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Manufacturing of bricks using sewage sludge

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Abstract*—Sludge resultingfrom wastewater treatmentplants creates problems of disposal. Generally,dewatered sludge's are disposed of by spreading on the land or by land filling. However, forhighly urbanized cities, sludge disposal by land filling might not be appropriate due to landlimitation.Incinerationmightbe an alternativesolution.However, a substantial amountofash will be produced after the burning process and must be disposed of by other means. Thisprojectpresentsthe results ofthe utilizationofdrysludgeasbrickmakingmaterials. Thedisposalofsewagewastescomprisesasoneofthemajorworldwideenvironmentalproblems as these wastes render the environment unfriendly. The growing demand for wasteutilizationhasmadesolidwasteslikesludgeanessentialcompositionofthisstudy.Thepossibilityofreductioninthe production costs providesa strong logicforuseofthis sludge.*

Generally sludge, bio degradable materials are dumped in the land, and they decompose over theperiod of time. This study involves the usage of sludge as an ingredient. The disposal of sewagewaste is the major problem in urban cities as it causes many harmful effect to the environment.Sludge is the main product from sewage waste. Conventional brick is mostly prepared by usingclay. Chemical composition of sludge is nearly similar to the clay. Hencesludge can be used asa replacementfora clay,soil inmanufacturing ofbricks.

The percentages of dried sludge within mixed with clay for brick making are10%, 20%, 30%,40%and50%.Drysludge,soil,waterthismaterials areusedforthis project.

The sieve analysis test , specific gravity test and liquid limit test these are basictest conductedon dry sludge andsoil.Andthe compression testandwaterabsorption testtheseare testconductedonsludgebricks andconventionalbricks.

As the conclusion, brick with 10% utilization of solid waste is acceptable to produce goodquality of brick. The sewage bricks will be bigger competitor to the cement brick and clay bricktypeinthemarket.

Keywords—Dry Sludge,Water, Soil.

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I. INTRODUCTION

The most basic building material for construction of houses is the conventional brick. Therapid growth in today's construction industry has obliged the Civil engineers in searching formore efficient and durable alternatives far beyond the limitations of the conventional brickproduction. A number of studies had taken serious steps in manufacturing bricks from severalof waste materials. However, the traditional mean of bricks production which has broughthazardous impacts to the context has not yet been changed or replaced by more efficient andsustainable one. If the utilization of the waste like sludge in clay bricks usually has positiveeffectsonthepropertiessuchaslightweightbrickswithimprovedshrinkage,porosity,thermal properties, and strength. The lightweight bricks will reduce the transportation andmanufactured cost. Moreover, with this waste incorporation it will reduce clay content in thefiredclaybrick,andthenreducethemanufacturingcostandbecomeeconomicalforconstruction.

Brick is one of the most important construction elements. The history of brick manufacturinggoesback8000yearswhenthefabricationoftheearliestsundriedclaybrickswasdiscovered. Sludge generated at sludge treatment plants should be treated and handled in anenvironmentally sound manner. Coagulant sludge is generated by sludge treatment plants,which use metal salts such as aluminiumsulphate (alum) or ferric chloride as a coagulant toremove turbidity. The traditional practice of discharging the sludge directly into a nearbystream is becoming less acceptable because these discharges can violate the allowable streamstandards. The discharging of sludge into water body leads to accumulative rise of aluminiumconcentrationsinwater,aquaticorganisms,and,consequently,inhumanbodies.Someresearchers have linked contributory influence to occurrence of Alzheimer's disease, childrenmental retardation, and the common effects of heavy metals accumulation. It is recognizedthat the disposal of aluminium-laden solids from water treatment plants will receive a closerscrutinyin the comingyears.

II. MATERIALS USED

1) DrySludge

Nowaday,disposalofsewagehasbecomeanecessityforsocieties.Theconstruction of treatment plants has caused problems with huge content of dry sludge. It hasbeen found that each person produce 35 to 85 grams of solid sludge per day. In recent years,wasteproductionhasincreaseddramaticallyindevelopingnations such as India.There are two methods to solve the problem such as disposal of solid waste (dry sludge)including land filling and using dry sludge as fertilizers. But by both these methods someharmful material remains in sludge which causes harm to environment including land, air andwaterasa whole.

