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Research Paper

Production Process of Cement in India

Commerce

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ABSTRACT

India is the second largest producer of cement in the world. Cement production increased at a compound annual growth rate of 9.7 per cent in the period 2006– 2013, producing 272 million tons (MT). Its capacity is projected to reach 550 MT by FY 2020. The cement industry has been expanding on the back of increasing infrastructure activities and demand from housing sector. The Department of Industrial Policy and Promotion, report that cement and gypsum products attracted foreign direct investment worth Rs 13,370.32 crores (US$ 2.24 billion) between April 2000 and Feb2014.The housing segment accounts for a major portion of the total domestic demand for cement in India. In the 12th Five Year Plan of the Government, there is a strong focus on infrastructure development and the Government plans to increase investment in infrastructure to an amount of US$ 1 trillion.

Introduction
The cement stocks have been in focus since Feb 2014, due to the expectations of strong demand led by delayed onset of monsoons and the government's thrust on infrastructure development in the economy. The slowing pace of capacity addition will also lead to improvement in effective utilization rate of the industry offering improved pricing power to the cement manufactures. It witnessed huge capacity expansion of 159 million tonne (MT) post years. This was largely lured by improving fundamentals of the cement industry as profitability of Indian cement companies reached historically high levels in FY 2013. This huge expansion distorted the demand-supply dynamics of the industry. Moreover, Indian cement industry has commissioned 243MT of new capacities in the last 18 years, of which 159MT (65%) were in the last 6 years. We expect the pace of capacity addition to reduce gradually once the earlier announced capacities come on stream as which will help overall cement industry to improve the utilisation level which has been in the range of 65-70% over last several years .

Production Process of Cement
In the times of Egypt and Greece, sintered and ground lime or plaster was used as cement for civil engineering and construction. In the 19th century, Portland cement was produced in England. This manual covers energy conservation in Portland cement production. A cement production plant consists of the following three processes.

1. Raw material process
2. Clinker burning process
3. Finish grinding process

In the wet process, raw materials other than plaster are crushed to a diameter of approximately 20 mm by a crusher and mixed in an appropriate ratio using an automatic weighed. The water added thereto, the mixture is further made finer by a combined tube mill with a diameter of 2 to 3.5 m and a length of 10 to 14 m into slurry with a water content of 35 to 40%. The slurry is put in a storage tank with a capacity of several hundred tons, mixed to be homogenized with the corrective materials, and is sent to a rotary kiln for clinker burning. In the wet process, the slurry can be easily mixed but a large amount of energy is consumed in clinker burning due to water evaporation. For the wet process, plant construction cost is rather low and high-quality products are manufactured easily.

Characteristics of energy consumption in cement production

Energy consumption
The cement industry is said to be an energy-intensive industry together with steel, paper and petrochemical industries. The percentage of energy cost in Portland cement production cost is 20 to 30%. If the energy cost is reduced, the manufacturing cost is lowered, resulting in increasing the company's profits. Ninety percent or more of fuel is consumed for clinker burning. About 40% of electric power is consumed for finish grinding, and a little under 30% each is consumed by the raw material process and the clinker burning process. The finish grinding process mainly consumes electric power for the mill, and the clinker burning process mainly for the fan. The raw material grinding process consumes a large volume of power for the mill and fan. The Japanese cement production process is mostly occupied by SP and NSP kilns and coal is used as fuel. In such a case, energy conservation measures shall be taken by focusing on the clinker burning process for the fuel consumption and on the finish grinding process for the electric power consumption.

Raw material process:

Wet process
Since raw materials can be homogenized and the mixing ratio can be homogenized and the mixing ratio can be corrected after grinding, this process is relatively simple.

Dry process
The raw materials received by a plant contain a small amount of water. Limestone contains 2 to 5% of water and clay about 5 to 10%. The dry process needs to evaporate water when grinding. process a is provided with an independent dryer to evaporate water, and the dryer may be a rapid dryer or impact dryer with a disintegrating or crushing function instead of the rotary dryer as illustrated. For drying, exhaust gas from the kiln and preheated is used, but sometimes a hot gas generator is installed for a time of commissioning of the plant and for a time of year when water contained in raw materials increases.

Clinker burning process:

Wet process
A typical example of the wet process is a straight cylindrical type kiln having a length of about 40 times of the shell' s inner diameter, installed with an inclination of 2.5 to 4% and slowly rotated at 0.5 to 1.5 rpm. Raw material is slurry containing 38 to 40% of

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water and fed from the upper end of the kiln, while fuel is blown in from the lower end of the kiln. At the raw material inlet, a chain curtain zone is installed extending to 20 to 25% of the overall length to help dry the slurry. The hot linker, which has been sintered in the kiln, is sent to the cooler and cooled down to 80 to 100°C. Hot air from the cooler is effectively used as the secondary air for combustion in the kiln.

