

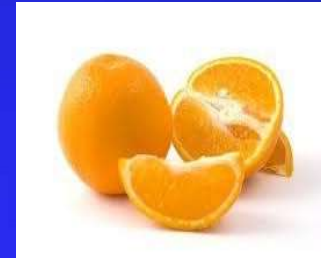
# Fruit Ripening Rooms



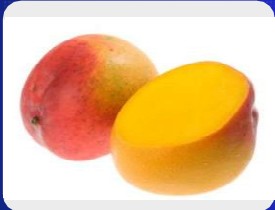
**Banana**



**Papaya**



**Oranges**



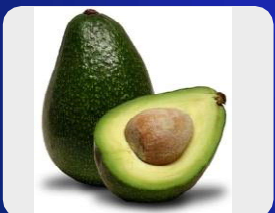
**Mangoes**



**Guavas**



**Tomatoes**



**Avocados**



**Melons**



**Reddening of  
Chilies**

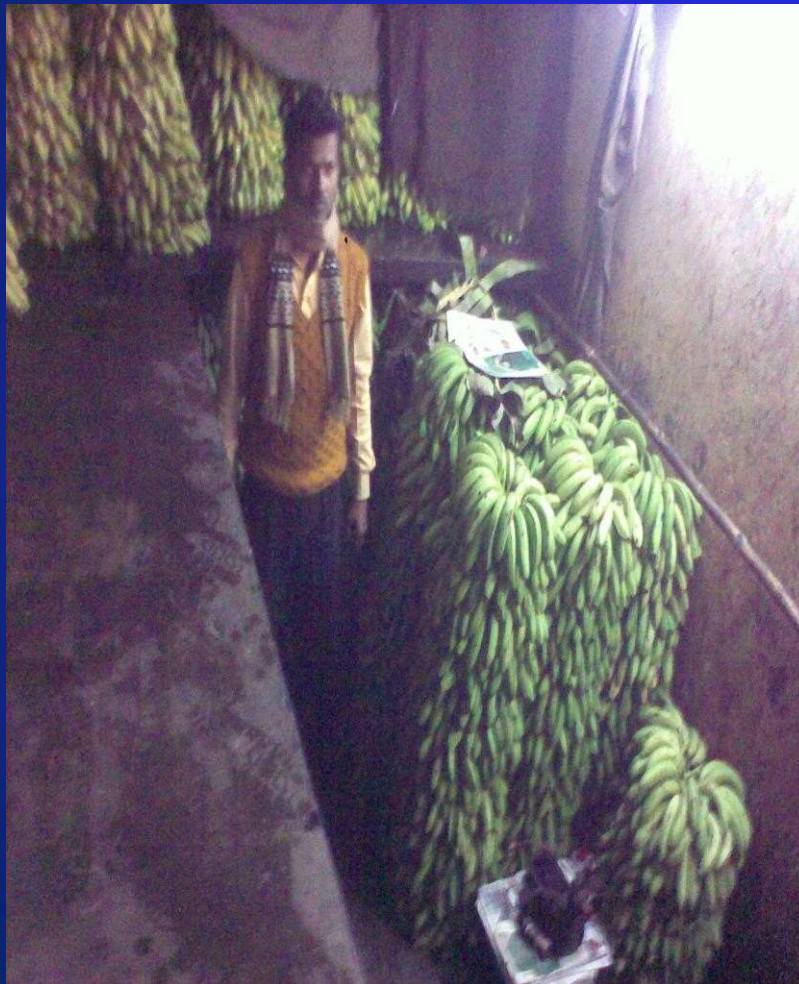
**Ripening of these and many other fruits....**

# Quality of Fruits





# Ripening Practice



# Introduction



- There are different kinds of ripening rooms all around the world.
- Generally ripening only happens for fruits like Mangoes, Papayas, Pears, Apricots, Guava as, Citrus, Melons and Reddening of Tomatoes, green Chilies.
- There are different kinds of ripening rooms which are used globally and they are as follows:-
  - ❖ LOCK SOCK
  - ❖ NTH Model
  - ❖ SIDE CURTAIN TYPE
  - ❖ AIR BAG SYSTEM
  - ❖ TARPED MODEL
  - ❖ COLD ROOM OR COLD STORE

