National Council for Cement and Building Materials

NCB FLYASH BRICKS

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NCB TECHNOLOGY DIGEST

NCB FLYASH BRICKS

THERMAL power stations using pulverised coal as fuel generate large quantities of ash as by-product. There are about 65 thermal power plants in India forming the major source of flyash in the country. Together, they produce about 27 MT (million tonnes) of ash per year. The figure is likely to go up to 70 MT per year by the year 2000, posing serious disposal and ecological problems in addition to occupying large tracts of useful and valuable land area. Realising the seriousness of issues, National Council for Cement and Building Materials (NCB) has been investigating the utilisation of flyash in the manufacture of building materials such as bricks, building blocks and roofing tiles in the construction industry. Out of these, the bricks manufacturing appears to be the most promising direction of utilisation.

TECHNOLOGY OF FLYASH BRICKS

Fired Flyash Bricks

In this process, flyash is used as one of the constituent in traditional clay brick manufacturing. This requires, depending upon the site of the brick plant, either flyash or clay to be transported and in both cases handling and transportation could cause problems associated with transportation of such materials. Secondly, the volume of ash that could be mixed with clay is limited to around 50% and hence utilisation is reduced to that extent.

Autoclaved Bricks

Autoclaved sand-lime bricks are produced in a number of countries notably in West Germany and some East European Countries and the same technology is used for the manufacture of flyash-lime autoclaved bricks. In this process, flyash and lime are mixed and required quantity of water is added to the mix. The bricks are moulded using hydraulic press and autoclaved at temperatures between 120° and 190° C. Though, autoclaving has a number of advantages, such as faster hardening, higher

strength and less drying shrinkage, the process requires larger investments.

NCB Flyash Bricks

At NCB, a different technology has been developed to produce good quality bricks. As autoclaving is avoided, this technology requires lower investment and less energy. The technology advocates establishing brick plants either at the power plant or adjacent to it, thereby minimising handling and transportation of flyash and making use of waste heat available from the power plants.

MANUFACTURING PROCESS OF NCB FLYASH BRICKS

The process of manufacture broadly consists of three operations : mixing, pressing and curing. A flow diagram of material for the manufacture of NCB flyash bricks is given in Fig. 1. The mixed material is pressed into shape in a semi-dry condition using mechanical presses and the pressed material is cured to gain the required strength. The strength of the product depends on the proportion of raw materials in the mix, efficiency in mixing, moulding pressure and curing conditions. As much as 80% of flyash has been used in this process.

Flyash used fulfilled the following requirement :

	Recommended limits	*Typical values of flyash samples*
Moisture content	8% max	—
Loss on ignition	12% max	4·3 — 15·8
SiO_2	35% max	49·2 — 55·6
Fe_2O_3		7·5 — 9·5
CaO		2·8 — 2·3
MgO	5% Max	0·98 — 0·60
Sulphur as SO_3		0·24 — 0·44

