

## UTILIZATION OF RED MUD AND POND ASH FOR AMBAKMENTS

B.DEVILAL

MTECH

Abhinav-Hitech College of Engineering

Email:devicivil103@gmail.com

G.SRINIVAS

Asst. Professor,

Abhinav-Hitech College of Engineering

**ABSTRACT**— Red mud a real solid waste\by product produced from the digestion of bauxite ore with caustic soda for the production of alumina. During the past decadal comprehensive work has been carried out by lot of researcher to develop various ways for the utilization of red mud. This paper deals with the basic and engineering property of red mud it's neutralization and disposal methods as enormous quantity in generation of red mud is creating threatening environmental issues .It also account for production and depiction of red mud in concern with the world and Indian context. The chemical and mineralogical composition of red mud are also resumed up.

**Key words:** Red mud, Bayer's process, neutralization, disposal, utilization

### I. INTRODUCTION

Rapid growth in industrlization which is necessary and inevitable for society progress had also created negative encroachment .Red mud produced during alumina production has strong alkanity in a pH range of 10-13% because of the sodium hydroxide solution used in the refining process . The base is strong enough to kill plant and animal life and due to finer particle and trace metal content it create soil contamination, ground water pollution and suspension in ocean . Red mud occupy large

area or its deposition in it .Red mud have property similar to sandy clay .Red mud have property similar to clay and sand, even if it does not contain quartz or clay mineral. Similarity in property is due to hydroxysodalite, goethite and hematite. Frictional behaviour is similar to clay (Newtson et al 2006).Due to the similarity in properties with soil red mud can be used as a substitute of soil.

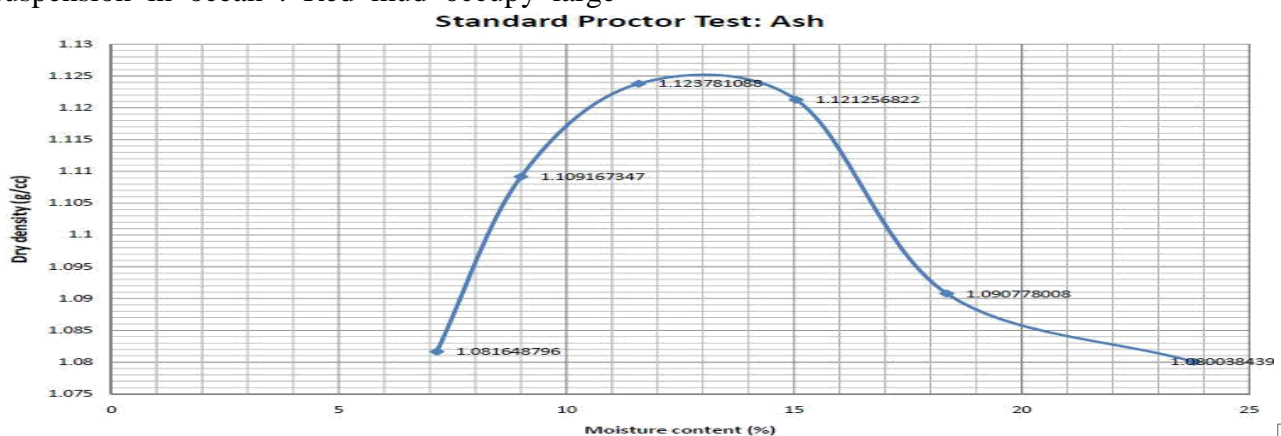
Significant research and evolution work for the storage ,disposal and comsumption of red mud is channelized all over the world .This paper deals with the characterization disposal various neutrllization and application of red mud.

#### A. Material Used:

□ Red Mud: The red mud is the foremost solid wastes in the Bayer's process of alumina production. For the current work it was collected from HINDALCO, At Renukoot, Uttar Pradesh. The conservative method of dumping of red mud in ponds has often unsympathetic environmental impacts

#### B. Characteristic Properties of Red Mud:

##### 1) Index Properties:-



**Specific gravity:** of the red mud has been conceded out as per the IS: 2720 (Part II) 1980. The experiment was carried out from both pycnometer method and density bottle. The

specific gravity of the red mud was found to be 2.86.

□ **Standard Proctor test:** was performed to determine the maximum dry density and

optimum moisture content of the red mud. The test is performed out as per the IS: 2720 (Part VII). Light compaction was adopted.

