



## A USER-FRIENDLY SMOKE HOUSE

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A user-friendly and fuel-efficient smoke house with new design features and low cost of construction per kilogram of capacity is described. The design features include a long inclined narrow duct like furnace, placed inside the smoke chamber, and a long inclined helical flue which ensure high fuel efficiency without compromising on safety. An easy to operate variable roof ventilator provides sufficient vent to release all the moisture and thick smoke during the initial burning and allows reduced outflow of air in later stage. This not only minimizes heat loss but avoids carbon deposit and tar dripping also. The water drainage facility provided in the smoke chamber allows loading wet sheets directly inside it without waiting for dripping and initial drying in open air. In addition, the new design feature allows loading and removal of sheets from the chamber without entering it. Thus wet sheets can be completely dried in three days. The cost of construction per kilogram of capacity is only Rs. 90 while that of conventional and other ready made smoke houses ranges from Rs. 120 - 150.

### INTRODUCTION

The rubber plantation industry that started in 1902 at Thattekadu, Kothamangalam, has spread over the country. It covers a total extent of 563000 Ha. India is the third highest natural rubber producer with the highest average productivity. The rubber plantations, started by Europeans as large estates, later adopted by natives, has now become the most popular and successful cash crop of small and marginal growers in Kerala and they contribute 90 percent of the total output. The small and marginal growers sector is highly vulnerable to fluctuations in the market. A survey conducted by M/s Vembanadu Rubbers and Periyar Latex reveals that small growers are getting a price which is at least 96 paise less than the market price published in dailies and in certain areas the gap widens to Rs.2/50 to Rs.4/-. the reason for which is attributable to the lower quality of the sheet rubber produced.

As a result of globalization, rubber

growers also have to face global competition in the market. In contrary to other major rubber producing countries where TSR is the major form of natural rubber marketed, 72% of the Indian natural rubber is marketed as sheet rubber. It is presumed that even after another decade the share of sheet rubber in India is likely to be around 50% or more. Therefore, quality improvement of sheet rubber is the task of today.

As far as sheet rubber is concerned smoke house plays an important role in the quality of the product. The requirements of a good smoke house are (1) minimum drying time, (2) minimum number of defective sheets, (3) easy loading/unloading of sheets, (4) minimum labour requirement, (5) maintenance of temperature in the range of 40-60°C. (6) continuous operation, (7) good ventilation, (8) minimum heat loss, (9) maximum fuel efficiency and (10) minimum cost of construction (Kuriakose and Thomas, 2000). Considering the importance



of smoke house, many modified designs have been introduced during the last fifteen years. All the modified designs have achieved many of the above requirements and eliminated drawbacks such as tar dripping. However, the cost of construction has always remained on a higher level. Therefore, a smoke house design with fuel efficiency, fast drying, easy loading/unloading facility coupled with cost efficiency, draws much attention. Among the various designs of small smoke houses, the cost of construction of conventional 85 kg smoke house has been comparatively low but presently it has gone up to Rs.12500/- costing at least Rs.147/- per kg of capacity, whereas the new design having 165 kg capacity costs

only Rs.90/kg capacity (Table 1). Many of the readymade types are far more expensive.

## EVALUATION OF OTHER REQUIREMENTS

### Easy loading / unloading of sheets

The new design is user friendly compared to conventional smokehouses (Table 2). The materials used for the construction of the smoke house is given in Table 3. Sheets can be taken in and out of the smoke house from outside, without entering the smoke chamber.

### Minimum drying time

Sheets, weighing 700-750 gram take only three days for drying whereas in a

Table 1. Cost of construction per kg of capacity

Type of smoke house	Cost per kg of capacity
Conventional 85 kg smoke house	Rs.150/-
Ready made types	Rs.138/- to Rs.360/-
Smoke houses with a capacity of 1000 kg and above	Rs.110/-
Furnace inside smoke chamber types	Rs. 120/- to Rs.200/-
The new design	Rs. 90/-

Table 2. User-friendly features

Type of smoke house	Easy loading/unloading of sheets from outside	Condensation of moisture inside smoke chamber when wet sheets are loaded
Conventional 85 kg type	Not possible	Not eliminated
Ready made type	Possible	Not fully eliminated
Smoke houses with capacity of 1000 kg and above	Not possible	Not fully eliminated
The new design	Possible	Fully eliminated

Table 3. Materials used

Part of smoke house	Materials used	Cost (Rs.)
Furnace	Fire bricks	12,000/-
Furnace top and flue top	Concrete slabs	
Flue wall	4" concrete hollow block	
Serum collecting tray	Aluminium	
Smoke chamber wall	6" concrete hollow block	
Door, door panel and ceiling	Wood	
Roof	Asbestos cement sheet	
	Labour charges	3000/-
Total		15,000/-



conventional smoke house it takes usually four days for drying. When the weight of the sheet is reduced, proportional reduction in drying time is also noticed.