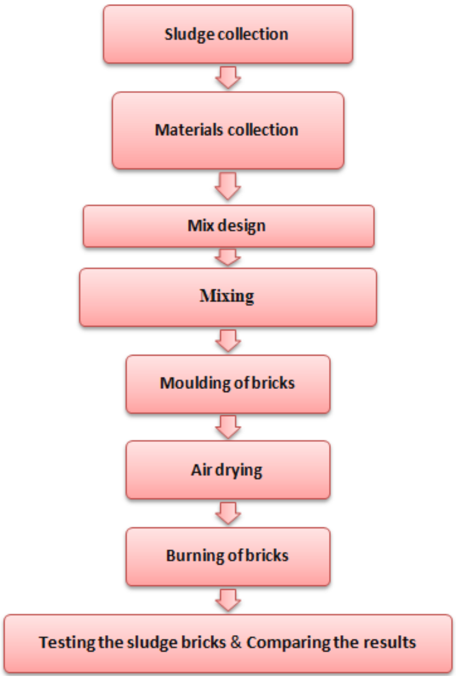
Figure1:Dry Sludge

2)Soil

Soilsampletestforprojectisobtainedfromlocal brickmanufacturingunit.

Figure 2:Soil

III.MIX DESIGN



MIX DESIGN FOR BRICKS

DifferentpercentageofSludge	Soil	Water
10%	90%	12%
20%	80%	12%
30%	70%	12%
40%	60%	12%
50%	50%	12%

IV.TESTCAREEIDOUTONDRYSLUDGEANDSOIL.

1. Sieveanalysistest
2. Specific gravitytest
3. Liquidlimittest

4.1.SIEVE ANALYSIS TEST:Determination of quantitative size distribution of particles ofdrysludgeto finegrainedfraction.

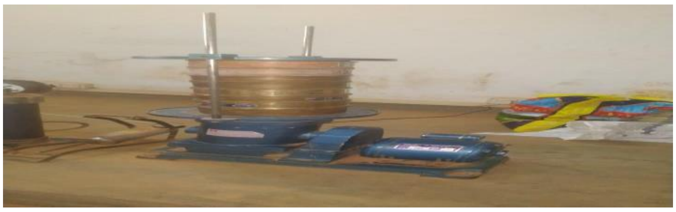
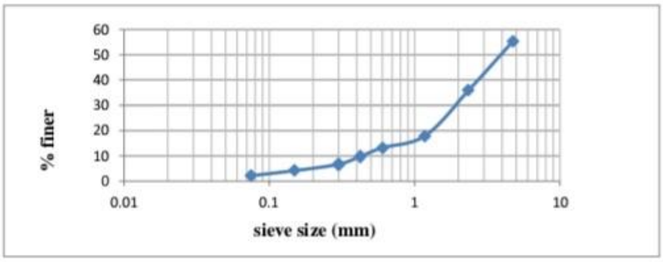


Fig4.1 : sieve analysis test

Table4.1: Sieveanalysistest (drysludge)

Sl. no	Issieve(mm)	Mass retained(g)	%ofmass retained	Cumulative %retainer	% of finer
1	4.75	223.4	44.7	44.7	55.3
2	2.36	97.1	19.4	64.1	38.9
3	1.18	90.2	18.0	82.1	17.9
4	0.60	23.4	4.7	86.8	13.2
5	0.425	17.2	3.4	90.2	9.8
6	0.30	15.8	3.16	93.36	6.64
7	0.15	12.6	2.52	95.88	4.12
8	0.075	10.2	2.0	97.70	2.1
9	Pan	10.1	2.1	100	0

