Industrial Engineering & Management
ISSN: 2169-0316
Ocheri and Mbah, Ind Eng Manage 2018, 7:2
DOI: 10.4172/2169-0316.1000254
Research Article
Open Access

Study on the Mechanical Properties of Pellets Produced from Blends of Itakpe and Agbaja Iron Ore

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Abstract

The research work of the study was carried out on mechanical properties of pellets produced from blends of itakpe and agbaja iron ore. This was performed to produce pellets in a form that allows the free movement of oxygen around the particles and this was achieved by agglomerating the ores into pellets, which are rounded balls of concentrated ore. This underscore the need to carry out intense research work in this area with a view to blending a high and low grade of iron ores to be used as burden in the blast furnace. The burdens need to be fed in the blast furnace operation and Direct reduced Iron. The mechanical properties of the Itakpe and Agbaja Iron ores blends produced into pellets revealed the behaviour of the blends through compressive strength results (both green and dry) The mechanical properties of blended Itakpe/Agbaja Iron ores were subjected to Compressive Strength which the results of the green pellets confirmed the presence of hygroscopic and hydrated waters. The Itakpe/Agbaja blend ratio of 70/30 gave the optimum indurating compressive strength of 2613.33N/P and therefore is best suitable for the reduction and production of liquid pig iron in the blast furnace and the Direct Reduced Iron process. Sufficient mechanical strength of fired pellets for 70/30 Itakpe/Agbaja blend ratio was achieved.

Keywords: Mechanical; Properties; Pellets; Blends; Itakpe; Agbaja; Iron ore

Introduction

In modern blast furnace operation, careful burden preparation to provide a well sized burden of consistent chemical composition is essential in order to obtain high furnace productivity. Intensive work into the improvement of burden preparation and quality has identified facets of burden properties which can play an important part in furnace operation.

As it is becoming increasingly important to know the physical and chemical properties of the individual burden constituents, many test procedures have been and are being developed to determine and quantify various properties. In considering the performance of the materials inside the furnace under reducing conditions, it is accepted that it is difficult to develop tests which can precisely simulate furnace conditions. Many tests have been developed in an endeavour to obtain meaningful information which is of assistance to blast furnace operators. As the blast furnace is final smelter of any material, it is important to carry out blast furnace trials to evaluate a specific material under test conditions, in order to correlate the results with laboratory tests. Various practices in furnace operation and local economics must be borne in mind attempting to determine the acceptable level of any specific property of a burden (Table 1).

Also during the processing of high grade iron ores which does not need beneficiated, fines which are generated can be pelletized and used instead of being disposed of. Iron Ore Pellets are formed from beneficiated or run of mine iron fines. The iron is usually ground to a very fine level and mixed with limestone or dolomite as a fluxing agent and bentonite or organic binders as a binding agent. If the ore is a haematite ore, coke or anthracite coal can be added to the mix to work as an internal fuel to help fire the pellets. This mixture is blended together in a mixer and fed to balling discs or drums to produce green pellets of size typically about 9-16 mm. The green pellets are then fed to the induration machine. Both straight grates and grate kilns dry the pellets out in a drying section, then bring the pellets up to a temperature of about 800-900°C in a preheat zone, then finish the induration process at roughly 1200-1350°C. The pellets are then cooled to a suitable temperature for transporting to a load out facility. Both processes recycle the heat from the pellet back through the process to aid in energy efficiency and decrease fuel usage.

Both processes can be used to generate almost any type of desired pellet chemistry, from direct reduction pellets (DR pellets) to blast furnace pellets. By adjusting the amount of fluxing agent or limestone added, pellets can be made that are anywhere from acid (or non-fluxed) pellets to heavily fluxed pellets. In view of these Nigeria is blessed with abundant iron ore located in some state of the Federation like, Kogi, Enugu and Abuja etc It should be noted that Iron ore deposits was discovered in Nigeria as far back as 1904 since then several deposits have been discovered. The deposits are haematite, magnetite, goethite or siderite goethite grades. The reserve is estimated at over 3 billion metric tonnes and their utilization deposits in iron and steel plants will reduce the cost of importation thereby saving foreign exchange, improve our technology i.e., agriculture, military defence and provide employment [1]. The pellets produced are to be used in the operation of the Blast furnace and Direct Redution Iron (DRI) typical example of such furncaes are located at Ajaokuta Steel Company Limited, Ajaokuta Kogi State,while the other type of furnace is used at the Delta Steel Company Limited, Aldaja, Delta State (Figures 1 and 2).