Graph 1: DRY Density Vs Water Content Curve

□ **Particle Size distribution** of the red mud was carried out as per the IS: 1498 – 1970 .The Sample fraction is distributed into two parts dry and wet analysis. The particle passing through (4.75mm and retained on 75 micron)is collected and performed by sieve analysis. The particles passing through 75 micron was carried out to performed the Hydrometer analysis and to determine the particle size distribution.

□ Silt size -10%

□ Sand Size-90%

□ **Atter Berg's limits:** of the red mud was conceded as per the IS: 2720 (Part V). Liquid limit is the water content corresponding to the boundary between liquid and plastic states of soil mass. To determine the liquid limit of given sample by cone penetration test. It is non-plastic so plasticity index is zero.

□ **California Bearing Ratio :** of the red mud as per IS-2720 (Part-XVI):1987 .The CBR value of a soil is to consider an index which is related to its strength. The soaked value of CBR is 3.36.

□ **Direct Shear Test:** of the red mud as per I.S-2720 (Part -XII): 1991 .The cohesion value is 0.27 kg/cm<sup>2</sup> and internal friction is 24.2°

□ **Permeability:** of the red mud as Per IS-2720 (Part XVII) to determine the flow of fluid through the soil is perform through constant head permability test is 1.376x10<sup>-2</sup> cm/sec.

□ **Toxicity:** of this red mud is within permissible limit

*C. Chemical and Mineral Compositions of Red mud*

*Neutrilation of Red Mud:*

Neutrilation of red mud will promote to reduce the environmental effect caused due to its storage and important managment. Efforts are provided to study the amelioration of red mud by possibly incorporating a pH-reduction processing , step during disposal of red mud and include studies on following processes.

□ **Acid Neutralization :** properties of RedMud were analyse by initial rapid and pseudo-equilibrium acid neutralization curves by

additions of HCl from an initial pH of  $\approx 9.3$  to final pH  $\approx 2$ .

□ **CO<sub>2</sub> Treatment:** The carbonic acid reacts with basic components of the red mud, lowering down its pH. The pH of water when react with CO<sub>2</sub> do not lower down its value below 5.5, so it is not applied in industries .High pressure liquid CO<sub>2</sub> is use instead of vapour phase.

□ **Seawater Neutralization:** when sea water is reacted with corrosive red mud, the pH of the mixture decreases causing hydroxide, carbonate or hydroxycarbonate minerals to get precipitated.

*G. Comprehensive Utilization Of Red Mud:*

(1) Red mud in cement replacement : Application of red mud in cement not only reduces the energy utilization of cement production, but also enhance the early strength of cement and resistance to sulphate attack.

(2) Concrete industry: Red mud obtained from Birac Alumina Industry, Serbia was hardened as a pigment for application in the building material for standard concrete mixtures.

(3) Clay based products: in the use of red mud and fly ash for the production of heavy clay products have been broadly undertaken at the Central Building Research Institute, Roorkee, India. . The test results obtained for compacted clay samples containing red mud and cement-red mud additives have a high compressive strength, decreased hydraulic conductivity and swelling percentage in comparison to natural soil.

