicate

III. CONCLUSION

- Thispracticeleadstoeagerlyawaitandpreservationofenvironmenttoescapefromclimatedisasters. Sodium silicate was used asaselfcuringagentandreplacedbyvolumeofwateras0%,2.5%,5%,7.5%,and 10%.
- Thespecimenswith5%ofsodiumsilicateachievedthedesireddesignstrengthof31.15N/mm^2(Compressivestrength)and3.98 N/mm^2(Splittensile strength)at28days.
- Ifthereplacementofwaterbysodiumsilicatewasaboveandbelow5%thestrengthwasfounddecreased.

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