

# Construction and Working of a Pilot Smoke House for Small Estates

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## Introduction

Complete drying within 3 to 4 days with fuel economy and production of top grade sheets are possible on small estates with simple permanent smoke houses, a type of which has now stood the test for over a decade near Kothamangalam. The model built on the basis of plan given by the Board incorporating most of the improved features of large modern smoke houses is the first of its kind in India. A symposium in regard to its initial working published in 1954 elicited large number of enquiries<sup>1</sup> culminating in the construction of some 50 similar ones varying in minor details but following the general pattern. This development in south Indian estates is quoted by the Rubber Research Institute of Ceylon in its Journal<sup>2</sup>.

During 1953/60, parties seeking advice for the erection of smoke houses were taken at the Board's expense to the pilot smoke house for demonstration and for spot discussions of such alteration as deemed necessary to suit individual requirement. Sometimes masons also accompanied them. No plan as in the first case was furnished; demonstration proved more practical and effective than mere advice and supply of blue print of model not previously made or seen or tested.

The second model completed in 1953 near Nedumkunnam on the pattern of the

pilot type relates to modification of an old double-storey smoke house and fitting the improved furnace which reduced the smoking period from 7 to 4 days, apart from other advantages. The third was made in 1954 at Vazhoor, the fourth in Ernad taluk, Kozhikode, the fifth and sixth in Ernakulam district, the seventh in Thodupuzha taluk, the eighth near Trivandrum and the next three in Changanacherry taluk followed by others. The size of the smallest one is only 160 cubic feet.

In all the small smoke houses built by the co-operative societies under the Rubber Board's subsidy scheme from 1963, identical furnace as used in the pilot smoke house is invariably incorporated. The representatives of the Cheruvally Rubber Karshaka Co-operative Society who initiated the first smoke house under the subsidy scheme had also been taken to the pilot smoke house to get them acquainted with the construction of the improved furnace and other features. This paper is intended to describe the evolution of the pilot smoke house and experience gained in the working of similar ones made since 1952.

## History

In the construction of smoke house, the main advances made during the last 25 years other than oil fired drying are:



- (a) Reduction of handling of sheets to the minimum by improved layout of the factory and providing mechanical aids for moving sheets.
- (b) Use of cheaper building materials and lighter construction.
- (c) Dispensing with the entire ground floor solely constructed for stoking and consequent saving in the cost of building double storeys.
- (d) Improved outside furnace which preheats the air entering into the smoke house and improved ventilators enabling smoking to be completed within  $3\frac{1}{2}$  to  $4\frac{1}{2}$  days.
- (e) Improved internal drainage for serum.

Massive structures once considered essential to eliminate fire risk are unnecessary as they need high temperature to heat up especially during monsoon. Further, fire outbreak may be caused by the accumulation of inflammable gas coupled with careless firing and not necessarily due to cheaper and lighter construction.

One of the permanent and large models recommended in Malaya is the Tunnel Smoke House developed by the Rubber Research Institute.<sup>3</sup> Smoking in the smallest one designed to deal with about 1000 lb. dry rubber daily (about 4000 lb. when full) is completed within  $3\frac{1}{2}$  to  $4\frac{1}{2}$  days.

Neither of the two RRIM type large smoke houses built in India during the pre-war period from blueprints obtained from Malaya is provided with the main improved features including the modified furnace possibly due to oversight or mistake. Details of cost and working of a standard

RRIM A model, true to type—the only one known to exist—constructed in 1955 in accordance with the assistance rendered by the Board will be furnished in a separate paper.

#### **Standard models for small estates**

Model smoke houses suggested for holdings and small estates in Malaya and Ceylon in pre-war period comprise two categories:

- (a) Temporary ones of bamboo and sacking treated with starch etc., or the so called "wattle and daub" types;<sup>4</sup>
- (b) Double storey permanent smoke houses<sup>2</sup>

Further development of small smoke house or pattern is not recorded after the war.

Temporary smoke houses are not viewed with favour in India and so far known none has been erected. Permanent ones can be either single or double storeyed with inside or external furnace and not in conformity with any standard pattern which hardly exists.

#### **Improved models for small estates**

Mechanical aids which form one of the improved features of approved large smoke houses are obviously superfluous for small smoke house but the other features could profitably be utilised. But though the RRIM type smoke house was designed some 26 years ago, the preheating device connected with the improved furnace and other beneficial features are not recorded to have been adopted in the construction of small smoke houses in Malaya nor in Ceylon.