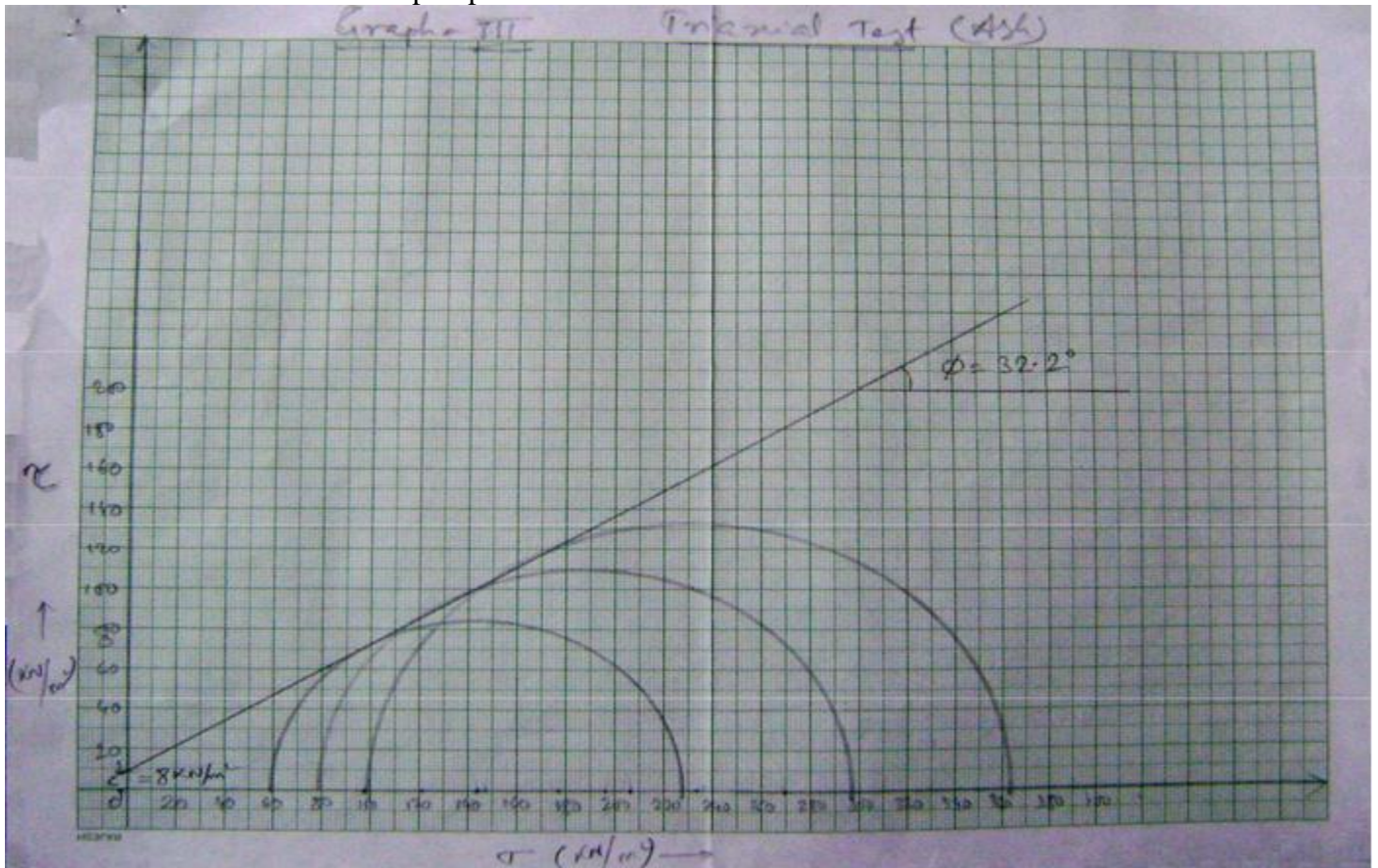
(4) Geopolymer is cover of a synthetic aluminosilicate materials with probable use in a number of areas, as a replacement for Portland cement and for advanced high-tech composites and ceramic applications. The geopolymerization is a chemical reaction between red mud and alkali metal silicate solution performed under highly alkaline conditions.

(5) Recovery of metals: Iron present in extreme percentage is extracted from it.

