International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 8, Issue 4 - January 2021 - Pages 24-29

STRENGTH IMPROVEMENT OF MSW DUMPSITE USING GGBS AS AN ADMIXTURE

Soumya S Hiremath, *Assistant Professor, Dept. of Civil Engineering*
RTE Society's Rural Engineering College Hulkoti
Gadag, Karnataka,India

ABSTRACT

Municipal Solid Waste is an issue of concern now a days all over the world. Due to increase in population there is increase in the generation of waste which should be managed well. An increase in urbanization has led to construction on these deteriorated lands. So there is need of studying various properties of the dumpsite soil. This study is concern about locating the dumpsite and study its chemical and geotechnical properties of the soil. GGBS was added as an admixture. This was added at different percentage to increase the strength of the soil of dumpsite. Various chemical tests were performed to find the chemical properties as well as tests were carried to find various geotechnical properties of both contaminated and uncontaminated soil.

Keywords—GGBS, MSW

1. INTRODUCTION

Municipal Solid Waste

Dealing with solid waste is an issue of concern now a days all over the world. Due to population explosion and development of cities at a rapid rate, there is large generation of solid waste and hence there is a need for solid waste management to maintain a healthy environment. Waste contains different forms of material which can cause harm to the environment. Unscientific waste disposal is one of our country's major problems due to that there are many problems such as community diseases which are produced by numerous diseases affecting microbes in the dumpsite ground water effluence, soil effluence, effect on flora and fauna, water source effluence etc.

Brief history on area under investigation:

Mulagunda is a town in Gadag district of Karnataka. Mulagunda is located at 15.25°N 75.53°E. It has 675 meters (2214 feet) of maximum altitude. It is located 23 km towards south-west from Gadag. The total waste generation as per generator based assessment (sum of waste collected from Households, Commercial establishments, Markets and street sweeping) **6.19** tons per day. The normative estimate is 5.92 tons per day (Total Population * Per Capita waste). The waste generation of 6.19 tons per day is adopted as a realistic waste generation. An average of about 5.14 tons per day of waste is collected.

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 8, Issue 4 - January 2021 - Pages 24-29

Fig: 1.1 **Google images of Mulgunda city, Gadag district**

2. OBJECTIVES

- The intent of work is to relate the chemical and geotechnical properties of soil which is procured at two points of landfill site and to recover the same of polluted soil using GGBS admixture.
- Comparison of geotechnical properties (Atterberg limits, permeability, compaction characteristics, shear strength parameters, UCS) of uncontaminated and contaminated soil.
- Outcome of GGBS on addition of 5%, 10%, 15% GGBS on contaminated soil
    - Index properties
    - Compaction characteristics.
    - Permeability
    - Shear strength parameters.
    - UCS.

3. MATERIALS

- Soil from landfill site
- GGBS (Ground Granulated Blast Furnace Slag)

4. METHODOLOGY

Samples were obtained via the excavation of landfill sites at two separate locations.

- Sample collection by digging right underneath the landfill.
- The second soil sample from the landfill was obtained approximately 90 ft beneath th e landfill.

The samples collected were disturbed form and these samples were collected which umbered in separate polythene bags and then transported to the geotechnical

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 8, Issue 4 - January 2021 - Pages 24-29

laboratory. Some small portions of soil samples were also collected to decide the Chemical properties of the soil.

Ground Granulated Blast furnace Slag

GGBS a secondary product of pig iron manufacturing.Ironore, coke and limestone are put in fu rnace and heated at a temperature around 1500°Cto 1600°C & molten slag formation takes place above molten iron . This liquefied slag consists of siliceous and aluminum remaining which is separated from molten iron and is then reduced to form glassy granulate.This glassy granulate is dehydrated and grounded into powder.

GGBS is an industrial waste and in this study, we have attempted to use it for the perseverance of stabilization of soil. The effect of GGBS on contaminated soil is studied. GGBS is added to soil in 5%, 10% and 15% and the changes in geotechnical properties is observed.