The Itakpe ore is suitable as a feedstock to one of the direct reduction methods of iron making. The ore is typical of one formed by magmatic segregation. But the Agbaja ore is an acidic pisolitic/oolitic

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Received March 02, 2018; **Accepted** March 26, 2018; **Published** April 02, 2018

Citation: Ocheri C, Mbah AC (2018) Study on the Mechanical Properties of Pellets Produced from Blends of Itakpe and Agbaja Iron Ore. Ind Eng Manage 7: 254. doi:10.4172/2169-0316.1000254

Compound	Concentration (%)
$(Al_2O_3$	4
SiO_2	15
$(K_2O$	0.15
CaO	0.32
V_2O_5	0.02
Cr_2O_3	0.091
MnO	0.1
Fe_2O_3	79.1
CuO	0.0052
Br	0.14
Rb_2O	0.14
ZrO_2	0.26
In_2O_3	0.1
la_2O_3	0.09
P_2O_5	Trace

Table 1: Chemical Composition of Itakpe Iron Ore Concentrate.

Figure 1: Pictorial view of the Direct Iron Reduction process at the Delta Steel company Limited.

Figure 2: Pictorial view of the Blast Furnace at Ajaokuta Steel Company Limited.

ore consisting of goethite, magnetite and major amounts of aluminous and siliceous minerals. It cannot be used directly in a blast furnace or other reduction process without further treatment, like, pelletsing, pelletizing or briquetting. Agbaja ore is lean and of sedimentary origin. It is therefore necessary to harness the opportunities created to blend both ores since they are available in very large quantity in order to be used in blast furnace operation at the Ajaokuta Steel Company Limited, Ajaokuta in Kogi State and the Direct Reduction Iron (DRI) process which is also available at the Delta Steel Company Limited, Aladja, Delta State both in Nigeria (Table 2).

Compound	Concentration, %
Al_2O_3	12
SiO_2	6.9
P_2O_5	1.3
CaO	0.972
TiO_2	0.33
V_2O_5	0.11
Cr_2O_3	0.11
MnO	0.19
Fe_2O_3	74.78
CuO	0.034
ZnO	0.054
Br	0.23
Re_2O_7	0.06

Table 2: Chemical Composition of Agbaja Iron Ore Concentrate.

Materials and Methods

General description of ores

The Itakpe sample was a compact, banded crystalline ore which varied in colour from grey to black. The ore obtained indicated that the particles consists of dull and slightly magnetic properties. The Agbaja ore sample showed the compacted ground fine particles were present which signifcally exhibits the characteristic of being friable and also magnetically strong.

Chemical and mineralogical methods: Mechnical processes were carried out where the ores were crushed,it was further subjected to sieve analytical processes where the particle sizes and size distributions were recoreded. The crushed lumps taken from the parent bodies reflected the true ores used. Efforts were further made in order to prepare the crushed samples for other experimental procedures. The ranges of the sizes of the particles where with the mesh sizes of 16-10.

General description of ores

Itakpe iron ore: The topography of the region is a plateau rising gently to the east, down to the river Niger. The plateau is bestrewn with scattered hills which are made of Precambrian gneisses and granites that overlook the surrounding by about 200 m to 300 m. The Itakpe deposits is part of these hills. Its estimated reserve is over 300 million tonnes while its proven reserve is 200 million tonnes [2].

Agbaja iron ores: The technical and economic viability for the development of an iron ore mining and processing operation at Agbaja is to produce 5 million tonnes of upgraded iron ore concentrate per annum. This is based on the current Resource of 586 million tonnes at 41.3% iron, one of the17 exploration licences held by the company – with the majority, or about 466 million tonnes at 41% iron, classified in the higher confidence indicated category. These are sufficient to support a 5Mtpa project for a period of more than 35 years through a mine plan sufficient for 21 years production.

Agbaja is one of the magnetite deposits in the world while its average iron grade of 41.3% places it at the top end of magnetite projects world-wide, which generally range from 20% to 40%. The material is relatively soft and friable and only requires moderate grinding, simple magnetic separation, and only a coarse grind particle size to liberate the iron. Consequently mining and processing costs for the Agbaja project are relative low compared to other magnetite projects. Agbaja's estimated total operating costs rank in the bottom quartile when compared to operating costs other magnetite projects.