*H. Utilization of Red Mud as a filling material*

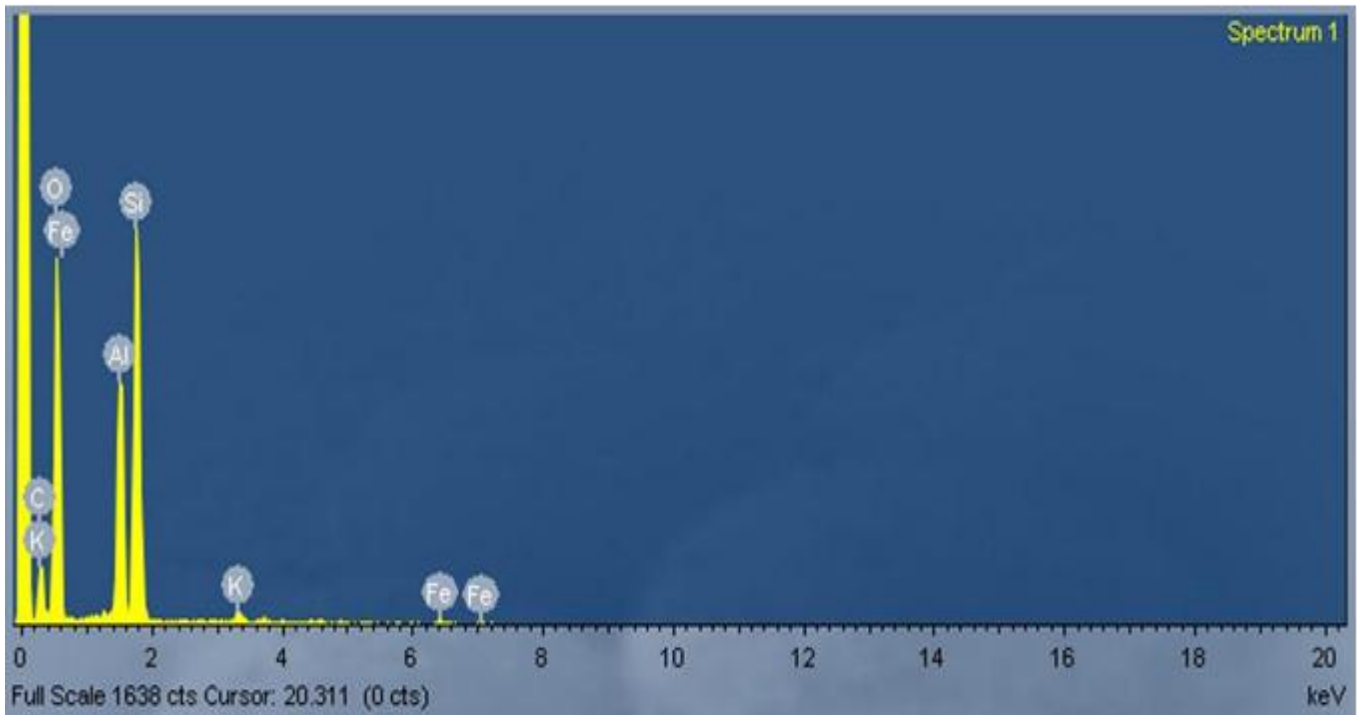
(1) Road Base Material: Road of high grade strength which is constructed from red mud obtained from sintering process.

(2) Mining: The mixture of red mud ,fly ash, lime and water in certain ratio is pumped into the mines to prevent ground subsidence.



#### I. Application In Pollution Control:

□ Waste water Treatment: Red mud shows potential in application of water treatment for removal of toxic heavy metal and metalloid ions, inorganic anions such as, fluoride, nitrate and phosphate, as well as organics including phenolic dyes, compounds and bacteria





□ Soil Improvement by Red Mud: Bauxite residue was mixed with variant type of, saline soils, acid soils organic rich material and silicate soil suitable pH conditions were achieved to promote vegetation growth.

□ Treatment of Waste Gas Containing Sulphur by Red Mud: Bekir et al. activated red mud by drying and roasting, and studied the absorption of this activated red mud for SO<sub>2</sub> gas This technology can concurrently solve the problems of the absorption of SO<sub>2</sub> exhaust and the neutralization reaction of alkali red mud. II. RESULT AND DISCUSSION

□ Specific gravity obtained from the red mud is 2.86 which is very high as compared to the soil. So the density of red mud will be increase and so the strength obtained is more.

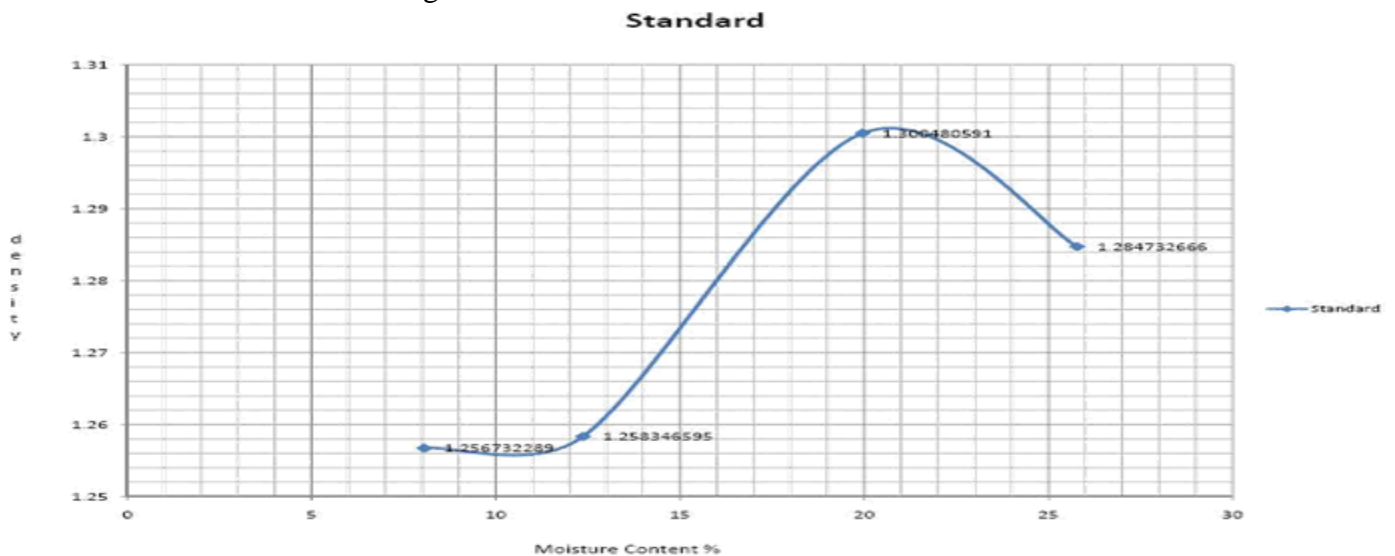
□ From the graph2 showing particle size distribution of red mud shows grains are fine

