

NÜRNBERG MESSE



# FRUCTORIBE

## A SMALL SCALE RIPENING CHAMBER FOR RETAIL AND CONSUMER APPLICATIONS

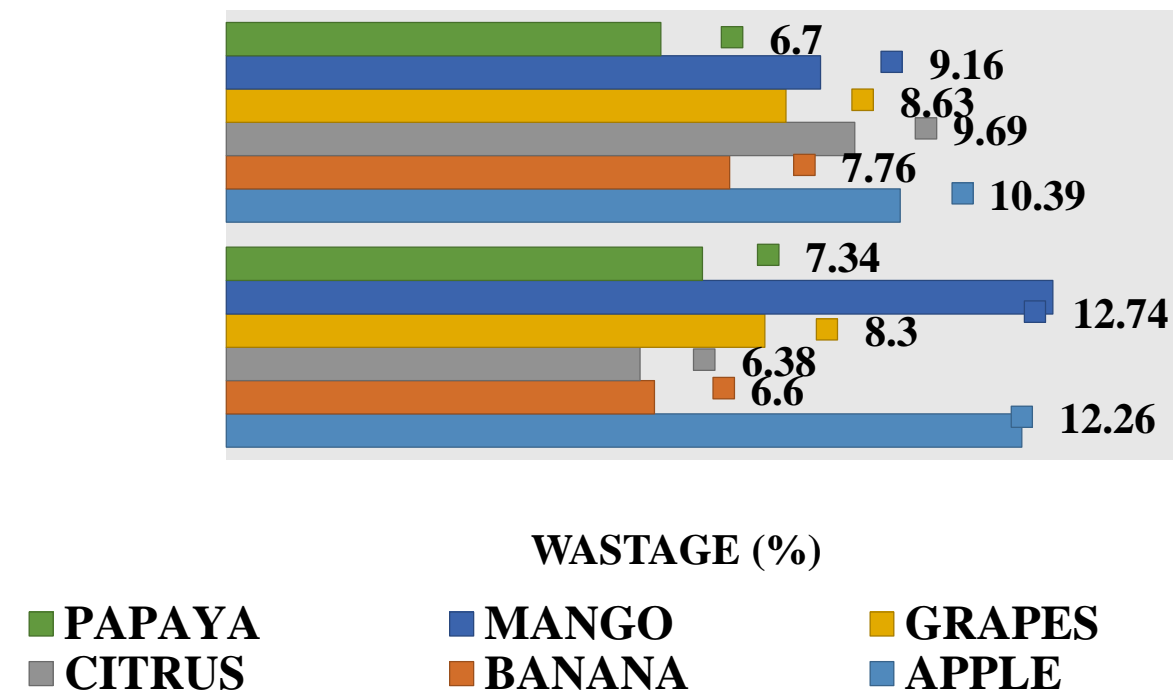
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### INTRODUCTION

The fruit ripening process currently followed in India is not as per the standards laid down by **National Horticulture Board (NHB) Guidelines**. Most of the supply chains still use Calcium Carbide for ripening of fruits as it is economical. **The Food Safety (Prohibition and Restriction in Sale) Regulations 2011 bans sale of fruits ripened by calcium carbide or acetylene gas. Calcium carbide contains arsenic and phosphorus, and can prove fatal for human beings. It can cause diseases like cancer, abdominal dysfunction, etc. 18% of the fruits and vegetables produced by India which are valued at nearly Rs. 13,300 crore get wasted annually, as per a data from the Central Institute of Post-Harvest Engineering and Technology (CIPHET). This is an alarming amount of loss for any developing country.** So, an alternate solution to deal with the above stated problems is being suggested.

### HARVEST AND POST-HARVEST LOSSES OF FRUITS (IN %) DURING TWO EVALUATION SESSIONS



### METHODOLOGY

#### Design of the Ripening Chamber:

Volume of the chamber is of the size of microwave oven ( internal 30 cm \* 40 cm \* 40 cm) and can easily contain 8 kg of mangoes or equivalent amount of other fruit by volume.