The Agbaja Iron ore are made of brown compacted fine grained materials which consist of extremely lager particles which show the tendency to be friable. Agbaja iron ore is strongly magnetic. The ore particles were further processed by crushing them for specific experimental procedure Analyses for calcium, magnesium, iron, aluminium, sulphur were made by atomic absorption spectrometry, silica was determined by a combination of gravimetric and colorimetric method, x ray diffraction analysis that were performed (Figures 3-6).

Mechanical Properties of Pellets Produced from Blends of Itakpe/Agbaja Iron Ore

The experimental materials used for the study were iron ore concentrates obtained from the National Iron Ore Mining Company (NIOMCO), Itakpe in Kogi State, and Agbaja Iron ore obtained from the Agbaja plateau in Agbaja town both in Kogi State Nigeria. The chemical compositions of the ores were determined which showed the compositions of the ores. The iron ores concentrates were properly investigated, the ores were locally sourced which are readily available in Nigeria and the nature of the two ores were also determined. The blend of both ores (Itakpe/Agbaja) were investigated and standard procedures were used as a basis of comparison in this investigation [1].

Figure 3: Sample of the Iron ore as obtained from Itakpe mines.

Figure 4: Sample of the Iron ore as obtained from Agbaja mines.

Figure 5: Itakpe Iron ore concentrate.

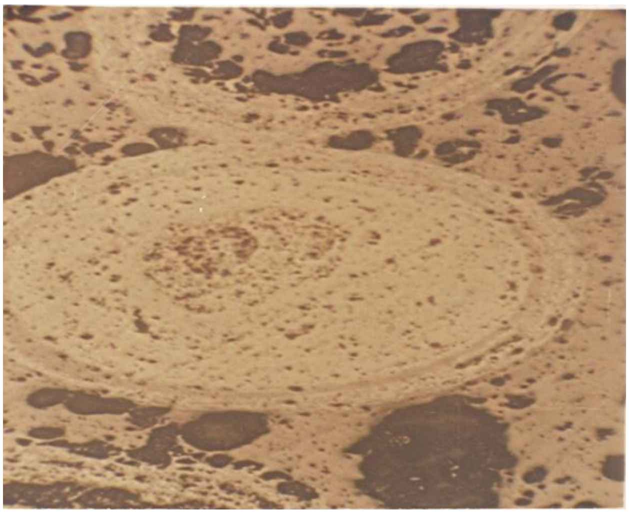

Figure 6: Micrograph of the ore as obtained after the thin section analysis.

Equipment

The following equipment were used, they are :

(a) Ball milling machine made by Bico Sprecher and Schn (2287) – pellet production, the Sieve of 0.5 mm and 0.63 mm were employed for the screening of the size of the of iron ore.

(b) Pelletizing machine - for the production of pellets were used Form and Test Seidner Strength testing machine-D7940, Salter Scale 50 kg type – used to weigh milled iron ore,

(c) Electric digital weighing balance – this equipment was used to weigh the pellets,

Sample plate which housed pellets towards drying, Beaker were filled with Benzene which was used to determine the porosity.

(d) Sample handler was used to safe guide the pellets.

(e) Muffle furnace : the furnace was used for heating the sample to high temperature Heating Furnace the heating furnace was used to heat the pellets at low temperature [1].

Methods

The Itakpe Iron Ore concentrate was obtained from the National Iron Ore Mining Company (NIOMCO). Itakpe, Kogi State Nigeria, while the Agbaja iron ore concentrate was obtained from National Metallurgical Development Centre, Jos, Nigeria. The chemical compositions of the ores are given in Tables 1 and 2. The Agbaja Iron ore contain high phosphorus while the Itakpe iron ore concentrate has phosphorus in traces

Sample preparation (pellet preparation): 5 kg of each iron ore of Itakpe and Agbaja Iron ore were charged at different times into ball milling machine made by Bico Sprecher and Schn (2287) Industrial control, United State of America. Then one hundred balls of varying diameters ranging from 10 mm to 40 mm were charged into the ball mill (10.0 mm balls – 35 pieces, 20 mm balls-35 pieces, 30 mm balls-20 pieces and 40 mm-10 pieces).

The samples were allowed to mill for six (6) hours after which they were discharged and sieved using 0.63 mm sieve size. The oversize materials were recycled until they all passed through the 0.63 mm sieve. At this point, the three samples prepared were worked upon :

1. 5 kg Itakpe iron ore pulverized to – 0.63 mm sieve size.

2. 5 kg Agbaja iron ore pulverized to – 0.63 mm sieve size.