and it is well grade, hence soil can be used as an embankment and backfill material etc.

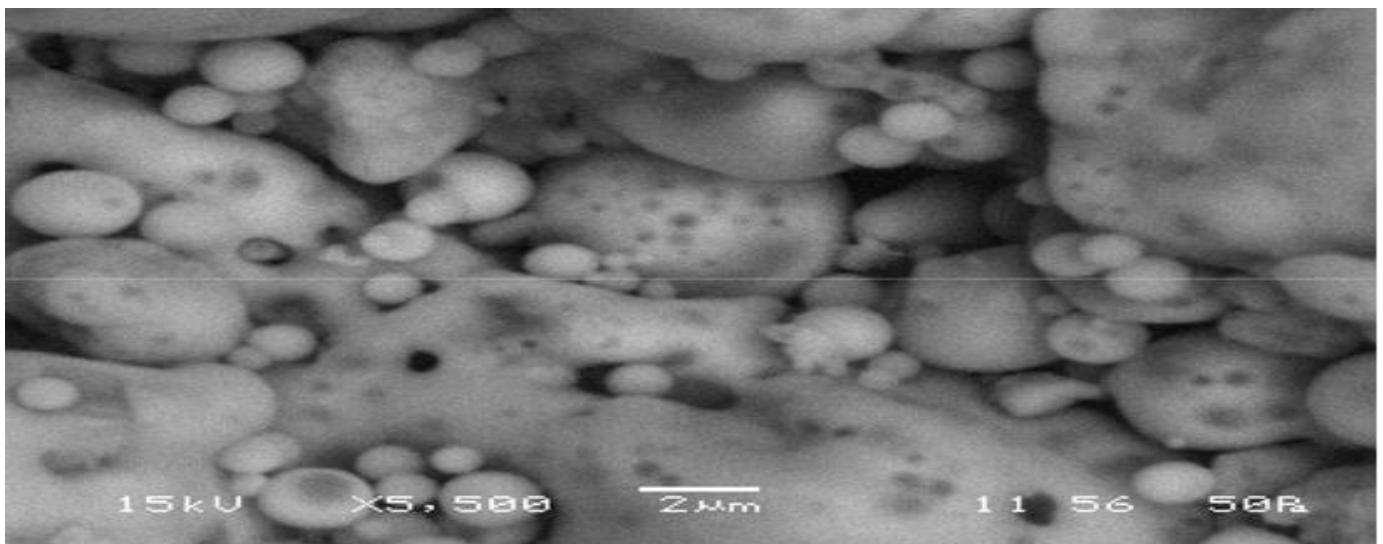
□ The optimum moisture content and maximum dry density obtained from the red mud is 27.5% and 1.289 gm/cc Respectively .

□ Co-efficient of permeability of red mud is  $1.376 \times 10^{-2}$  cm/s which shows that permeability is medium. This permeable materials can be used for construction of, road embankments, earthen dams etc.

□ The cohesive strength and the angle of shear resistance obtained from the triaxial test are 0.268kg/cm<sup>2</sup> and 24.80° which shows that strength value of the red mud is higher than the conventional soil.



