Realizing state of the art "All Indian Pellet plant" by MECON

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Abstract

Huge quantity of iron ore fines are accumulated at different mines head during mining and remain un-utilized in our country because of its limitation in use through sintering route. Slimes /ultra fines are also being generated / expected from Crushing and Beneficiation plant which have considerable Fe content and needs to be further utilized. Considering scarcity of quality lump ore, its price & future demand, extensive use of pellets as prepared burden by conversion of the above is gradually gaining its importance. In view of this, design & manufacturing of Pellet plant within India has become an absolute necessity for better understanding of critical design aspects under Indian raw materials condition & minimizing project cost. It is expected that MECON's state of art "All Indian Pellet plant" based on Travelling grate (TG) process will meet the above demand. Two major process routes i.e. Travelling Grate (TG) & Grate Kiln (GK) process are adopted worldwide for pellet production where in, TG process has some edge over GK process under Indian raw material condition.

MECON started its journey in pelletization in India with KIOCL pellet plant. The projects from start up for MECON are KIOCL, Hy-Grade, JSW etc.. Subsequently, it has played a key role in installation of country's majority of pellet plants. MECON is now in a position to offer a wide range of services in the field of pelletization including EPC execution. MECON's "All Indian pellet plant'' will ensure minimum engineering interfaces, indigenous plant at a competitive price, design suiting Indian raw material and operating condition, improvement in design based on feed-back from operating plant etc. Besides demand, it is suggested that prior to installation, capacity of pellet plant shall be carefully thought off based on certain key considerations i.e, sustained supply of raw materials over pellet plant life, operating expenses etc.

Introduction

Primarily due to depletion of good quality Hematite ore reserves in the country, time is appropriate to give a serious thought for gainful utilization of the accumulated dumps containing a sizeable proportion of ultra fines. Moreover, non utilization of these dump fines would pose a serious environmental threat. Beneficiation route is emerging out as a

pre-requisite to ensure supply of quality iron ore to the steel industry. This requires intensive crushing of iron ore to reach its liberation size. During crushing & beneficiation, lot of ultra fines and slime are also generated which will go on increasing day by day for sustained supply of quality iron ore to the steel industry to meet the future demand. As we all know that the sintering route has limitations in utilization of these ultra fines and slimes, these materials can only be gainfully utilized as prepared burden to Blast furnace and DR plants by adopting the pelletization route. With increase in future demand of steel vis-à-vis current scenario, sustainable supply of quality prepared burden in the form of pellet will become inevitable in our country. Anticipating this demand, Indian entrepreneurs should be facilitated with indigenous design and manufactured pellet plants which will not only meet the critical design aspects under Indian raw materials conditions but also bring growth in manufacturing industry and generate more employment. It is expected that MECON's state of the art "All Indian Pellet plant" will meet the above demand.

Critical design aspects under Indian condition

Type of ore and its characteristics play an important role in Pellet plant design and its performance. In India, majority of iron ore occurs are hematite & magnetite. However, hematite is the only exploitable ore available since most of the magnetite deposits occurs in eco-fragile zones which is at present not minable due to stringent law of the Honorable Supreme court of India.

During induration, Hematite gets transformed to artificial Magnetite initially which is an endothermic reaction before getting converted back to Hematite. The firing zone length of the indurating machine is finalized to accommodate the endothermic transformation. While in case of Magnetite, the only transformation i.e. Magnetite to Hematite being an exothermic nature, the heat requirement gets reduced in comparison with Hematite resulting lesser firing zone length requirement.

Further, it is observed that Indian iron ores (hematite) is often associated with goethite ores leading to high LOI characteristics. Prolonged drying and pre-heating are required during heat hardening cycle to gradually remove the moisture and to avoid crack formation in the pellets. This aspect plays an important role in arriving at Indurating machine area, zone length in drying and pre-heating, indurating machine speed etc. In addition, up-stream facility is to be designed suitably to feed additional material to compensate the LOI effect.