500 g blended Iron ore was weighed with Itakpe iron ore in the blend-475 g. (95%) and Agbaja iron ore in the blend-25 g.(5%) were weighed using Salter Digital weighing balance with trade mark – Mettler Pm 2000. The weighed samples were charged into a clean and moisture free Erich 2287 Palletizing disc machine of 35 cm diameter wide palletizing disc. 4% lime was also added, while the Machine rotated at the speed of 25 rpm. The samples were properly mixed after which 100 mls of water by volume was measured and added to the iron ore mix in the rotating pelletizing disc which work gradually; while the charge were been scrapped on a continuous basis to avoid sticking to the disc. As the experiment progresses the pellets of varying diameters ranging from 10 mm to 20 mm were formed. Rotation of the Pelletizing disc continued in a reduced speed of 15 rpm; after satisfactory formation of pellets impacted further strength on the pellets formed,the formed pellets were discharged [3-6].

Drop number test of pellets from height of 60 cm: Six (6) green pellets from each group of blends were picked at random. Each of the six samples were dropped from a measured height of 60 cm where the number of drop were noted until the samples were fractured into pieces. The number of fall continued until fracture were recorded as the drop number. While average drop resistance for the six (6) pellets were recorded as the drop resistance for that particular set of blend. Such experiments were repeated for the rest of the blends while average drop number for the six (6) pellets was recorded as the drop number.

Drop resistance test of pellets from 48 cm, 60 cm and 72 cm height: Six (6) green pellets form each group of blends were picked at random. Each of the six samples were dropped from a measured height of 48 cm, 60 cm and 72 cm. Care was taken to monitor the number of drop until the samples were fractured into pieces. The number of fall were noted until fracture occurred and thereafter the drop resistance was recorded after which were placed under load, on the same machine. Average of the compressive reading gave the actual dry compressive strength test of the pellets. Same procedure were applied to the rest of the pellets.

Green compressive strength test: Six (6) selected pellets from a set of blend were picked at random and then subjected to load until scattered occurred using Form and Test Seidner Strength testing machine-D7940 Reidlingen Laboratory Test equipment West Germany. The readings of the scattered load were noted as they were applied to various six pellets which were recorded and the average of the readings was chosen to be the actual green compressive strength test of the pellets.. Same experimental procedures were repeated for the rest of the pellets.

Dry compressive strength test: Six (6) selected pellets from a set of blend e.g., 95% Itakpe iron ore and 5% Agbaja iron ore was fired in muffle furnace to 600°C. After which they were subjected to load, on the same machine until fracture occurred. Average of the compressive reading gave the actual dry compressive strength test of the pellets. Same procedures were applied to the rest of the pellets.

Indurating compressive strength test: This experimental process was peformed and observed that the only difference was that pellets tested in this group were fired in a heating furnace to a temperature of 1200°C, before the samples were subjected to load on the compression machine and the average of the reading was taken as the actual indurating compressive strength test of the pellets. The same experimental procedures were repeated to the rest of the blends.

Moisture content of pellet in each blend: The moisture content of the sample was carried out and a representative of the pellets of a blend was taken and placed in to a crucible which was thereafter weighed and the reading recorded, the crucible and pellet were then transferred into a heating oven at a heating temperature at 105°C this process was allowed for two (2) hours after which it was brought out and weighed after it was allowed to cool down. The sample was then returned into the heating oven and then reheated for another one (1) hour, thereafter the sample was allowed to cool down and it was re- weighed; this process was done severally until constant weight reading was achieved [6-10].

The initial weight of crucible+sample=W_1

The final weight of crucible+sample=W_2

Volume of H_2O expelled from sample=W_1-W_2.

Micro-porosity of pellet in each blend: Weight of the fired pellets to 900°C were taken, after this the pellets were dropped into a beaker containing benzene; Immediately this was done, there were release of bubbles from the pelletswhich indicate that empty spaces in the pellets were filled with benzene displacing the blow of air which was filled with benzene displacing the blow of air within the pellets, which was caused by the firing of the pellets. The sample remains in benzene until the bubbles stopped. The pellets were then brought out of benzene and quickly weighed. This was then repeated for all other samples from other blends.

$$\text{Porosity} = \frac{\text{Wt.of pellet in Benzene}(\text{D}) - \text{ wt. of pellet before immersed in Benzene}(\text{d})}{\text{Wt. of pellet in Benzene}(\text{D})}$$

$$= \frac{\text{D} - \text{d}}{\text{D}} x100\%$$

Tumbler resistance test: 30 Pellets of 95% Itakpe Iron ore and 5% Agbaja iron ore blend weighing 300gms were fired dried at 150°C slowly in a heating furnace for two (2) hours after which, the pellets were introduced into a drum with diameter 0.25 m, length 0.1 m, with two (2) lifters each of height 0.25 m located inside the drum which was allowed to rotate for five (5) minutes at a speed of 25 rpm, after which the chattered pellets were screened and the fraction of +0.63 mm and -0.5 mm were collected separately. The percentage of separated