□ California bearing ratio(CBR) value of the red mud obtained in soaked condition is 3.36% which is greater than the 3%, so it can be utilize in road base material in villages.



### Direct shear test

Sample : 70%Red Mud and 30% Pond ash

OMC = 21%

MDD = 1.39 g/cc

For 120 gms,

Mass of red mud = 84 gm

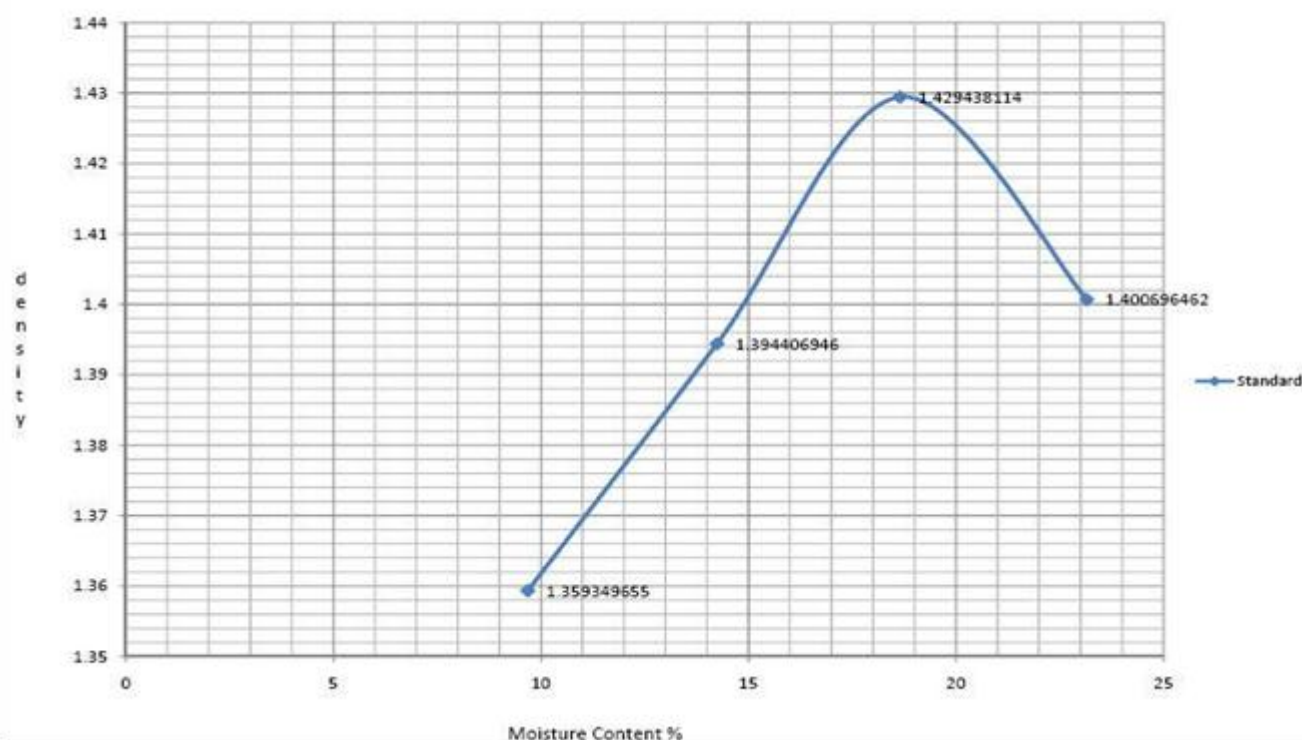
Mass of ash = 36 gm

Water = 25.2 ml

Mass of mixture required =  $1.39 \times 79.2$   
= 110.09 gm

Normal load(lb)	Normal load(N)	Proving Ring reading	Shear load(N)
5	111.13	27	102.8
10	222.26	48	182.6
15	333.39	69	263.4