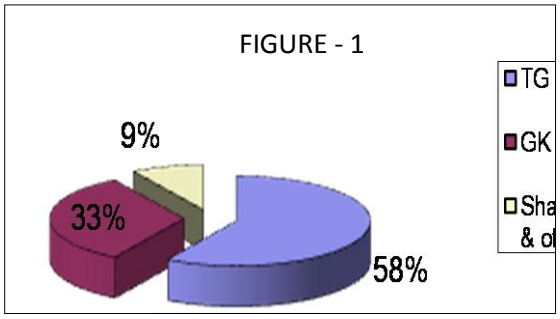
It is also observed that silica & alumina content in Hematite ore varies from 3.5 % to as high as 7.5% even after Beneficiation. As green pellet strength decreases considerably with higher percentage of silica & alumina, it is suggested that green/fired pellets should be subjected to minimum falls during heat hardening cycle to avoid breakage of pellets.

Blaine number is another important aspect to influence green ball formation. Although Blaine number of ground iron ore fines is controlled during iron ore grinding in raw material preparation area. At times, it becomes difficult to maintain required Blaine number (1800-2200 cm2/gm) with change in iron ore characteristics. Lower Blaine number means coarser material and difficulty in green ball formation & its breakage. However, it is reported that Blaine number beyond 2200 cm2/gm also does not contribute in any further improvement in green ball formation but need more induration temperature to arrive at the required strength of the indurated pellets. Moreover, additional moisture and binder quantity adjustment will be primarily required to optimise green ball formation.

Provision to counter the above typical constraints of Indian raw material is to be kept in design in order to have optimum plant performance.

MECON's perspective on available design

Two major processes for iron ore pelletisation are Travelling (TG) process and Grate Kiln (GK) process accounting for more than 90% of total installed capacity in the world. Remaining processes namely, shaft furnace process, cold bonded process etc. accounts for a meager share. While Traveling Grate process, accounts for about 58 % of the world capacity, Grate-Kiln process, accounts for about 33 %.



A brief comparison between TG & GK process

Item	Travelling grate (TG)	Grate kiln (GK)
Heat hardening cycle	Drying, preheating, induration and cooling are done on a single grate.	Drying and preheating on a grate, induration in rotary kiln and cooling in annular cooler.
Pellet movement	Pellets remain stationary throughout the process.	Pellets tumble continuously in rotary kiln.
Burners	Large number of burners along the length of induration furnace.	Single burner is used for the Kiln.
Refractory lining	No direct contact with pellets	Contact with pellets and subjected

Item	Travelling grate (TG)	Grate kiln (GK)
		to heavy wear
Major Fuel	Coke + Gaseous/liquid fuel	Gaseous/liquid fuel + pulverized coal
Pellet grades	Both BF & DR grades.	Both BF & DR grades.
Grate bars	Grate bars subjected to high temp; side & bed layers necessary.	No side or bed layers necessary. Bed depth is nearly half.
Others	-	Chunk formation inside rotary kiln

Although, both the processes are widely adopted for pellet making, under Indian raw material condition, Travelling grate process enjoys some distinct advantages with less fines generation, more flexibility in heating pattern with varied ore quality particularly to take care the LOI and having lower maintenance & less refractory failure.

MECON in Pelletisation

Since inception, MECON's strive remained very strong in gaining knowledge of the latest technologies of Pelletization. A small step taken forward in the form of installation Pellet plant at KIOCL, there has been no looking back. The projects from start-up for MECON are KIOCL, Delta Steel Co., Warri, Nigeria, Hy-grade pellet Ltd, Vizag (1st & 2nd module), for JSW, Toranagallu (capacity expansion), MSPL etc.

After, start up, MECON has played a very important role in installation of the following major pellet plants.

Sl No	Pellet plants	Process Type
1.	3.85 Mt/yr BPSL, Rengali	TG
2.	4.0 Mt/yr BRPL, Jajpur	TG
3.	1.2 Mt/yr Crest Steel Limited, Raipur	TG
4.	6060 t/d Monnet Ispat & Energy Limited - Raigarh	TG
5.	1.2 Mt/yr Shree Jagannath Steel & Power Limited, Barbil	TG

In addition to the above, MECON has been recently entrusted with the consultancy and engineering assignment for two prestigious project, under public sector viz. 4.0 Mt/yr Pellet plant for RMD-SAIL, GUA and 2.0 Mt/yr Pellet plant for NMDC.