In 1952 Shri K. Thomas, Manager of Mangalam Estate sought advice for the construction of a small smoke house suitable for some 100 acres. A plan incorporating all the practical features mentioned was furnished to him with due warning on the risk involved in the construction of untested model. The details of the Pilot Smoke House thus originated are summarised here-under :

Size	10×10× 0 ft.
Capacity	About 700 to 800 sheets when full weighing 1¼ to 1½ lb each
Drying time	3 to 4 days even without dripping and 4 to 5 days during monsoon. Inside temperature ranges from 120 to 140°F. The Board's Thermostat which records automatic weekly temperature ranges in chart was supplied for verification.
Floor	Concrete, sloping from the centre towards the sides so that serum dripped from the sheet can drain off easily through outlets provided.
Wall	Laterite in lime mortar.
Roof	Tiles over wooden conical ceiling.
Window	A window provided to facilitate the inspection of sheet.
Chimney	A small cheap but efficient chimney made on wooden frame with asbestos is provided through the ceiling.
Fuel	Fuel economy is an important consideration as firewood becoming scarce and costly. When the smoke house loaded fully, the quantity of firewood required works out to slightly

less than a pound for curing one pound of dry rubber.

#### Furnace

The furnace used is a second hand 44 gallon drum enclosed by a cavity comprising—

- (a) Two side walls made of bricks 9".
- (b) Reinforced concrete top comprising of two removable slabs provided with rings for lifting and inspection when necessary. The inner adjoining sides of the slabs are grooved to fit to each other without setting.
- (c) The face plate of ¼" bolted on to the walls and to which the fire door to the drum is fitted. The drum rests on the floor of the outer structure but clear of the walls and top by 4" the least.

The air space between the drum and the outer case is ventilated by two air inlets one at each side of the door. During smoking, the air between the drum and outer structure becomes heated and passes into the drum through the air inlets provided at each side of the back of the drum. The hot air mixing with the smoke in the drum enters the flue and finally into the smoke house. Vertical iron rods fixed inside the drum about one foot from the rear serve as fire stops to prevent fire-wood from being pushed into the flue and choking it.

Air inlet into the furnace is provided through horizontal cutting made on the door.

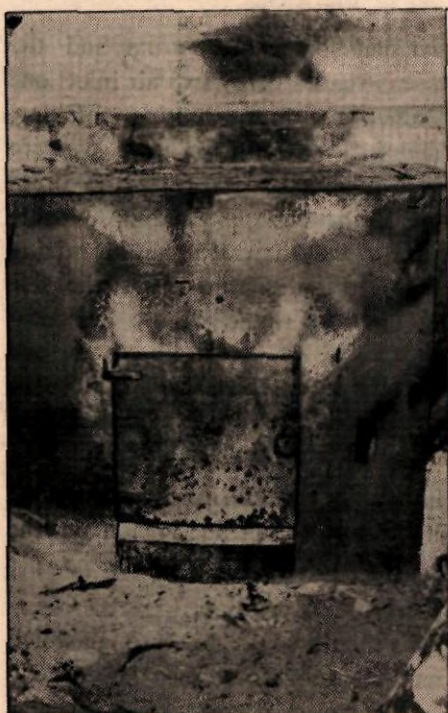
#### Distribution of smoke,

Over the mouth of the flue through which smoke and warm air enter into the smoke

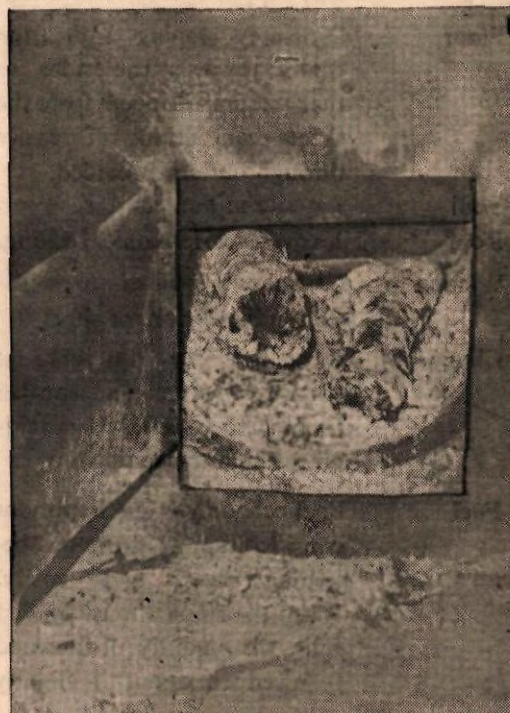




The roofing of the smoke house with the Chimney. (The smoke house is built in the corner of two wings constituting store, coagulating and machining shed and office).



Front view of the furnace with the door closed.



Same as in picture on left, but door opened showing smoldering logs.