5. RESULTS AND DISCUSSION

TABLE 5.1 Overall values before stabilization

Description	Uncontaminated Soil	Contaminated Soil
Natural Moisture Content (%)	4.45	17.93
Specific Gravity	1.66	1.7
LL (%)	37	42.5
PL (%)	23.31	26.67
PI (%)	14.19	15.83
FI (%)	8.0	8.0
TI	1.77	1.978
From Plasticity Chart	CI	MI or OI
Compaction Test		
OMC (%)	12	17.75
MDD (kN/m^3)	19	17
Permeability Test		

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 8, Issue 4 - January 2021 - Pages 24-29

Constant head method , K (cm/s)	2.48x10-4	3.86x10-4
Variable head method , K (cm/s)	2.494x10-4	3.774x10-4
Direct shear test		
C (kN/m^2)	15	10
ϕ (°)	22	19
Unconfined compressive strength test		
qu (kN/m^2)	8.11	6.78
Cu (kN/m^2)	4.05	3.39

TABLE 5.2 Overall values after stabilization

Depiction	**Contaminated Soil**	**5%**	**10%**	**15%**
LL (%)	42.5	41.02	38.55	37.46
PL (%)	26.68	25.81	23.91	23.08
PI (%)	15.82	15.21	14.64	14.38
FI (%)	8.0	7.9	7.8	7.7
TI	1.978	1.925	1.876	1.867
From Plasticity Chart	MI or OI	MI or OI	MI or OI	MI or OI
Compaction Test				
OMC (%)	17.75	15.5	14.0	12.5
MDD (kN/m^3)	17	17.3	17.85	18.3
Permeability Test				
Constant head method , K (cm/s)	3.86 X 10^{-4}	3.5 X 10^{-4}	3.3 X 10^{-4}	3.17 X 10^{-4}
Variable head method , K (cm/s)	3.774 X 10^{-4}	3.597 X 10^{-4}	3.36 X 10^{-4}	3.168X10^{-4}
Direct shear test				
C (kN/m^2)	10	11	12.5	13.4
? (?)	19	20	22	23
Unconfined compressive strength test				
qu (kN/m^2)	6.78	6.9	7.5	8.35
Cu (kN/m^2)	3.39	3.45	3.75	4.175

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 8, Issue 4 - January 2021 - Pages 24-29

CONCLUSION

- Liquid limit was found to be 42.5% for contaminated soil and 37.5% for uncontaminated soil.
- The coefficient of permeability of contaminated soil is 3.774X10-4cm / s where 2.495 X 104cm / s has been found as that for uncontaminated soil. It me ans that soil pollution has contributed to increased porosity, which has in effect increa sed soil permeability.
- The results of the compaction test show that OMC was 12.0% for contaminated soil a nd 17.75% for uncontaminated soil.MDD was 17kN/m2 & 19kN/m2 for both the type of soil.
- UCS test illustrated that UCS of natural soil was more to that of polluted soil which was 8.11kN/m2 & 6.78kN/m2 respectively.
- From Direct Shear test, strength of natural soil was more than polluted soil.
- Stabilization test conclusion

  i.LL & PL values got reduced with rise in percentage of GGBS.

  ii.LL & PL values were least when the concentration of GGBS was 15 percent.

  iii.Permeability coefficient reduced with rise in GGBS percentage.

- The Compaction test illustrated that

  i.MDD of stabilized soil increases with rise in GGBS percentage & ultimately reducing the OMC.

  ii.For 15 percent GGBS addition MDD = 18.3kN/m3 & OMC = 12.5%.

- Of UCS test, with the rise in GGBS percentage strength got increased & for 15 percentage of GGBS UCS was 8.35kN/m2.
- After stabilization the direct shear test shows soil strength rised with rise in GGBS percentage.

Acknowledgement

The authors gratefully acknowledge Sri. S. R Patil Secretary, RTE Society's Rural Engineering College, Hulkoti-582205 Gadag, Karnataka, and Principal and all faculty of civil engineering department for their moral support during the research work.

International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
Available online at: www.jrrset.com
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Volume 8, Issue 4 - January 2021 - Pages 24-29

REFERENCE

1. Ayininuola G M (2014), "Decomposed soil waste impact on soil shear strength and California bearing ratio". IOSR journal of mechanical and civil engineering, volume 11, issue 3, version 7 (may – june 2014).
2. Beena K S et al (2011), "Geotechnical characteristics of leachate – contaminated lateritic soil". Proceedings of geotechnical conference, December 15-17,2011, Kochi.
3. Dr.Krishna M Ketal,(2016), "Effect of MSW leachate on the quality of soil", International jo urnal of engineering science invention, volume5, issue6, june 2016.
4. Dr.Solly George etal(2015), "Study on geotechnical properties of diesel oil contaminated soil ".International journal of civil and structural engineering research ISSN 2348-7607, volume2, issue2 october 2014 march 2015.
5. Dr.Timothy A Adedokun et al (2013), "Geotechnical evaluation of municipal solid waste as a n alternate material for land filling". International journal of emerging technology and advanc ed engineering, volume 3, special issue 4, October 2013.
6. Krishna R Reddy et al.(2011), "Geotechnical properties on municipal solid waste.at different phases of degradation". Waste management 31 (2011) 2275-2286.