Semi-dry process

The semi-dry process is a example of the dry process and uses a Lepol kiln or shaft kiln. In either kiln, the raw material ground in the dry process is shaped into pellets with diameter of 10 to 15 mm, so that about 13% of water is added. In Lepol kiln, the pellets are dried and preheated once by the movable grate preheated shown in fed into the kiln. This system applies for the first time in the cement plant a concept of separating the raw material preheating process. Then, the Lepol kiln has lost its position when a kiln with suspension preheater was introduced .

Dry process

There are the dry long kiln, the short kiln with boiler, the SP kiln and the NSP kiln. The dry long kiln is mainly used in the near and Middle East where rain falls less and alkaline components in raw material are large; In Southeast Asia, Central and South America, and North America, the wet process long kiln is mainly used. A recent large NSP process has a heat consumption rate of about 750 kcal/kg.cl and is superior to all the conventional sintering processes.

Finish grinding process:

The finish grinding process is roughly divided into an open circuit grinding system and a closed circuit grinding system. In the open circuit mill, the mill shell has a length of about 4 to 5 times of its diameter to obtain a prescribed fineness, and the shell outer wall is sprayed with water to prevent the temperature of the product in the mill from rising. It is also possible to spray water into the mill interior but the closest attention has to be paid so as not to deteriorate the product quality. In the closed circuit mill, the mill has a length of 3 times or below of its diameter so as to accelerate the passage of the product. Starts from the software including OP and process control, extends into the field of hardware including equipment improvement and process improvement. Energy conservation efforts can be classified into the following three steps:

Step 1 - Good housekeeping

Energy conservation efforts are made without much equipment investment, including elimination of the minor waste, review of the operation standards in the production line, more effective management, improvement of employees' cost consciousness, group activities, and improvement of operation technique. For example, such efforts include management to prevent unnecessary lighting of the electric lamps and idle operation of the motors, repair of steam leakage, as well as reinforcement of heat insulations.

Step 2 - Equipment improvement

This is the phase of improving the energy efficiency of the equipment by minor modification of the existing production line to provide waste heat recovery equipment and a gas pressure recovery equipment or by introduction of efficient energy conservation equipment, including replacement by advanced equipment. For example, energy conservation efforts in this step include an effective use of the waste heat recovery in combustion furnaces and introduction of the gas pressure recovery generator in the iron and steel works and waste heat recovery generator in cement plant.

Step 3 - Process improvement

This is intended to reduce energy consumption by substantial modification of the production process itself by technological development. This is accompanied by a large equipment investment. However, this is linked to modernization of the process aimed at energy conservation, high quality, higher added value, improved product yield and man power saving.

The energy conservation technique in the cement industry is classified as follows:

	Raw material process	Clinker burning process	Finish process
1st step	1) Selection of raw material. 2) Management of fineness. 3) Management of optimum grinding media.	1) Prevention of stop due to failure. 2) Selection of fuel. 3) Prevention of leak.	1) Management of fineness. 1) Management of optimum grinding media.
2nd step	1) Use of industrial waste material . 2) Replacement of fan Rotor. 3) Improvement of temperature and pressure control system. 4) Improvement of mixing &homogenizing system.	1) Use of industrial waste material. (2)Recovery of preheater exhaust gas. 3) Recovery of cooler Exhaust gas. 4) Replacement of cooler dust collector from multilane to E.P.	I) Installation of closed Circuit. 2) Installation of feed Control system.
3rd step	1) From wet process to dry process. 2) From ball and tube mills to roller mill.	1) From wet process to dry process 2) Conversion of fuel 3) From SP to NSP 4) Use of industrial waste. 5) From planetary and under coolers to grate cooler.	

Conclusion

The cement industry in Japan has drastically changed its production process from the wet process to the dry process and promoted the NSP system as increasing production scale. Since energy conservation is an important matter in technical improvement activities. The cement production cost depends on the adopted production process. The wet process cannot defeat the dry process as regards energy consumption. In technical level of quality and productivity, there is no reason why the adoption of the dry process should be impeded. The improvement of a cement plant, however, needs large investment. The timing of the investment of process improvement must be carefully determined taking into consideration the budgetary condition of enterprises and the outlook of the cement market.

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