#### The inside conditions required for perfect ripening are:

##### For Banana Ripening:

- Optimum ripening Temperature = 15-18 °C
- Indoor Relative Humidity = 85-95%
- Ethylene concentration = 100-150 ppm
- CO<sub>2</sub> Concentration = less than 1%.

##### For Mango Ripening:

- Optimum ripening Temperature = 20-22 °C
- Indoor Relative Humidity = 85-95%
- Ethylene concentration = 100-150 ppm
- CO<sub>2</sub> Concentration = less than 1%.

#### Ambient conditions:

Outdoor Temperature = 40 °C (For maximum heat load)

Outdoor Relative Humidity = 60 – 80 %.

#### Cooling system:

Vapor Compression Refrigeration is to be used in this device. 24 V DC Rotary compressor with refrigerant R134a is proposed. Its benefits for a small scale device are limitless. **Some of the benefits include:**

- Silent operation
- Compact and lightweight
- High reliability
- Precise temperature stability
- Reduced power consumption
- Low DC voltage designs

Perfect for temperature calibration in precision detection systems.

#### Heat Load Generation due to ripening of the fruit:

Temperature of Ripening(°C)	Heat Generation Rate (in kcal/metric ton/day)	Heat Generation Rate (in W/kg)	Total Heat Generation Rate (in W considering 8 kg mangoes)
15	8221.14	0.398	3.184
20	9009.34	0.436	3.488
25	9287.19	0.450	3.600
Ambient	10745.55	0.520	4.160

#### Power consumption Calculations and Solar Power Requirements:

- Average power consumption of Refrigeration unit = 250W
- Fans = 0.3 amp at 12 V. All fans will account to a max. current of 1 Amp and hence a power consumption of 12W.
- Pump = 1.7 Amp at 12 V. Hence, power = 20 W
- Microprocessor = 0.1 Amp at 12 V. Hence power = 1.2 W.
- **Total average power consumption at full load = 285 W.**
- **Therefore, battery and solar panel specifications chosen are 300W.**

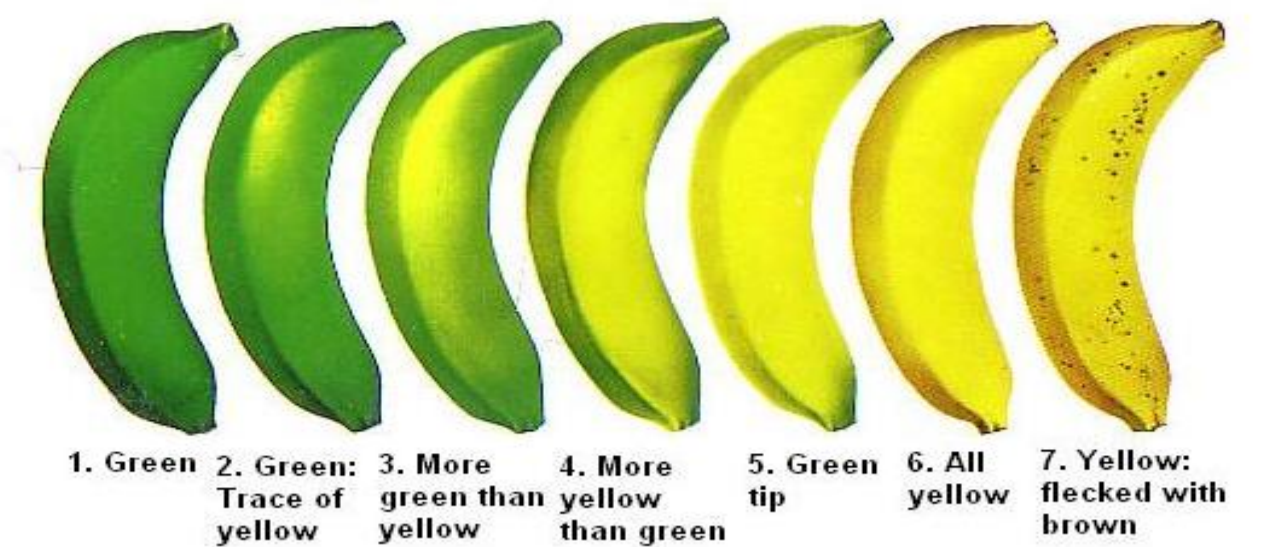
#### Sensors Required:

- Digital Humidity and Temperature Sensor: DHT -11,DHT -22
- ESP8206 mode MCU (WIFI module)
- Arduino Uno & LM 35 Temperature sensor.