GRAPH



Result: Fineness modulus of drysludge is**7.5%.**

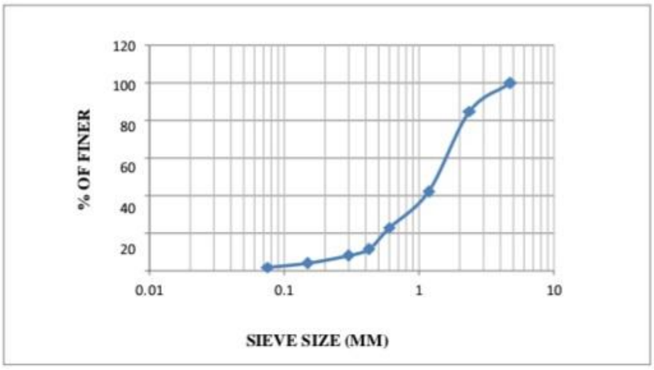
4.1.1 SIEVEANALYSISTEST:(SOIL)

Table4.2: sieveanalysistest (soil)

Sl. no	Issieve (mm)	Massretained (g)	%of mass retained (g)	Cumulative %massretained (g)	% of finer
1	**4.75**	**12**	**12**	**1.2**	**55.3**
2	**2.36**	**142**	**14.2**	**15.4**	**38.91**
3	**1.18**	**424**	**42.4**	**57.8**	**17.9**
4	**0.60**	**195**	**19.15**	**77.3**	**13.2**

5	**0.425**	**113**	**11.3**	**88.6**	**9.8**
6	**0.30**	**34**	**3.4**	**92.0**	**6.64**
7	**0.15**	**40**	**4**	**96.0**	**4.12**
8	**0.075**	**23**	**2.3**	**98.3**	**2.1**
9	**Pan**	**17**	**1.7**	**100**	**0**

GRAPH



Result : Fineness modulus of soil is**6.26%**

4.2 SPECIFICGRAVITYTEST:

TABLE 4.3: SPECIFICGRAVITYTEST: (DRYSLUDGE)

Particulars	**1**	**2**	**3**
Emptyweight of the pycnometer (M1)g	612	612	612
Weight of thepycnometer +drysoil(M2)g	886	894	953
Weightofthe pycnometer+soil +water(M3)g	1650	1654	1684
Weightofthepycnometer+water(M4)g	1504	1504	1504
Specificgravity(G)	214	213	214
Average(G)	= 2.12		

Result:Specificgravityof drysludge = 2.12

TABLE 4.4: SPECIFICGRAVITYTEST:(SOIL)

PARTICULARS	1	2	3
Emptyweight of thepycnometer (M1)g	457	457	457
Weight of thepycnometer +drysoil(M2)g	680	696	678
Weightofthepycnometer +soil +water(M3)g	1184	1188	1183
Weightofthepycnometer+water(M4)g	1048	1050	1048
Specificgravity(G)	2.56	2.34	2.55
Average(G)	2.50		

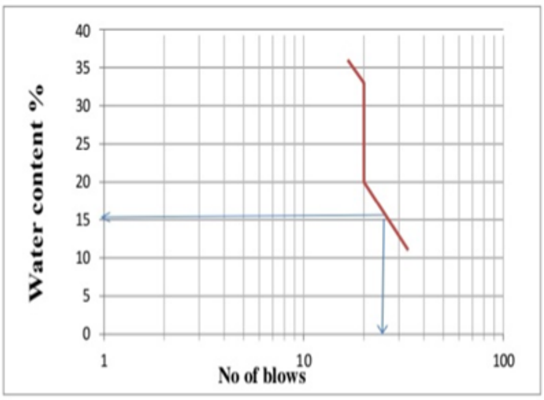
RESULT:Specificgravityofsoil =2.50

4.3LIQUIDLIMITTEST

Table4.5:LIQUID LIMITTEST:(DRYSLUDGE)

DeterminationNo	1	2	3	4
Numberofblows	11	20	33	36
Containernumber	31	37	32	9
Massofcontainer(g)	15	15	15	16
Massof(container+wetsoil)g	17	18	18	19.5
Massofdrysoil(g)	16.5	17.5	17.5	19
Massofwater(g)	0.5	0.5	0.5	0.5
Watercontent %	33.33	20	20	16.6

