

MAKING OF VALUEADDED CONSTRUCTION BRICK BY USING OVER BURDEN DUMP AS RAW MATERIAL, A MINE WASTE

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Abstract

This paper presents utilization of waste rock of surface coalmine in making bricks and blocks in place of clay bricks. These bricks and blocks may be used in building construction and as pavement material in and around coalmine. Acidic and alkaline overburden helps in neutralizing acidity or alkalinity of wastewater by making drain with such bricks. Mineral waste utilization as a construction material for making building bricks and blocks has already started in developed and developing countries. In India, marble slurry, tailings and red mud are being suggested to use as a building material.

Keyword: over burden dump, brick, geotechnical, curing, compressive strength test.

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Introduction

Coal has relatively high importance for the economic growth of a country. The Mining industry in India is a major economic activity which contributes significantly to the economy of country. The GDP contribution of the mining industry varies from 2.2% to 2.5% only but going by the GDP of the total industrial sector it contributes around 10% to 11%. Even mining done on small scale contributes 6% to the entire cost of mineral production. Indian mining industry provides job opportunities to around 700,000 individuals. India is the largest producer of sheet mica, it ranks 3rd in production of coal, iron ore and lignite, 2nd in barites, 4th in iron ore, 5th in bauxite and crude steel, 7th in manganese ore and 8th in

aluminium. Mining in India depends on over 3,100 mines, out of which over 550 are fuels mines, over 560 are metals, and over 1970 are extracted for non-metals.

Coal is a very important resource for India where most of the industries such as thermal power plant, mineral industries are using coal for extracting energy. Around the world, India dominates the third position in the largest production of coal and has the fourth largest coal reserves approx. (197 Billion Tons). It has been estimated that 75% of India's total installed power is thermal of which the share of coal is about 90%. Nearly about 600 Million tons of coal is produced worldwide every year, with Fly ash generation is about 500 MT at (60-78 %) of whole ash produced. In order to meet the increasing challenging demands, many coal based thermal power plants have been constructed. Near about 70% of power is generated through thermal power plants. Coal based thermal power plant has consumed about 640 million tons of coal in 2015-16 which is about three fourth of the total coal consumed in the country. In India, there are 556 coalmines producing 411 million tonnes (Mt) of coal. Considering geo-mining conditions, surface mining technology is most appropriate and only 164 surface mines with 33 mixed mines are responsible for major production of coal (80%), which is being contributed by 30 open cast mining projects only. Technology used in opencast mining include walking draglines, shovel dumper combine, surface miners in pit crushing and conveying. Surface mines are producing about 328 Mt coal along with huge quantity of overburden waste rocks as mine spoil. There is 84 million m³ (Mm³) annual overburden removal with an accumulation of 916 Mm³ since 1990 only in one coal company of India (South Eastern Coal field Ltd.,

SECL). This volume of overburden is going to accredited every year due to dumping of overburden, increase of depth of coal seam and coal production.

Coal is a key energy resource of power production in India as most of the other countries like USA, China and Australia. The power sector in India is dominated by coal, which accounts for more than 70% of total electricity generation. As we are the second most populated country of the world, there is a need to produce coal in a large scale to fulfil the energy demand of the country. Coal seams are found lying beneath the surface of sedimentary rock mass or lying very near to the surface. Opencast mines (blasting and digging) are used to extract the less deep coal seams whereas the coal seams that are found deeper are mined out with underground mining practice. Opencast mining is a dominated mining process that generates huge amount of rock waste along with valuable minerals. Waste rock material generated along with mining is called mine overburden. Generally, the amount of waste rock is more in case of open pit mining rather than underground mining. Opencast mining is a developmental activity, which is bound to damage the natural ecosystem by several mining activities. During opencast mining, the overlying soil is removed and the fragmented rock is heaped in the form of overburden dumps. OB dump is considered as a major contributor to the ecological and environmental degradation as soil erosion and environmental pollution which is also results in non-productive use of land and atmospheric pollution. Due to such major problems a sustainable use of ob dump is required which can reduce atmospheric pollution and large consumption or use of ob dump can be done and therefore brick making by using ob dump can be a very good option. While making bricks by using over burden dump the prime objective that one should keep in mind is that the analysis of Geotechnical properties of over burden dump. The analysis for geotechnical property is very necessary because when the bricks will get ready they will be subjected to heavy compressive strength. The geotechnical test performed on ob dump sample are specific gravity, bulk density, permeability test, compaction test, liquid limit, shrinkage limit, optimum moisture content & sieve analysis. Then another objective is proper casting of brick from over burden dump by using conventional

methods. In bricks the proper casting is very necessary because if it will not be casted properly then it will not fix properly while using for construction which will ultimately effect strength. And lastly the Testing for the suitability of over burden dump bricks for construction. This objective is very important objective because it will provide the ultimate result whether the made brick is usable for construction or not and the tests which will be performed of the bricks will be compressive strength, efflorescence test, structure test, impact test, soundness test, hardness test & water absorption.

Sampling

The sampling for over burden dump is done at Bastacolla Area, Jharia coalfield, Dhanbad, Jharkhand. About 35 kg of over burden dump is collected from the sampling area for the present study.