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fractions in proportion to the feed weight was the value of tumbler index (i.e., +0.63) and abrasion index (i.e., -0.5 mm).

$$\text{Tumbler Index} = \frac{\text{Weight of Chattered Pellets at} * 6.3\text{ mm}}{\text{Total wt of pellets charged}}$$

$$\text{Abrasion Index} = \frac{\text{Weight of chattered pellets at} - 0.5\text{mm}}{\text{Total wt of pellets charged}}$$

Mechnical Propoerties of Blend Itakpe and Agbaja Iron Ore

Chemical analysis of the blends and mechanical properties of pellets were presented in Table 3 respectively. Figures 7-15 are the graphs of mechanical properties of produced blended pellets (Drop number, Drop resistance, Green compression strength, Dry compression strength, Indurating compressive strength, Moisture content, Tumbler index, Abrasion index and Micro-porosity) [11-13].

As stated earlier the mechanical characteristics of blended iron ore pellets were investigated to evaluate the possibility of using the blend mixture to produce liquid pig iron in the blast furnace. The drop number, drop resistance, green compression strength, dry compression strength and indurating compressive strength values were used as major criteria in assessing the selected blends under study. The results of the mechmical properties of the blended Itakpe/Agbaja iron ores could be found in Appendix I.

Drop number

Figure 7 shows the variation of drop number with percentage Agbaja/Itakpe iron ore pellets. The highest drop number point was attained at 3.82 cm.blend ratio of 70/30 Itakpe/Agbaja while the standard minimum is 4 cm.

Drop resistance

Figure 8 shows variation of drop resistance with various blends of Itakpe/Agbaja iron ore pellet. The best drop resistance was attained at Itakpe/Agbaja blend ratio of 50/50 at 4.50 cm when compared to the standard minimum value of 4.65 cm while the maximum is 5.8 cm.

Green compression

Figure 9 shows variation of Green Compressive Strength with

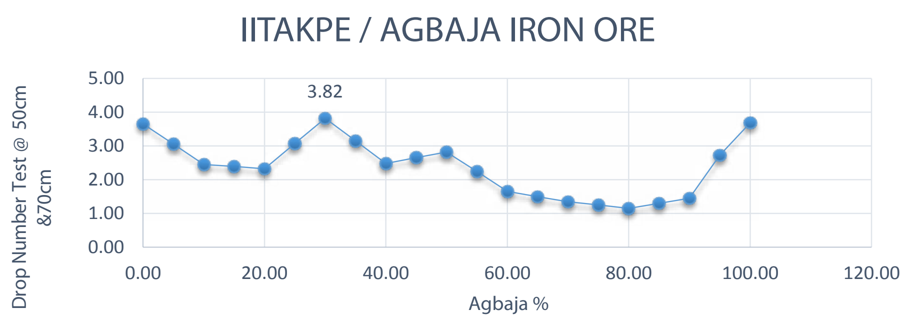

Figure 7: variation of drop number with various blends of Itkpe/Agbaja Iron Ore Pellets .

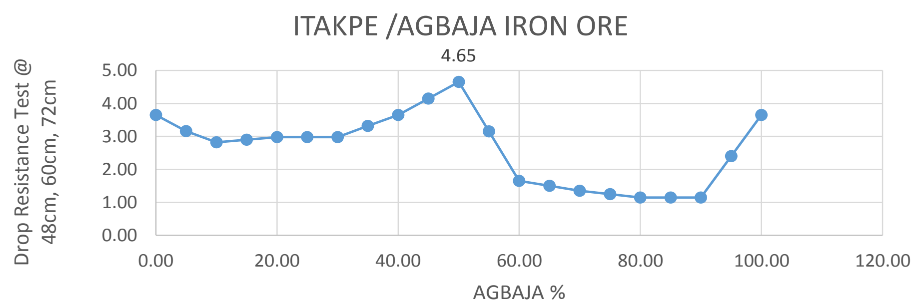

Figure 8: Variation of Drop Resistance with various blends of Itakpe/Agbaja Iron Ore Pellets .

