Case Studies on Cleaner Brick Production

Case Study No.1

Production of Perforated Fired-Clay Bricks

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1 Introduction

1.1 Background

In several of the developing countries, fired-clay bricks are the prevalent building materials and are still produced through traditional technologies and practices. Some of these practices have adverse impacts on the environment. Various studies have established that improvements in technology and practices can reduce fuel consumption and pollutants emissions (including black carbon) significantly. Climate and Clean Air Coalition (CCAC) is a collective effort of governments of some of the countries along with United Nations Environment Programme (UNEP) towards mitigation of the impacts of short-lived climate pollutants and address the climate change. The CCAC Brick Production Initiative is aimed at substantial mitigation of emissions of black carbon and other pollutants from brick kilns through employing a range of technology and policy approaches. International Centre for Integrated Mountain Development (ICIMOD), is coordinating CCAC-BPI activities in South Asia.

The reduction in emissions can be achieved through shifting to efficient brick kiln technologies as well as through production of resource efficient products such as perforated/hollow bricks or flyash-clay bricks (utilizing flyash, an industrial waste, in brick making). The objective of these case studies is to showcase the examples of brick manufacturing enterprises who have adopted these measures to improve efficiency and reduce emissions. In this endeavour, case studies on four brick manufacturing enterprises operating in South Asia region have been developed. These case studies are focused on:

1. Production of perforated bricks;
2. Production of bricks through Natural Draft Zigzag Kiln;
3. Production of bricks through Hybrid Hoffman Kiln (HHK);
4. Utilisation of flyash in brick making.

This case study is focused on an enterprise producing perforated/hollow fired-clay bricks.

1.2 Introduction to perforated bricks

Perforated bricks are the bricks having holes passing through it. For the production of perforated bricks, a brick extrusion machine is required for the moulding of green bricks. The advantages of perforated bricks are:

- Reduced clay consumption
- Reduced energy consumption in firing of bricks
- Improved thermal insulation of the bricks
- Better surface finish and product quality because of machine moulding

Figure 1: Various types of perforated bricks

1.3 Brief description of the enterprise

Name of the company/enterprise	Prayag Clay Products Pvt. Ltd.
Location	Hariharpur, Varanasi, India
Name of the owner	Mr. O. P. Badlani
Type of products	Solid bricks, Perforated bricks
Type of kiln technology	Natural draft zigzag kiln
Operational season	~ 6 months
Total annual production	6-8 million bricks
Annual production of perforated bricks	2.5-3.0 million bricks
Producing perforated bricks since	2013[1]
Method of production of perforated bricks	Moulding through extrusion system; drying in shade and firing in natural draft zigzag kiln

[1] The enterprise has been producing perforated bricks for around 10 years, but the production of the perforated bricks at this site was started in 2013.

Rated production capacity of extrusion system	5,000 bricks per hour

2 Production process

The schematic of production process being practiced at the manufacturing plant of Prayag Clay Products is shown in the picture below:

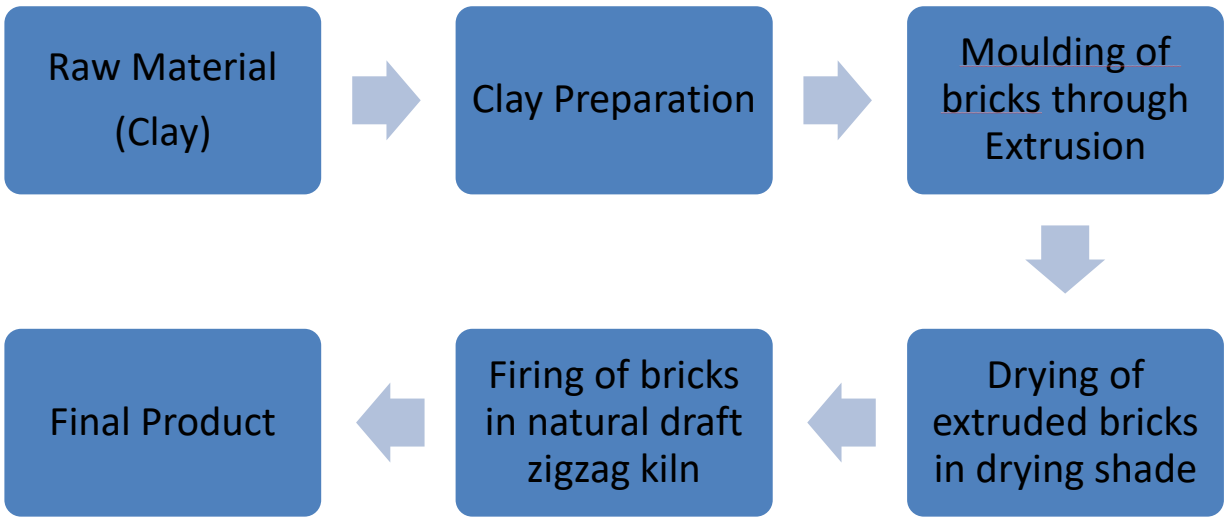
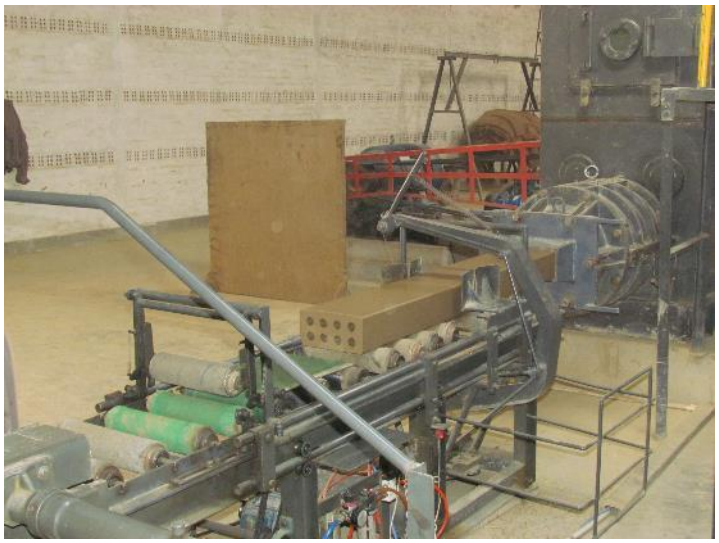