Data as per National Horticulture Board(NHB) guidelines

Pulp Temperatures °F

Day	1	2	3	4	5	6
4 Day Schedule	64°	64°	62°	60°		
5 Day Schedule	62°	62°	62°	62°	60°	
6 Day Schedule	62°	62°	60°	60°	60°	58°



### BILL OF MATERIALS:

SNO.	PRODUCT	QUANTITY	COST
1	Fabrication	1	960
2	Humidifier Setup	1	1800
3	Refrigeration Setup	1	5000
4	Ethylene Cans	1	200
5	Solar Panel & Battery	1 set	21000
6	Power Supply Module	1	5500
7	Sensors, LED Display	As reqd.	1500
<b>TOTAL(for 1 prototype)</b>			<b>35960</b>

### BUSINESS OPPORTUNITIES & POTENTIAL USERS:

#### ✓Retail:

- Fruit vendors and commercial supply chains to promote themselves as more health conscious and hygienic.
- For extended storage of fruits and vegetable if they are not sold on the same day.
- A wide range of temperature, humidity & ethylene settings available for ripening different fruits.

#### ✓Rural Users:

- Farmers can use it for selling ripened fruits in their locality as it can operate on solar power in remote villages where electricity is not abundant.

#### ✓Urban Users:

- People living in cities or towns can use it for consuming safe, reliable and quality fruit at lower cost.
- Varieties of fruits from far off regions can also be consumed as they can be transported unripe and ripened at the consumer/retail end.

#### ✓Consumer:

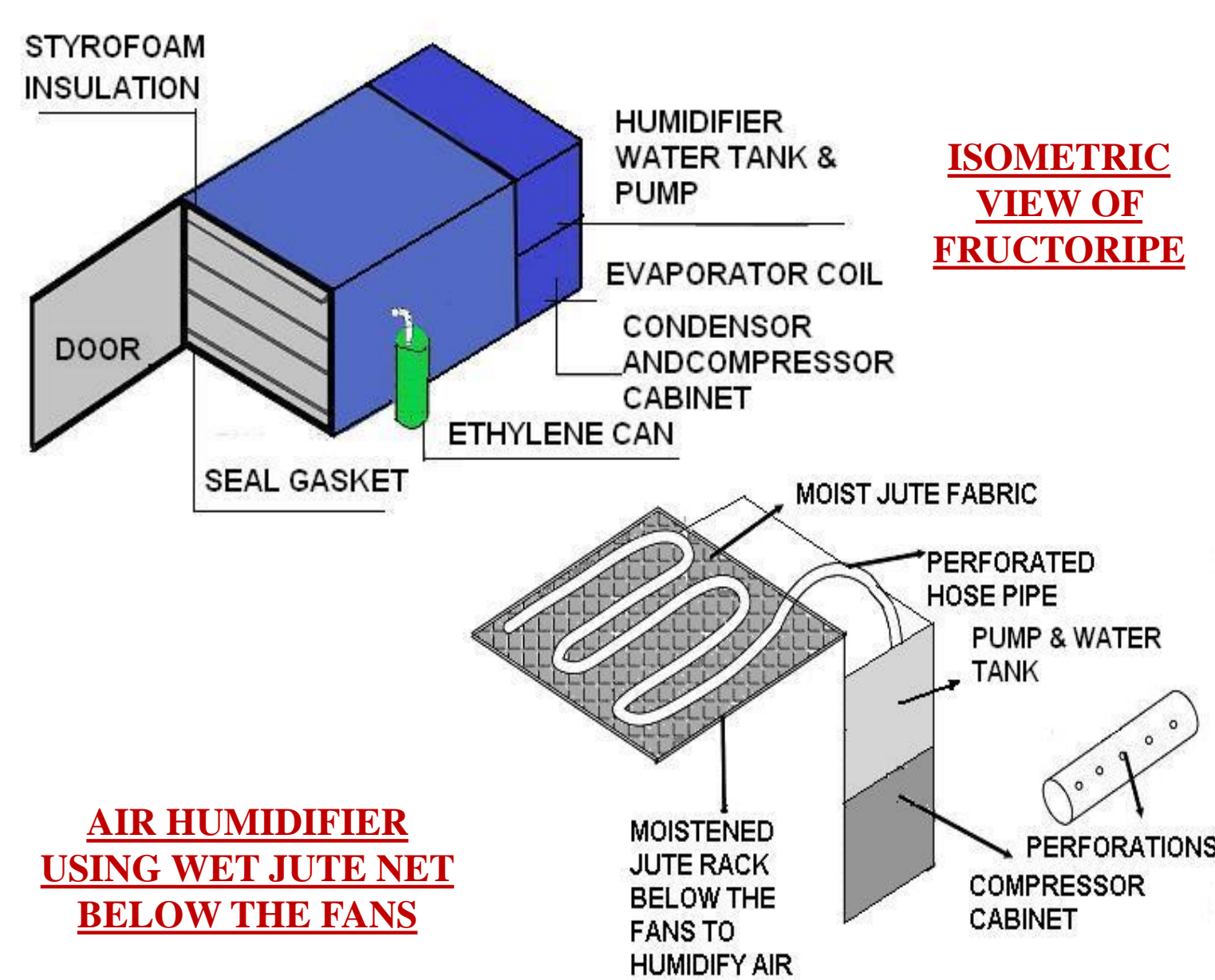
- It can be operated with car battery, so its suitable for travel and for outdoor uses.
- Due to its compact size, it can be put in transportation vehicles so that fruits can be ripened on the way while being transported from source to consumers.

