

MODERN EQUIPMENT USED IN CEMENT INDUSTRY

By

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SYNOPSIS

Introduction of newer technologies and equipment in the cement industry has played a significant role in growth of the industry in India. The experience of the cement industry with most of the improved technology and modern equipment has been very-encouraging. The technological trends leading to development of system and equipment have made substantial contribution towards the following major thrust areas:

- *Setting-up of larger capacity plants to take advantage of economy of scale*
- *Energy efficient plant operation*
- *Optimum utilisation of waste heat*
- *Protection of the environment*
- *Quality control*
- *Production of blended cement by using fly ash, slag, etc.*
- *Flexibility and reliability of operation*

This paper deals with some of the modern equipment introduced in the cement industry in the recent past, in India namely, On-Line Analyser, Grinding Systems, Controlled Flow Coolers, Mechanical Transport for Pulverised Materials (in place of pneumatic system), High Efficiency Fans, Advanced Control Systems, etc.

The systems described in this paper provide a glimpse of the present trends as also orientation towards the futuristic trends.

Adoption of any particular system for a specific plant and application has to be carefully done based on overall techno-economic considerations.

1. INTRODUCTION

Till 1982, cement was a controlled commodity and hence growth and modernisation of the cement industry was very sluggish. After partial decontrol in 1982, industry has taken rapid strides and production has gone-up four times. Introduction of newer technologies and equipment has played a significant role in growth of the industry in India.

This paper deals with some of the technological developments and trends in the Indian Cement Industry. These modern technologies/equipment are being adopted increasingly in the industry based on techno-economic considerations.

2. QUARRY MACHINES

With the increasing plant capacities, need was felt for faster reclamation of the raw material. Rippers and surface miners were introduced at a few plants to achieve this goal. This however, could be made possible in the deposits where material is having fairly uniform quality and stone is soft to medium hard.

Rippers and Surface Miners where employed, have helped in doing away with drilling and blasting operation.

Further, to avoid dependence on dumpers in many plants, crushers are being installed (mobile/semi-mobile) in mines and crushed material transported by means of belt conveyors to the plant.

3. CRUSHERS

A new machine called sizer, has recently been introduced in the industry for crushing raw materials. The machine works on the principal of toothed-roll crusher.

The machine is claimed to be good for crushing sticky raw materials with lower power consumption and lower dust generation. However, size reduction is achieved in two stages.

4. ON LINE BULK ANALYSERS

Bulk Analyser is a compact unit using nucleonic source to analyse on-line the elemental composition of the raw material. This offers a quick and accurate analysis of raw materials on continuous basis. It is installed across the belt conveyor going to limestone preblending stockpile, after crusher.

The additional feature of the system is that after formation of a pile, it gives the average quality of the pile. This facilitates in deciding the raw mix and arranging corrective/additive materials accordingly.

5. RAW MATERIAL GRINDING

Vertical Roller Mills (VRM) are normally being employed for raw material grinding. Experience with Roller Press for this application in one of the cement plants, has been encouraging. There was a power saving of about 5% over VRM. The drying capacity of the system however, is limited. If it exceeds 5%, a pre-crusher cum dryer needs to be introduced to make the system effective. This however makes the system complicated and should be avoided. Also, system availability is relatively lower than VRM.

6. PYRO-PROCESS

6.1 Rotary Kiln

Some of the major suppliers have introduced short rotary kilns (L/D ratio upto 10) with two pier supports. This provides a balanced support system and also results in lesser radiation losses.

6.2 Grate Coolers

All major machinery suppliers have introduced horizontal air flow concept in the grate cooler. This has not only resulted in the reduced cooler size, heat recuperation is better with lower cooling air requirement and consequently the lesser vent air. The system has been just introduced in the industry and first

feed back is awaited. However, it is expected that it will give a saving of atleast 15-20 Kcal/kg. of clinker, apart from overall lower specific power consumption of the pyro-process section.

7. CEMENT GRINDING

7.1 Cement mill System

The conventional cement grinding system is ball mill. In some of plants roller presses have been installed. Though the performance in terms of output and specific power consumption is quite satisfactory, the system availability has been low. Also high wear has been experienced.

Industry thus, is looking forward to VRM for cement grinding as the system is quite simple. A few systems are under implementation. It is expected to give a power saving of atleast 15%.