Figure 2: Schematic of production process at the manufacturing plant of Prayag Clay Products

For production of perforated bricks, extrusion system is required for moulding of the green bricks. The steps involved in the clay preparation and extrusion process being practiced at the manufacturing plant along with the photographs is described below:

Feeding of clay in box feeder: The clay is first fed into the box feeder from where it is transported to roller crusher through conveyors.	

The clay is then crushed in a double cylinder roller crusher	
After crushing, clay is transported through conveyor belt to the screw mixer where water is mixed with the clay.	
To get a proper homogeneous clay mix, the clay is again passed through a second mixer just before the extruder.	

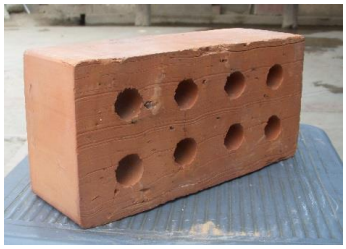
The clay mix is then fed into the vacuum extruder which produces perforated slab through extrusion.	
The extruded slab is wire-cut to get individual green bricks.	 

The moulded bricks are dried in the drying shade before loading these into the kiln for firing. The drying time varies with the weather conditions – 15-20 days in summer months while 30 or more days in winter months.	

Cost of the extrusion system:

The total cost incurred in setting up the extrusion system[2] is around USD 275,000 (INR 17 million). The cost includes the cost of machinery along with the control panel and DG set for power backup, and the cost of erecting the work shed and the drying shed.

3 Main Features and Benefits of the product (perforated brick)

Photograph of the product	
Size of the bricks	230 x 115 x 75 mm
Type of holes in perforated bricks	circular
No. of holes	8
Diameter of holes	25 mm
% perforation by volume	~ 15%
Weight of solid bricks	3.05 kg
Weight of perforated bricks	2.75 kg

[2] The clay preparation systems and the extruder was imported from China and hence the cost includes the customs duty. The control panel, DG system as well as gasifier were purchased from India.

% perforation by weight	~ 10 %
Reduction in clay consumption	~ 10 %
Reduction in fuel consumption in firing	~ 5% [3]
Other benefits	– Better thermal insulation properties as compared to solid bricks – Better finish and quality of bricks as compared to hand moulded bricks

4 Conclusions

- Perforated bricks have advantages over solid bricks in terms of reduced clay and fuel consumption and improved quality and thermal properties.

- The extruded bricks are being dried naturally in shade which takes longer time for drying (15-20 days in summers and more than 30 days in winters). As the area of the drying shade is limited, the plant utilization factor of the extrusion system is lower compared to its rated production capacity. Use of an artificial drying system will increase the utilization factor of the extrusion system.

- The market for perforated bricks is limited at present. Dedicated and sustained effort is needed to generate awareness among the users and develop the market for perforated bricks.

[3] The fuel saving is an estimate by the brick entrepreneur. The exact savings are not known, because both solid and perforated products are mixed and then fired in the kiln, which makes it difficult to calculate the exact fuel savings.