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The Effect of Change of Molarity of Sodium Hydroxide on Geopolymer Concrete

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ABSTRACT: Powerstations using hard coal orbrowncoal as fuels are important energy sourcesworld-wide. But only about 20% of the fly ashesproduced as by-products in the combustion processarereused.Inordertoreducethenegativeenvironmental impact of the production of ordinaryPortlandcement,thepossibilitytoreusethisinorganicwasteasalkalineactivatedbuildingmaterials (geopolymers) is of increasing importance.Theprojecteduseofsuchmaterialisconcreteforthebuilding industry in general, concrete with specialproperties(highresistancetoacidsandfire)and mortar for repairs. In order to reach this goal moreknowledge about the characteristics of the fly ashes,mix design and resulting properties is needed. In thisstudyonehardcoalandfourbrowncoalflyashesarecharacterizedbyvariousmethodslikechemicalanalysis andlasergranulometly.Geopolymermortarsandconcretesareproducedbymixingflyash,aggregates, sodium silicate, sodium hydroxide anddeionizedwater.Thevariablesusedweretheamountofactivators(sodiumhydroxideandsodiumsilicate),curing temperature (40-95°C) and curing time. Theinfluenceofthese·variablesoncompressivestrengthandhydrationmechanisms werestudied.

KEYWORDS: Geopolymer,AlkalineSolutions,Ambientcuring, Molarity,flyash.

I. INTRODUCTION

Hardorbrowncoalasfuelforpowerstations plays an important role world- wide. As aresult,highquantitiesoffly-ashesareobtainednowadays.Forexample, in CzechRepublic morethan 10 million tons of fly-ash is obtained per year.Mostofthefly-ashisconsideredaswasteandputout in landfills. Currently, only about 20% of theseashesarereused.Onepossibilityisthereuseasgeopolymers.Geopolymersareaninorganicaluminum-silicatecompositesynthesizedfrommaterialsasflyash orslagthatarerichinsiliconandaluminum. The potential use of the alkali-activatedgeopolymers includes concrete for the constructionindustry, in particular concrete with high resistanceto heat and acids and repair mortars. On the otherhand, production of ordinary Portland cement needslargeenergyresourcesandisresponsibleforaconsiderable C02 output into the atmosphere. Theglobalcementindust1ycontributesaround1.3billiontonsofthegreenhouseeffectgasesemissionsannually; that is about 7% of the total world madegreenhouse gas emission to the earth's atmosphere.The increased use of alkaline activated geopolymersasconcrete and mortar represents apossibility todecrease C02 emission in the production of buildingmaterials.

II. OBJECTIVES OF STUDY ARE

1. Cutting the world's carbon.2.Better compressive strength.3.The price of fly ash is low.4.Eco-friendly.

III. METHODOLOGY

1. FLY ASHAND AGGREGATE:

F Type Fly Ash and Natural sand & coarseaggregate (20mm) maximum size wereused in this research. Physical properties ofsandandgravelareasperISCode.

2. SODIUMSILICATE:

Sodium silicateisalsoknownaswaterglassorliquidglass,availableinliquid(gel)form.Inpresentinvestigationsodiumsilicate2.0(ratiobetweenNa2Oto SiO2) isused.Asperthemanufacture,silicates were supplied to the detergent company andtextileindustryasbondingagent.Samesodiumsilic

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ateisusedforthemakingofgeopolymerconcrete.

Table1:Thechemicalcompositionsoftheflyash,asdeterminedbyX-RayFluorescence

Sr.no.	**Parameter**	**Content (%)**
1.	Alumina (Al_2O_3)	22.86
2.	Silica(Sio_2)	77.15
3.	Iron(Fe_2O_3)	00.65
4.	Calcium (CaO)	01.60
5.	Magnesium (MgO)	00.16
6.	Potassium (K_2O)	00.031
7.	Sodium(Na_2O)	00.027
8.	Sulphur(SO_3)	00.72

B.EXPERIMENTALINVESTIGATION

1. Mixdesignofconcrete:
ByusingIsmethod,M20gradeconcreteweredesigned,
Proportion1:1.5:3.3

2Teston FLYASH:
ClassFflyashoriginatesfromanthraciteandbituminous coals. It consists mainly of alumina andsilica and has a higher Loss of ignition than Class Cflyash

Table2:MixDesign(1:1.5:3.3)

Materials	**Kg/m^3**
FlyAsh	408
FineAggregate	612
CoarseAggregate	1305
Sodium Hydroxide(10M)	137ml
SodiumSilicate	342gm.

4. Teston hardenedconcrete:

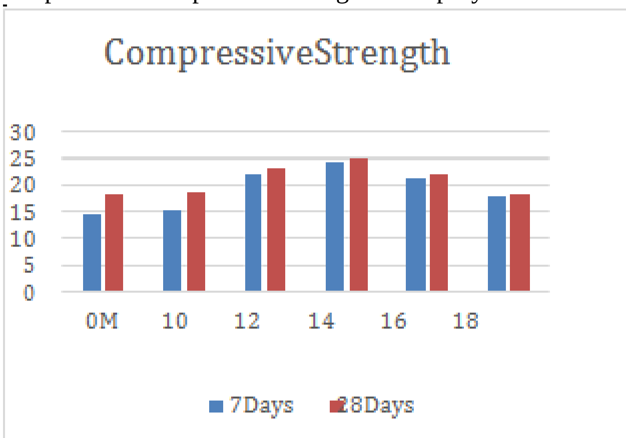
From each concrete mixture, cubes of size 150mmx150mmx150mmhavebeencastedforthedetermination ofcompressivestrength.Theconcretespecimenswerecuredunderhotaircuringconditions as per IS 516-1959 and were tested at7daysand28daysfordeterminingcompressivestrength as per IS 516-1959 and splitting tensilestrengthasperIS5816-1999.

Figure3.Compressive strength test of cubeusingCTM

Tableno-3CompressiveStrengthTestresultsforcubespecimens ofsize150mmx150mmx150mm

	CompressiveStrength(N/mm^2)	
Molarity	7Days	28Days
OrdinaryBlock (0M)	14.22	18.16
10M	15.11	18.66
12M	21.77	23.11
14M	24.22	25.11
16M	21.33	21.77
18M	17.56	18.22

GraphNo.1:-CompressiveStrengthofGeopolymerConcrete



IV. CONCLUSION

On the basis of results obtained, followingconclusions canbedrawn:

1. Higher concentration (in terms of molar) ofsodium hydroxide solution results in highercompressive strength of fly ash & natural sandbasedgeo-polymerconcrete.
2. Themixconcretegiveshigher

compressivestrength,asithashighmolarityofNa OH

3. Geo-polymer concrete shall also be used in theInfrastructureworks.
4. In addition to that fly ash shall be effectivelyused and hence no land fills are required todumptheflyash

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