GRAPH:

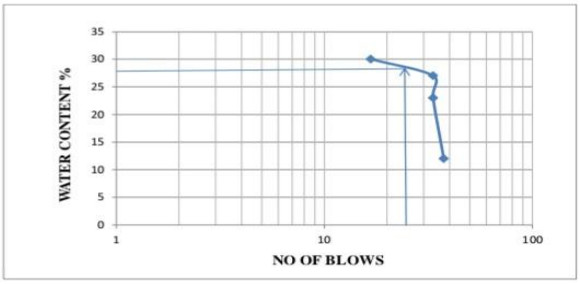


Result:Liquid limitof drysludge WL= 16%

Table4.6:liquidlimittest: soil

DeterminationNo	1	2	3	4
Noofblows	12	23	27	30
Containerno	1	2	3	4
Massofcontainer(g)	16	17	21	19
Massof(container+wetsoil)g	27	25	29	26
Massofdrysoil(g)	24	23	27	25
Massofwater(g)	3	2	2	1
Watercontent %	37.5	33.33	33.33	16.7

GRAPH



Liquidlimit of soliWL= 27.5%

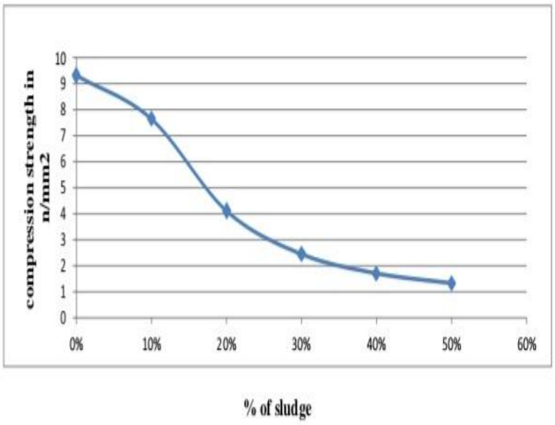
V.TESTCAREEDOUTON:BRICKS

5.1COMPRESSIVESTRENGTHFORSLUDGEBRICKANDCONVENTIONALBRICKS

Table5.1: Compressionstrengthofbrick

Conventional brick		**10%**		**20%**		**30%**		**40%**		**50%**	
Load (KN)	Compression strength (N/mm2)	Load (KN)	Compression Strength (N/mm2)	Load (KN)	Compression Strength (N/mm2)	Load (KN)	Compression strength (N/mm)	Load (KN)	Compression strength (N/mm2)	Load (KN)	Compression strength (N/mm2)
140	8.02	120	6.87	50	2.86	30	1.72	20	1.14	20	1.14
150	8.60	130	7.45	80	4.58	40	2.29	30	1.72	20	1.14
200	11.46	150	8.60	90	5.16	60	3.44	50	2.86	20	1.72

GRAPH



5.2WATERABSORPTIONTEST

Table5.2: Waterabsorption

Sl.no	% of sludge	Weight before testing 'kg'	Weight after testing in 'kg'	%of water absorption
1	0	3.450	3.754	8.81
2	10	3.310	3.580	8.15
3	20	3.200	3.500	9.30
4	30	3.118	3.480	12.98
5	40	2.890	3.460	19.72
6	50	2.705	3.353	23.95

VI.CONCLUSION

- Thesewagebrickswillbebiggercompetitortothecementbrickandclaybricktypeinthemarket.
- Drysludgeisavailablefreecost,so wewill reducecostofbricks.
- Environmentaleffectsfromwasteand disposalproblem ofwastean be reducedthroughthis research.
- Compressivestrengthincreaseswhenreplacementofdrysludgewhencomparedtotraditionalbrick.
- Fromtheproject,replacementsofsoilwiththisdrysludgematerialprovidegoodcompressivestrength at drysludge10%replacement.

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