In international market, lately HORO mill has also been introduced. Availability of this machine is reported to be better.

7.2 Drive System

Conventionally, ball mills are driven by a cumbersome twin drive system.

In some of the plants, integral drive (girth gear and gearbox combined) has been introduced thereby avoiding grease lubrication system and long torsion shafts.

In a few plants, central drive has also been used which improves the power efficiency and the drive system becomes quite simple.

8. CEMENT STORAGE, PACKING AND DESPATCH

8.1 Storage

In view of the competitive market scenario, producers are making different varieties of cement to get an edge over others. This has resulted in need for a comprehensive storage system. Concentric or multi-section silos have already made in-roads in the industry to meet this requirement with relatively low investment.

8.2 Packing

Electronic rotary packers have already replaced old mechanical packers to provide customer with more-or-less 50 Kg. cement in a bag. Packing capacity has gone-up to 200 t/h with two discharge configuration.

To achieve loading of cement bags into trucks and wagons at such faster rates, truck and wagon loading machines in different designs, have been put to use in a big way.

8.3 Transportation

With the increasing cost on transportation, various means of transportation are being adopted.

Sea transportation of clinker and cement in bulk, is already being resorted to by some producers to gain the advantage in freight.

One project, employing bulk cement transportation by rail, is also under implementation in which cement from some of the major plants shall be moved in bulk, to Bombay and then supplied in bulk or in bag.

In future, it is expected that more and more producers shall adopt road bulk carriers for this purpose with mobile packing machines and ready mix concrete.

9. MATERIAL HANDLING

9.1 Bucket Elevator

Bucket elevators were the main equipment for elevating material, till late sixties. However, it was replaced by pneumatic systems in a big way in seventies as availability of bucket elevators on account of poor quality of chains, was quite low.

With more and more emphasis being laid on the power conservation, power intensive pneumatic systems are giving way to bucket elevators again, with availability of good quality chains. The saving in power consumption is around 60%.

9.2 Pipe Conveyor

Belt conveyor systems though easy to operate and maintain, need a lot of space and invariably leaves a trail of spillage dust all along the length. The new generation pipe conveyors though costly from initial investment point view, provide advantage in terms of space saving by negotiating bends/higher inclination and the cleaner environment.

10. FANS

In a cement plant, power consumption on fans is around one third of the total power requirement and hence design of fans is being continuously improved. The latest version of fans are able to give efficiency upto 85%.

Apart from fan efficiency, many a times, they need to be operated on different conditions and if a suitable speed variation device is not applied, there is a tremendous power loss. All such fans now hence, are provided with any one of the following speed variation devices:

- Slip recovery system

- Frequency variation
- DC motor
- Grid resistance controller

11. **PLANT AUTOMATION**

Level of plant automation is increasing with the increase in plant capacities. Automation plays a very vital role in plant operation and following features have become almost routine in all the major plants:

- Expert Control and Optimisation systems
- Refractory Management
- Energy Management
- More and more Process Control loops
- Management information system
- X-ray spectrometer.

12. **CONCLUSION**

Introduction of modern equipment in the cement industry have helped in improving the overall performance of the cement plants, which shall be evident from some of the performance figures given in the following para.

12.1 **Capacity Increase**

With advent of modern equipment, the plant sizes have gone-up from a level of 1.0 mio t/a capacity to a level of 2.5 mio t/a. Still bigger capacity plants are being conceived in the coastal areas.

12.2 **Energy Consumption**

The Heat consumption has improved from a level of 900 Kcal/kg clinker to 710 Kcal/Kg. In near future, it is further expected to improve to a level of 680 Kcal/kg.

The power consumption has improved from 140 Kwh/t to around 100 Kwh/t. With introduction of more energy efficient systems, it is likely to improve to 85 Kwh/t (OPC).

12.3 **Environmental Protection**

It is well known that till eighties, almost all cement plants used to be quite dusty and dirty. Pollution Control Norms were first introduced in 1982 and limit on dust pollution from stack was prescribed as 250 mgm/Nm³. The limit, over a period of 15 years, has been reduced to 100/150 mgm/Nm³. In near future, not only this limit may be reduced to 50 mgm/Nm³, PCB may also impose pollution control on waste gas composition.

Industry is well prepared to meet these requirements.