Iron ore Deposit	Parameters (%)									Indicated interred Reserve in MT
	Fe	SiO_2	Al_2O_3	CaO	MgO	TiO_2	MnO	P	S	
Itakpe	32.68	44.80	1.0	0.30	0.20	0.10	0.05	0.18	0.05	200⁺ 310
Oshokoshoko	34.45	51.07	9.67	0.15	0.18	0.61	0.08	0.02	0.007	1085
Ajabanoko	37.22	46.50	3.39	0.21	0.15	-	0.01	0.10	0.03	2565
Agbaja	47.80	10.89	9.60	0.72	0.38	0.37	0.14	0.08	0.12	9621250
Koton Karfi	48.15	5.13	6.70	0.45	0.07	0.24	0.56	2.14	0.04	428,850
Bassa Nge	46.90	8.28	10.87	0.46	0.46	0.26	0.13	1.45	0.05	825 450
Muro	31.60	40.00	0.40	0.50	2.10	0.20	0.10	0.10	0.10	3.8
Source: Asuquo and Nebo, 1994, Uwadiale and Nwoke, 1995										

Table 3: Chemical Composition and Estimated Reserve of some Nigerian Iron ore.

various blends of Itakpe/Agbaja Iron Ore Pellets. The best green compression strength amongst the blend mixtures was achieved at 80/20 blend ratio of itakpe/agbaja with a value of 12.33N/P when compared to the standard minimum value of 10N/P

Dry compression

Figure 10 shows Variation of Dry Compressive Strength with Various blends of Itakpe/Agbaja Iron Ore Pellets. In this trend the best green compression strength amongst the blend mixtures was achieved at 70/30 Itakpe/agbaja blend ratio with green compressive strength of 34.7N/P as compared to the standard requirement value of 10 N/P.

Indurating compressive strength

Figure 11 shows Variation of Indurating Compressive Strength with various blends of of Itakpe/Agbaja Iron Ore Pellets. In this trend the best green compression strength amongst the blend mixtures was achieved at 70/30 Itakpe/agbaja blend ratio with green compressive strength of 2613..33N/P as compared to the standard requirement of 2600N/P.

Moisture content

Figure 12 shows variation of moisture content with various blends of Itakpe/Agbaja iron ore pellets Itakpe/Agbaja blend ratios of 50/50 has moisture content value of 5.36 ml. However, the blends did not meet the standard requirement of 9.3 ml.

Tumbler index value

Figure 13 shows variation of tumbler index with various blends of Itakpe/Agbaja iron ore pellets. Itakpe/Agbaja blend ratio of 40/60 has tumbler index value of 97.01 percent both blends attained the standard requirements of 94 percent.

Abrasion index

Figure 14 show variation of abrasion index with various blends of Itakpe/Agbaja iron ore pellet. Itakpe/Agbaja blend ratio of 50/50 gave abrasion index value of 16.56 percent. These two values of abrasion index are well above the standard value of 5 percent.

Micro porosity

Figure 15 shows the best micro-porosity point was achieved at Itakpe/Agbaja blend ratio of 10/90 with a value of 14.99 percent. According to experiment this velocity is always so high that even porosity variation between 10-30% hardly cause great differences and

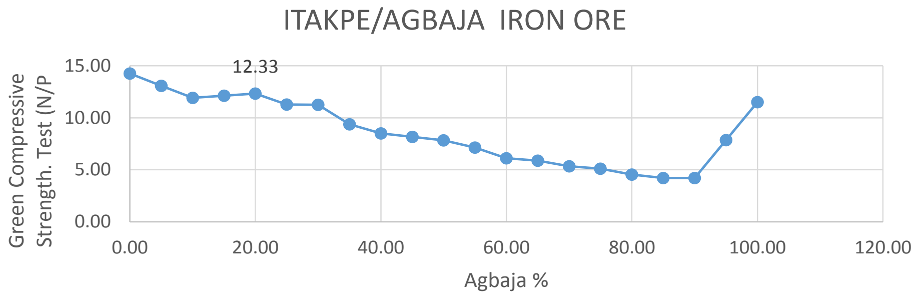

Figure 9: Variation of Green Compressive Strength with various blends of Itakpe/Agbaja Iron Ore Pellets.