Bastacolla Area is situated in the eastern flank of Jharia coalfield. It adjoins most ancient Archean Rocks, which form a bowl shape in eastern site of Jharia Coalfield. The total leased-hold area is 1210 hac. And is situated mostly on eastern side of Dhanbad-Patherdih railway line (dismantled) and between Dhanbad city and Lodna barrier. This Area is amalgamation of 33 mines of pre-nationalization period, most of which had primitive mining culture. At present Bastacolla Area is having four underground coal producing units namely Bastacolla, Bera, Dobari, Kuya and four opencast units namely Ghanoodih OCP, Golukdih/Kuya OCP, Bera OCP and Kujama OCP and has achieved the production to the tune of 20.50 lakh tonne during 2009-10, out of which Underground produced 5.73 lakh tonne, and opencast produced 14.77 lakh tonne. The Area registered a profit of 17.84 Crore. The project area, which forms a part of OCP VIII Block, is located in the eastern part of Jharia Coalfield and falls in Dhanbad District of Jharkhand. It is about 8 Km east of Dhanbad Railway station and in between N 99500 to N 105600 and E 91800 to E 96400.

Methodology

The methodology adopted in the present work was divided into four parts namely screening and sieving of ob dump, geotechnical testing on ob dump, brick

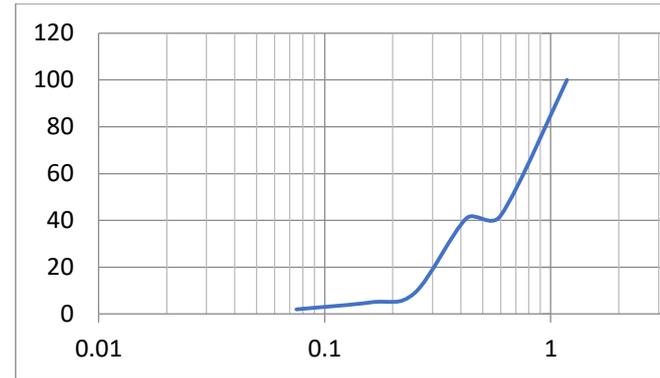
casting as well as curing and testing on ob dump brick.

The sampling of over burden dump is done at Bastacolla Area, Jharia coalfield, Dhanbad, Jharkhand. About 35 kg of over burden dump is collected from the sampling area for the present study. Screening and sieving of the collected ob dump sample was done in the laboratory. Geotechnical testing such as specific gravity, bulk density, moisture content, compaction, permeability, grain size analysis, plastic limit and shrinkage limit was done at geotech laboratory. Then mixing of water in a ratio of 10% by weight and casting of brick was done then it was left over night for air dry then burning of brick is done in muffle furnace at 1100°C . Final brick suitability test was performed. The test that was performed was Compression Strength Test, Water Absorption Test, Efflorescence Test, Impact Test, Soundness Test, Hardness Test and Structure Test. On the basis of these test result conclusion were obtain.

Result

1) Results of geotechnical parameter

- Specific gravity of the over burden dump sample is found to be 1.197
- Bulk Density of the over burden dump sample is found to be 1.22 g/cm^3
- Optimum Moisture Content of the over burden dump sample is found to be 1.1045 %.
- Compaction results are found to be very high at 19.55%.
- Permeability of the over burden dump sample is found to be $2.5 \times 10^{-4}\text{ cm}^2$.
- Sieve analysis graph curve is not a total S curve which shows that the over burden dump sample is not a well grade sample with a Uniformity Coefficient (C_u) = 2.27 Coefficient of Gradation (C_c) = 1.016.



- Plastic limit values are found to be 17.19%
- Shrinkage Limit values are found to be 14%.

2) Testing on Ob Dump Brick

1. Compression Strength Test: - The compressive test were performed on five bricks and the average of it were taken into consideration. The Average Compressive Strength is 67.22 kg/cm^2

2. Water Absorption Test: -The two water absorption test was performed and the average value of both were taken into consideration. The Average Water Absorption of the brick samples are 22.48%

3. Efflorescence Test: - Nil. There is seen no deposit of any salt even after repeated wetting.

4. Impact Test: -Five bricks were chosen randomly and dropped from the height of 1 meter and not a single brick got break. So the brick are of good impact value and acceptable for construction work.

5. Soundness Test: -Two bricks are chosen and they are struck with one another. Then sound produced was a clear metallic sound was heard and brick does not break.

6. Hardness Test: - For this test finger nail is used and with the help of that we try to make scratches on the randomly chosen sample brick but no mark was made on the brick by the scratch action.

7. Structure Test: - Five bricks were chosen randomly and they were fracture and closely

examine. There were no holes or cracks were found on all the samples.

CONCLUSIONS

- Compressive Strength Test of the bricks was tested in a lot of five brick and a average value of the compressive strength of the bricks was calculated which was 67.22 kg/cm^2 and the compressive strength value of the second class brick is 70 kg/cm^2 and the compressive strength value of the bricks commonly used in building construction is 35 kg/cm^2 .
- The water absorption was tested on two bricks and then average of both the values were calculated and it is 22.48% which is little bit high it should not exceed 20%.
- Nil efflorescence was found on the brick while testing the brick which is a very good result.
- The result for impact test was very good as after dropping all five bricks from one meter distance no brick got break.
- While striking two bricks with each other for soundness test, a sharp metallic sound was heard which shows that that quality of the brick is very good.
- After trying to put some scratches with finger nail for hardness test, no mark was made on the brick which shows that the quality of the bricks is very good.
- No hole or crack is found while examining for structure test this also shows that the quality of brick is very good.
- The overall brick is very good compressive strength is good which is very close to class second brick and all other tests such as impact test, soundness test, hardness test & structure test the results are very good but for water absorption test the value is little bit high (which can be subject of further study) but it can ignore for some area overall the bricks made from over burden dump can be used for construction.

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