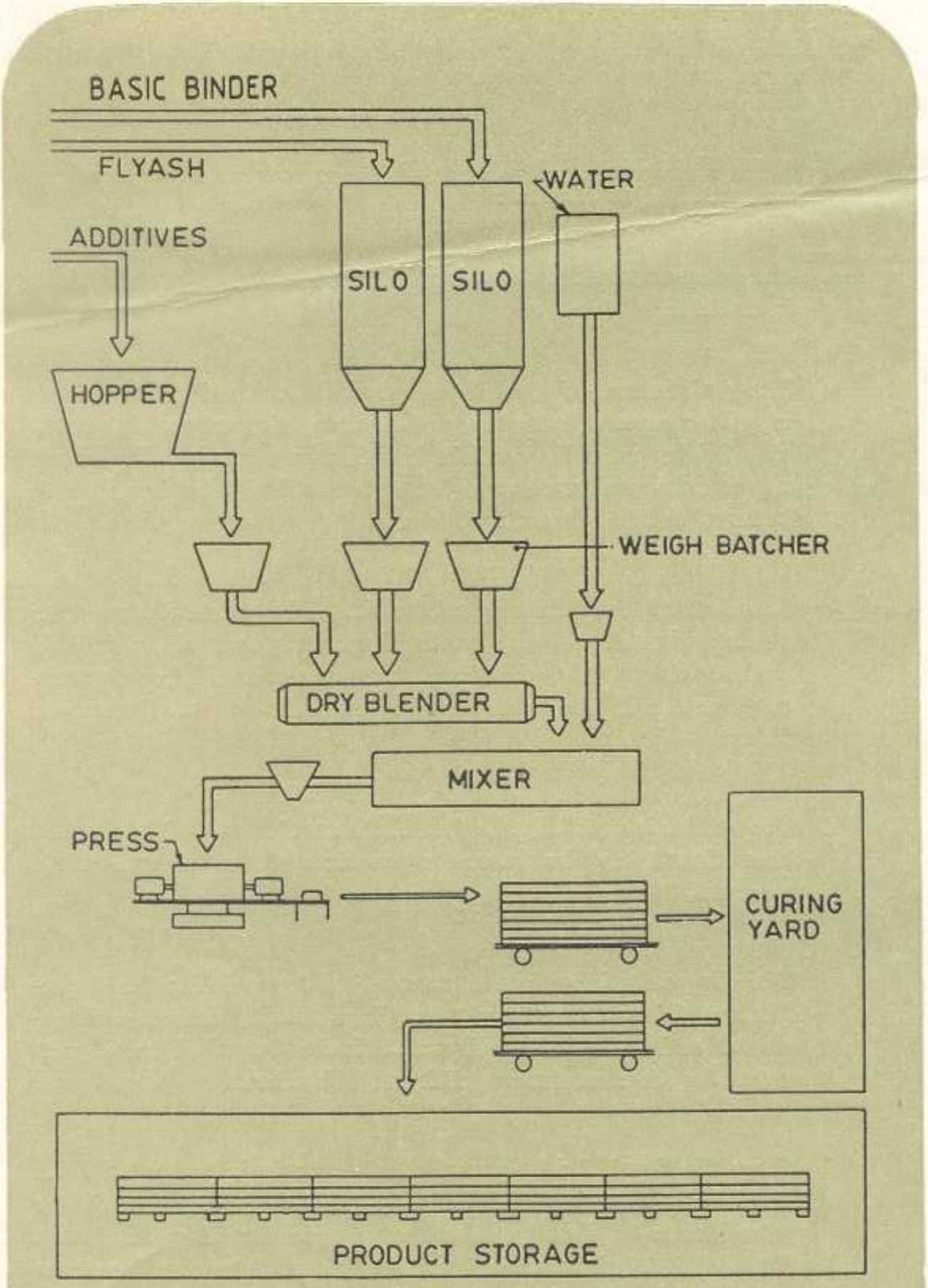

Fig. 1. Material Flow in Flyash Brick Plant

The NCB technology for manufacture of flyash bricks distinguishes itself by the following features :

i) Higher utilisation of flyash to the extent of 80%;

ii) No addition of soil as in the case of fired clay flyash bricks;

iii) Lower energy consumption; and

iv) Smooth external surface and better dimensional tolerances.

The NCB flyash bricks are comparable in strength and in other properties to the burnt clay bricks. Their comparative evaluation is given in the following table :

PROPERTY	FLYASH BRICKS	BURNT CLAY BRICKS
Compressive strength	100-140 kg/cm^2	35-120 kg/cm^2
Water absorption	15-20%	15% for bricks with compressive strength more than 150 kg/cm^2 20% for bricks with compressive strength less than 125 kg/cm^2
Durability	Good	Good
Efflorescence	Slight	Slight to moderate
Co-efficient of variation in compressive strength	5-10	5-15
Fire resistance	Good	Good

The prototype unit constructed using these bricks, is under observation in NCB Ballabgarh complex (photograph on cover page).

INDUSTRIALISATION OF FLYASH BRICKS TECHNOLOGY

The burnt clay brick is the most popular building material used in the construction industry. The current production is estimated as 60 billion bricks. Against this, the requirement of bricks to meet the construction targets including housing is much higher and the estimated figure is 90 billion in 1988.

Flyash bricks are promising alternative building bricks to burnt clay bricks and can replace the clay bricks particularly where the latter is costly or the quality of bricks is poor.

While the technology for manufacturing flyash bricks has been established to make this technology as economically feasible proposition for producing the bricks and marketing the same, it is necessary to consider the following techno-economic aspects :

1) The brick manufacturing plant should be located within or adjoining a thermal power plant to avoid double handling or transportation of flyash.

2) Surplus hot water/steam, if available in the thermal power house may be supplied to the brick plant for curing purposes.

3) The flyash may be supplied free of cost to the brick plant for reducing the cost of manufacture. If at all flyash is to be priced, it should be only very nominal.

4) Since the manufacture of flyash bricks is in many ways similar to the manufacture of other mechanised bricks, this should be completely exempted from excise duty to make them competitive and popular.

5) Since pollution control is a national problem, all possible support including subsidy, if required for establishing and marketing brick products be given.

CONCLUSIONS

The present status on the technology of manufacturing flyash bricks may be summarised as follows :

a) An indigenous technology for the manufacture of flyash bricks is available.

b) The performance of flyash bricks manufactured using this technology is comparable to the performance of good quality burnt clay bricks generally used in building construction. In certain aspects, the performance of flyash bricks has been found to be better than the burnt clay bricks.

c) The demand for bricks is substantially high particularly in the urban regions. The flyash bricks (if manufactured within 50 km) will help in off setting this demand. However, it will be economically feasible if the transportation is limited to a distance of 50 km.

d) The utilisation of flyash for the manufacture of bricks has been found to be more appropriate than other feasible avenues.

e) The disposal of flyash and removal of top soil for the manufacture of burnt clay bricks has been causing serious environmental and ecological problems. This can be solved to a great extent by the manufacture of flyash bricks, and

f) Since the flyash brick is a relatively new building material, all possible support including subsidy need to be given until the manufacture of flyash bricks becomes an established industry. The Delhi Administration has already agreed to give incentives to industrial units which undertake to use flyash to make bricks and other building materials.

NCB EXPERTISE

NCB, with its sophisticated infrastructure and advanced expertise in the field, renders assistance and advice in executing proposals for setting up flyash brick manufacturing plants.

Prepared by : Dr C Rajkumar, Dr S C Ahluwalia and Shri Rattan Lal

Edited by : Shri S S Kalra

For further enquiries, please write to :

Chairman & Director General
National Council for Cement and Building Materials
M 10 South Extension, Part II
New Delhi 110049 INDIA

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