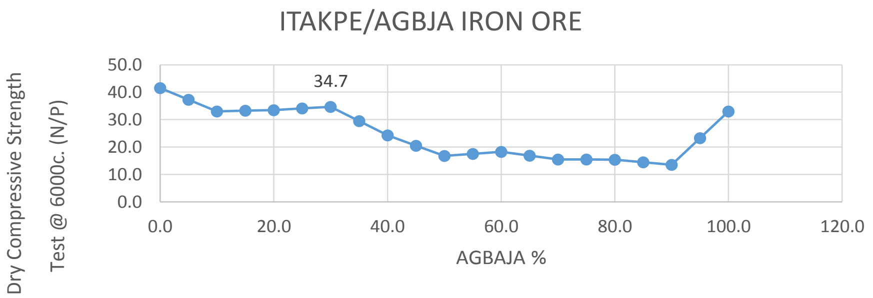

Figure 10: Variation of Dry Compressive Strength with Various blends of Itakpe/Agbaja Iron Ore Pellets.

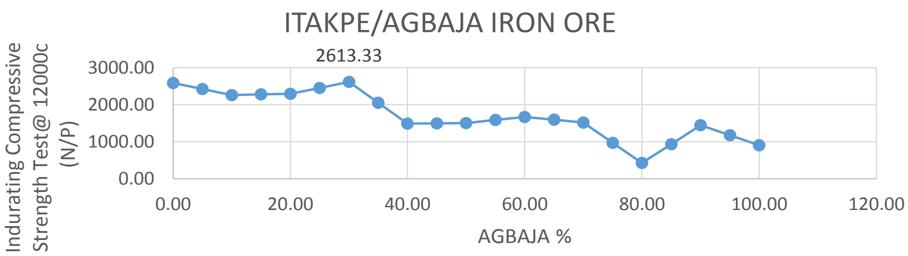

Figure 11: Variation of Indurating Compressive Strength with various blends of Itakpe/Agbaja Iron Ore Pellets.

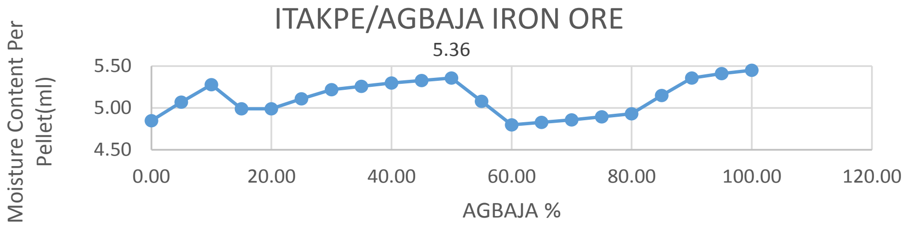

Figure 12: Variation of Moisture Content with Various blends of Itakpe/Agbaja Iron Ore Pellets.

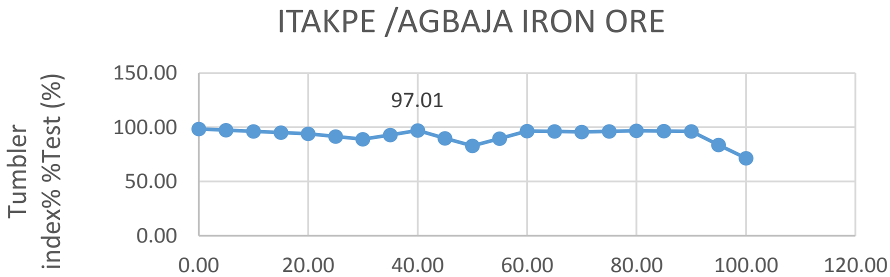

Figure 13: Variation of Tumbler Index with various blends of Itakpe/Agbaja Iron Ore Pellets.

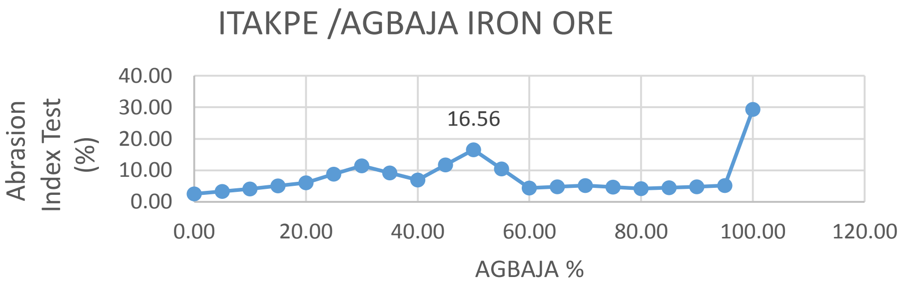

Figure 14: Variation of Abrasion Index with various blends of Itakpe/Agbaja Iron Ore Pellet.