As the construction material used is concrete hollow block the smoke house is ready to use within a week after construction which is much faster than conventional types (Table 4)

**Table 4. Time required for initial drying of smoke house structure**

Type of smoke house	Time required for initial drying after construction
Conventional construction type	1 to 2 months
Ready made type	Ready to use
The new design	1 week

#### **Minimum number of defective sheets**

Defects related to the smoke house such as reaper marks, blisters, tar drops etc. are not noticed on the sheets dried in the newly designed smoke house.

#### **Fuel efficiency**

The furnace is pushed inside the smoke chamber. Furnace walls are separated from smoke chamber wall by air space, which prevents any heat loss by conduction and radiation. The concrete slabs and stones / rubbles above it absorb a good quantity of heat generated by burning of firewood, and later released slowly into the smoke chamber itself. Heat retaining furnace and hollow brick smoke chamber wall with insulating air columns help to retain temperature for longer periods. The long inclined narrow duct like

furnace which can accommodate 3.5 feet long pieces of wood, ensures slow but complete burning and the space restriction averts accidental overloading and consequent over heating. The inclined helical flue with rough walls ensures sufficient filtering of smoke, thus prevents ash, and sparks entering the smoke chamber. Thus, fuel efficiency is achieved without compromising safety. (length of the flue itself is 10 ft). The long flue with permeable sidewalls also ensures an even distribution of heat in the smoke chamber. Thus the sheets could be dried in 3 days with 300-500 g of firewood per kg of sheet dried (Table 5). Aluminum tray placed above the flue opening scatters the hot air and smoke released from the furnace, avoiding blister formation on sheets in the bottom row. There is also provision for using biogas for drying.

#### **SPECIAL FEATURES OF THE NEW DESIGN**

##### **Variable ventilator**

The unique design of the roof ventilator allows adjustment of the outlet of moisture and smoke. More moisture and thick smoke are produced in the initial stage of burning firewood and free flow out of the smoke chamber is desired at this time to avoid carbon deposit (blackening) and tar dripping. In conventional types, smoke chamber door is kept open in the initial stage of burning to allow the heavy smoke to escape, which results in the undesired spreading of smoke into the surroundings. In the new design fitted with a variable roof ventilator, which is simple inexpensive and easy to operate, provides sufficient vent to release all the moisture and

**Table 5: Fuel efficiency**

Type of smoke house	Firewood required for drying 1 kg of sheet
Conventional 85 kg smoke house	1 kg
Ready made types	500 grams
Smoke house with a capacity of 1000 kg and above	750 grams to 1 kg
Furnace inside smoke chamber types	200 to 500 grams
The new design	300 to 500 grams





Table 6. Sheet quality

Type of smoke house	Reaper marks	Blisters	Rust	Colour of sheets	Grade
Conventional 85 kg smoke house	40%	Nil	20%	Brown/black	RSS 3 & RSS 4
Ready made types	5%	Nil	20%	Brown	RSS 4
Smoke houses with a capacity of 1000 kg and above	5%	5%	5%	Yellow to brown	RSS 1X to RSS 4
Furnace inside smoke chamber types	10%	20%	20%	Brown to black	RSS 2 to RSS 4
The new design	5%	Nil	Nil	Yellow to brown	RSS 1X to RSS 4

thick smoke produced in the initial burning and allows to reduce outflow in later stage to minimize heat loss. No other design has such a variable roof ventilator.

#### Provision for loading wet sheets

To ensure high quality, sheets have to be protected from sun and rain while kept for dripping. In the new design, wet sheets can directly be placed inside the smoke chamber without waiting for dripping and the dripped serum is drained out through the aluminium tray in the bottom without causing high humidity in the smoke chamber. This feature of the new design has the following advantages.

- As sheets are never exposed to sunlight, oxidation by UV radiation is prevented.
- Space for dripping is saved.
- Saving of labour cost
- By placing the sheets directly inside the smoke chamber, considerable labour is saved.
- Improved quality of sheets
- Small growers usually leave wet sheets in the open air for dripping. During rainy season microbial growth occurs within a day and this causes rust formation, which cannot

be rectified by smoke drying or washing. In the new design since the wet sheets are directly placed on the smoke chamber, chances for mould growth and rust formation are eliminated. In addition, chances for pilferage are also reduced

#### Provision for fitting additional safety device

The vertically sliding furnace door can be attached to a safety valve fixed inside the smoke chamber which drips at 65°C cutting off air supply and thereby preventing any further burning of firewood.

The quality of the sheets produced compared with that dried in other smoke houses is given in Table 6. High quality sheets (RSS 4 to RSS 1) could be made without blisters, rust and reaper marks.

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