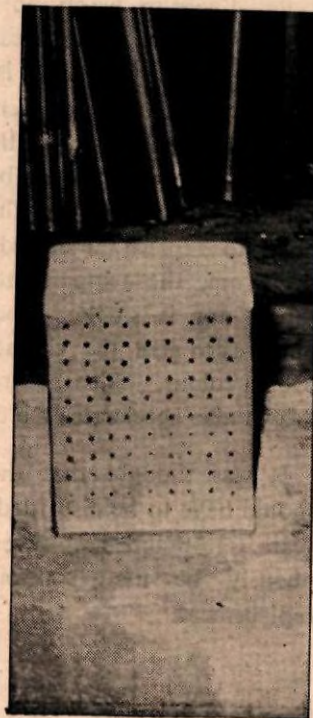




Interior of the smoke house showing rack arrangement.



The outer top casing without cracking even after use for over 12 years.



Interior showing the distribution of smoke and hot air through perforated kerosene tin inverted over the mouth of the flue.



house, a kerosene tin with perforated holes is inverted so as to prevent the sparks, if any, entering in and for spreading the smoke throughout the smoke house.

### Advantages

External furnace when provided is generally built at a side adjoining the wall of the smoke house. The furnace is mostly of brick or concrete or of metal plate with brick or concrete lining surrounding it on the mistaken notion for minimising the loss of heat radiated to the outside air. But such furnace takes a long time and high temperature to heat up during which the smoke produced may be burnt out in which case rubber sheets tend to become pale apart from the consumption of large quantity of firewood.

In furnace built of drum or of thin metal plate surrounded by an outer case, the heat radiated goes to warm up the air around the drum within the outer case and a continuous current of hot air is drawn into it through air inlets and then to the smoke house after mixing with the smoke in the drum. As cool air enters between the drum and the outer structure through ventilator holes to replace the heated air entering into the drum, the temperature is not unduly raised nor is smoke produced burnt out but goes to give the characteristic medium brown colour. The current of hot air drawn also accelerates the drying.

It was thought that the original drum should have to be discarded after one or two years. In practice, however, it could continuously be used for eight years before replacement.

The pilot smoke house built 12 years ago still remains outstanding in respect of the quality of sheet obtained and efficiency of its working and can be confidently recommended for small estates with a daily production ranging from 50 to 200 normal sheets. However, defects observed in those made in imitation to it but without incorporating and understanding *all its features* are accounted for to prevent avoidable failures.

(a) Large increase in the size of smoke house but without corresponding enlargement of the furnace may not be advisable unless fully tested. The size of furnace need not necessarily bear a fixed proportion to that of the smoke house owing to variable other factors. For the size of the smoke house built, 44 gallon drum is entirely adequate and even appears to be on the higher side, but larger types may need bigger furnaces and *vice versa*. In a smaller model furnace made out of second hand paint drum is successfully used.

A furnace of exactly the same type and measurements is embodied in the smoke house made in 1963 by the Cheruvally Rubber Karshaka Co-operative Society, the dimensions of which however, being  $18 \times 12 \times 12$  ft. against  $10 \times 10 \times 10$  ft. in the pilot smoke house. In another co-operative smoke house of the same size, larger furnace is provided. When they are worked fully loaded, valuable information will be available as to the maximum capacity to which the size can profitably be extended without impairing the efficiency and economy in fuel consumption when the standard 44 gallon drum along with preheating device is utilised as furnace.



(b) Construction of similar models but without suitable chimney has not been entirely successful.

(c) Negligence of providing sufficient air inlets on the door of the furnace at the correct height has been another cause for unsatisfactory working in some cases. The correct height is influenced by the actual size of the smoke house, furnace, chimney etc., and can be easily adjusted after some trials.

(d) The top outer casing enclosing the furnace when made with a single block of reinforced concrete tends to crack even after a year. In the pilot model, two removable slabs in reinforced concrete are inlaid side by side over the vertical brick walls. This seems to have prevented cracking even after 12 years without using expensive fire bricks and clays.

(e) Smoke house can only cure sheets. If sheets are carelessly and unsatisfactorily processed and machined, efficient smoking cannot result in the production of top grade rubber.

#### Acknowledgment

The original tunnel smoke house for large estates was developed by Mr. J. H. Piddlesden

alias J. H. Pidford, Chemical Engineer, formerly of the Rubber Research Institute of Malaya under whom I had the privilege to work in his experiments. I acknowledge my indebtedness to him.

I am also obliged to Dr. K. T. Jacob, Director of Rubber Research Institute of India and Shri T. Nambi Nair, Development Officer, Rubber Board for suggestions in the preparation of this paper.

#### References

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