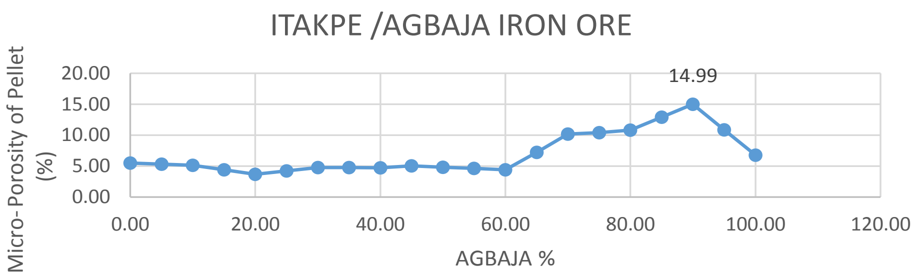

Figure 15: Variation of Micro-Porosity with various blends of Itakpe/Agbaja Iron ore Pellet.

the major part of pellets qualities is within the upper limit of this range.

Recommendations for Future Research

(α) Enough funds will be needed to perform this kind of research work because of its capital involvement which is intensive. In regards to this, some of the research institutions, universities and Industries were such research works are carried out should have a rate that could greatly affordable to students and researchers and some time waviers could also be given when such research works are performed.

(b) Time should also be made available for the completion of such project within the academic period as a lot of experimental procedures and processes are involved.

(c) Sourcing of the raw iron ores from the National Iron ore Mining Company, Itakpe and Agbaja plateau were very difficult as a lot of money was spent to get the raw iron ore and also the security network of the locations were not also easily to be accessed. The terrain were also not easily accessible. Efforts should therefore be made by all the stake holders to always assist researchers, students and other individuals the opportunity to have access to these raw materials

(d) The cost of performing such experiments are relatively high for an average students/researchers to afford, therefore Governments and other research Institutes, Universities and Industries should reduce the cost of performing such experiments with a view to encouraging researchers

(e) In view of the above therefore the Universities, Research Institutes in Nigeria should collaborate with agencies like the TEFUNDS, PTDF, SHELL CHEVON, AGIP etc to supply such equipment and to also partner with students in order to achieve optimal results.

(f) The research work performed is not exhaustive as more work could still be carried out with other iron ores available within Kogi State like the Agbajanoko, Oshokosho, Konto Karfi, Bassa Nge and Muro and in other States in Nigeria.

(g) Finally, there should be synergy between Government,Universities, Research Institutes and industries with a view to solving basic problems through such collaborations.

Conclusion

The research work has availed the researcher the opportunity to explore all the experimental processes available to understand the techniques involved in the study on the reducibility and mechanical properties of pellets produced from blends of Itakpe and Agbaja iron ore. It should therefore be known that the large deposits of the iron ores which were initial adjudged as not suitable for use in the production process in Direct Reduced Iron (DR) and the Blast Furnace are readily available in larger quantity in the country as indicated in the table below.

There are other Iron ores which have not be worked as indicated in the above table. Such ores could also be investigated and subjected to the reducibility processes and blending them with one another with a view to generating the necessary data and to make comparism with those already investigated.

Itakpe ore is a rich heamatite ore in which have some of heamatite in forms of an intergrowth with magnetite. The main impurity is silica, following liberation by mechanical crushing and physical separation of the quartz, the Itakpe ore is suitable as a feedstock to one of the direct reduction methods of ironmaking. The ore is typical of one formed by magmatic segregation, while the Agbaja ore is an acidic pisolitic/oolitic ore consisting of goethite, magnetite and major amounts of aluminous and siliceous minerals. This ore cannot be used directly in a blast furnace or other reduction process without further treatment, e.g., sintering, pelletizing or briquetting. It is also lean and of sedimentary origin it was on these basis that the ore was blended with Itakpe iron ore in order to produce pellets for optimal results where they could be used as burden materials in the operations of the Blast furnace and Direct Reduced Iron(DRI). From the results obtained for the mechanical properties of blended Itakpe/Agbaja, it was indicated that all the iron ore samples were found to be Oolithic in nature. The compressive strength results of the green pellets confirmed the presence of hygroscopic and hydrated waters. The Itakpe/Agbaja blend ratio of 70/30 gave the optimum indurating compressive strength of 2613.33N/P and therefore is best suitable for the reduction and production of liquid pig iron in the blast furnace and the Direct Reduced Iron process.

Sufficient mechanical strength of fired pellets for 70/30 Itakpe/Agbaja blend ratio was achieved. Finally it could be concluded that the research work was very successfully as a lot of experiences were obtained from all the experiments performed.

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