Standard

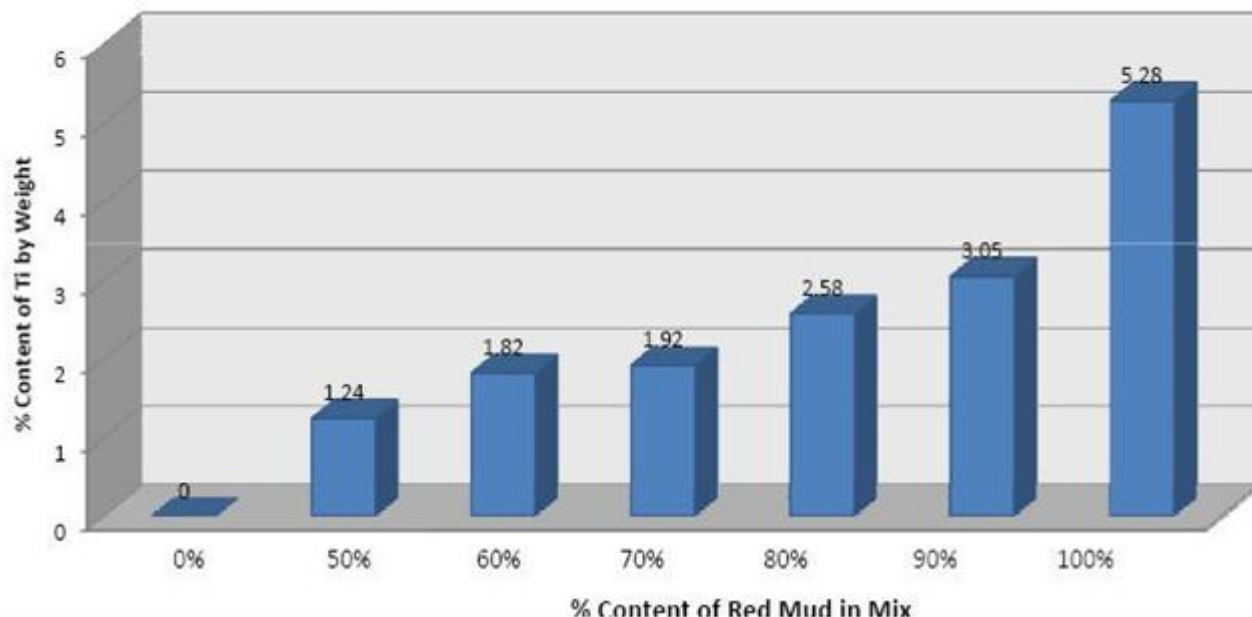


□ By analysing all these properties of the red mud we can employ the red mud as geotechnical material like Backfill material, embankment material and road sub-grade material. Red mud is further stabilized to enhance the more strength with fly ash, lime,

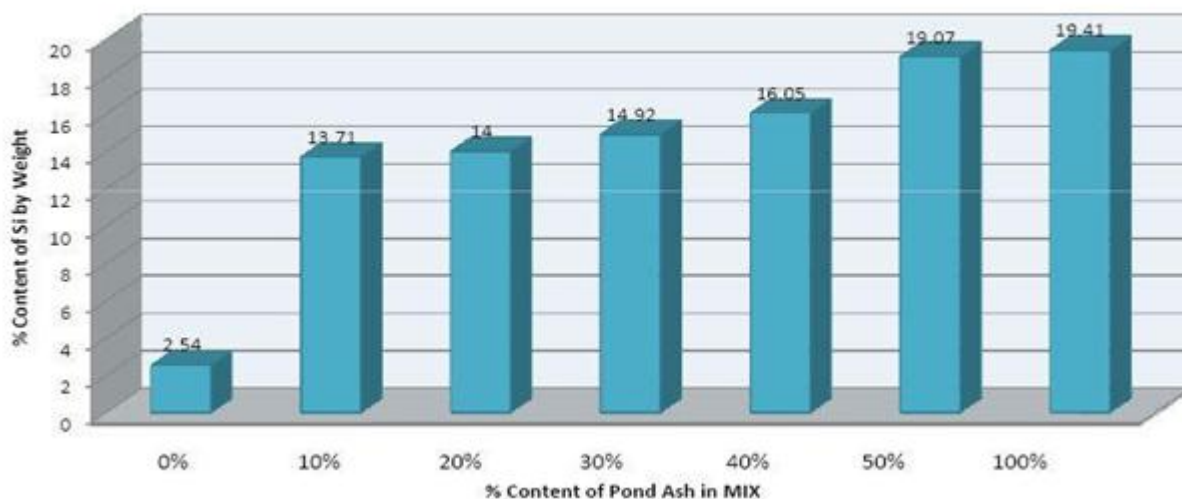
gypsum,

etc.

**Plot of Ti Content With %of Red Mud in Mix**



**Plot of Si content with % of Pond Ash in Mix**



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