MECON has already proven its position as frontline engineering, consultancy and contracting organization in the iron ore pelletisation industry, capable of providing full range of services required for setting up of project from concept to commissioning including EPC execution at a very competitive price. The same is reflected from the

recent successful bidding in two forth-coming prestigious projects of SAIL in Beneficiation & Pelletization in RSP & BSP. In the present scenario, MECON's state of the art "All Indian pellet plant'' will certainly provide some distinct advantages to the entrepreneurs planning for installation of pellet plant.

Range of services offered by MECON

Majority of the private entrepreneurs in our country intend to execute the pellet plant project in non-turnkey / semi-turnkey mode whereas in public sectors, it generally prefers project execution in turnkey mode. To meet varied demand of customers, wide range of services being offered by MECON and are summarized below:

- EPC execution from concept to commissioning.
- Basic & detail engineering with limited supply.
- Consultancy & detailed engineering services for non-turnkey modes of project execution wherein basic engineering to be provided by others.
- Consultancy services for turnkey project execution (by others).
- Project management services.

Besides this, preparation of techno-economic feasibility reports (TEFR), Detailed Project report (DPR), due diligence study of existing installations are the few which comes under other regular services before start of actual project execution.

Major advantages of "All Indian Pellet plant" by MECON & it's salient features

MECON's state of the art "All Indian pellet plant'' based on TG process will ensure complete engineering under one roof which will minimize interface related problems involving various engineering agencies. This will facilitate speedy engineering matching the actual site requirements, resulting reduced overall project implementation time. Based on the indigenous design and engineering, manufacturing could be maximized within the country which not only will enhance the growth of the Indian manufacturing sector but also will create possible employment. Maximisation of indigenous procurement from fully developed vendor base will optimize the project cost with less procurement time. Thus, dependency on foreign suppliers could be minimized. Further, being acquainted with the prevailing raw material conditions, MECON's "All Indian pellet plant" will be able to address the critical design aspects as discussed above by suitably selecting the process and equipment parameters to obtain desired output.

Salient features

Depending upon the space availability, a compact layout could be developed suiting to customer's requirement. Further, optimised building configuration with proper equipment layout without compromising the operational & maintenance requirement will result in reduced volume of work. Improvement in the design based on feedback from operating plant can also be accommodated to the extent possible, if felt necessary. Salient safety measures adopted in the design are explosion proof arrangement in the coke grinding system, use of Nitrogen to create an inert atmosphere to coke circuit, required safety interlocks with burner management system in Induration area etc.. Selection of ESP for elaborate area dedusting and dry handling of process & plant de-dusting ESP dust will ensure stringent pollution control requirement.

Recommendation on pellet plant size

For an entrepreneur, one of the important factors for finalising capacity of pellet plant primarily is its demand (internal / external). However, the Pellet plant size shall be selected in such a way that sustained supply of required quantity of iron ore fines (from own mine or purchased) is ensured over the life of the plant. It is worthwhile to mention here that depending upon the quality of the iron ore fines to be supplied over the period of pellet plant life, suitable iron ore grinding circuit has to be adopted. In our opinion, wet grinding circuit will have better flexibility, if beneficiation of iron ore fines is required in due course of time.

Further, it has been observed in pellet plants of smaller capacity (less than 1.0 Mt) have more specific energy & fuel consumption w.r.t. larger capacity plants resulting higher operating cost which is evident in pellet plants setup with GK process for 0.3 Mt, 0.6 Mt in our country. Moreover, these plants are also struggling to achieve its rated production, mainly due to lesser through put and increased fines generation. On the other hand, in TG process, Pellet plant size below 1.0 Mt may have very low induration machine speed to ascertain overall induration time and will lose the flexibility in operation under varied ore quality.

In view of the above, in our country, it is recommended to adopt minimum capacity of the Pellet plant as 1.0 Mt/yr based on TG process.

Conclusion

Typical characteristics of Indian iron ore fines demand specific design considerations to achieve optimum plant performance. In spite of TG process having some advantages considering Indian condition, still certain critical design aspects needs to be envisaged to overcome the challenges with Indian raw material. However, it is suggested to adopt capacity of the Pellet plant not below 1.0 Mt, based on TG process.

Further, MECON's state of the art "All Indian pellet plant'' will meet the future domestic demand, fulfill the critical design aspects under Indian raw materials conditions, bring growth in manufacturing industry and generate more employment.

References

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