### ABSTRACT

This poster aims at deploying portable fruit ripening chambers at retail & consumer level which can be powered by solar panels as well as electric mains supply. This shall reduce the wastage of fruits as unripe fruits will be transported to the markets and the consumers will ripen the fruits by themselves with the use of these portable ripening chambers as and when they require. Moreover, Ethylene gas based ripening will ensure healthy fruit characterizing great natural taste, color and freshness. The ripening chamber is chosen to be compact to fit in homes of the rural and urban population, with Vapor Compression Refrigeration Technology making it easier to run on solar energy. The complete mechanism of temperature control, humidity control and ethylene concentration are to be monitored using sensors and automated by the use of micro controllers as per the prescribed ripening data obtained from National Horticulture Board (NHB) Guidelines.

### OBJECTIVES

- To develop a small scale Ripening Chamber for consumer and retail usage.
- Eliminate the use of Calcium Carbide for fruit ripening and promote Ethylene based ripening.
- Control and monitor humidity, CO<sub>2</sub> concentration, ethylene concentration and temperature for achieving perfect ripening.
- To reduce power consumption from main supply by employing solar power based device.
- Development of a smart device which can be automated by the use of various sensors and a microcontroller to control the inside environment for maintaining perfect ripening conditions.



### INNOVATIONS:

- This concept in itself is an innovation as it is first of its kind to come into existence.
- It can be used as a cold store by closing ethylene valve for extending shelf life of fruits thereby reducing wastage.
- Smart monitoring of temperature, humidity & ethylene levels inside the chamber using ARDUINO.
- Automatic Switch On/Off of refrigerating system by the use of temperature sensors, thereby conserving energy.
- GPRS & WiFi module in association with Arduino for user-friendly Mobile App Based Control.
- Emergency cutoff switch to stop power supply in case of fire hazards automatically with real time alerts on mobile app.

### REFERENCES

- National Horticulture Board (NHB: CS4 2011)guidelines.
- Respiration behaviour and heat of respiration of mango (cv. Langdo) under different storage conditions BB. Patel, F.S Roy and D.C.Joshi(Citation: IJAEB: 9(5): 855-859, October 2016)
- Food Safety and Standards Authority of India (FSSAI) website & Central Institute of Post Harvest Engineering & Technology(ICAR-CIPHET) reports.