# Lock Sock



- Low Cost and light weight, constructed with PUF-panels
- Low investment and maintenance cost
- Plug-in, ready to commission, Doors Vertical or Sliding type
- Ripening capacities from 12 tons to 25 tons
- Moveable from one site to another
- Pre-cooling and Pressurized system of ripening
- Controlled levels of Ethylene, Co<sub>2</sub>, Temperature
- Humidity, time and, minimal product loss
- Micro process controlled compatible with computer
- Forced Air circulation by sealing hoses through Fruits
- Power efficient, uniform, quality ripening
- Single Tier can be loaded and unloaded by hand trolleys
- Can be run on lower load of fruits if whole room not filled.
- Patented and copyrighted property



# Pictorial Depiction



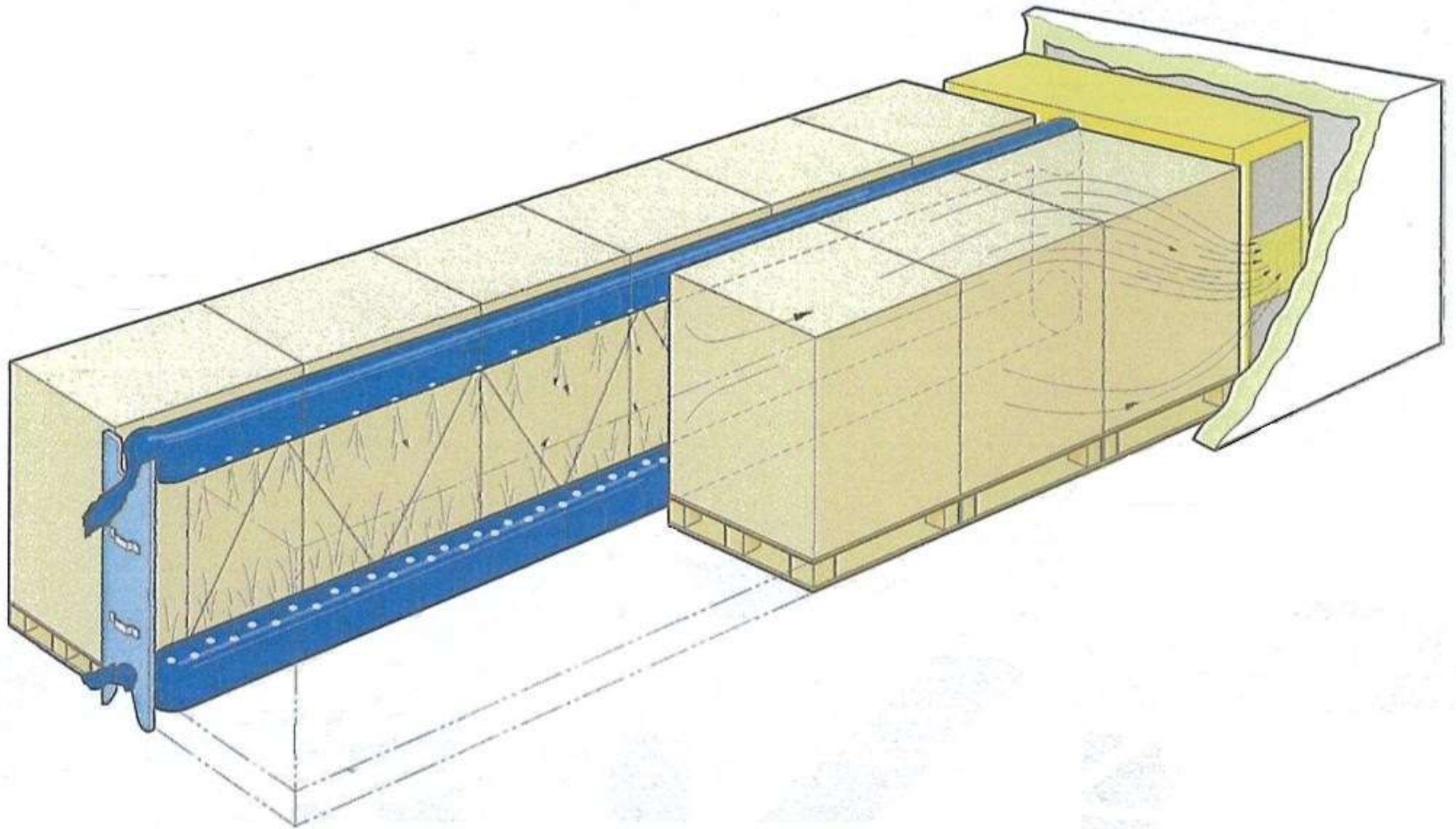












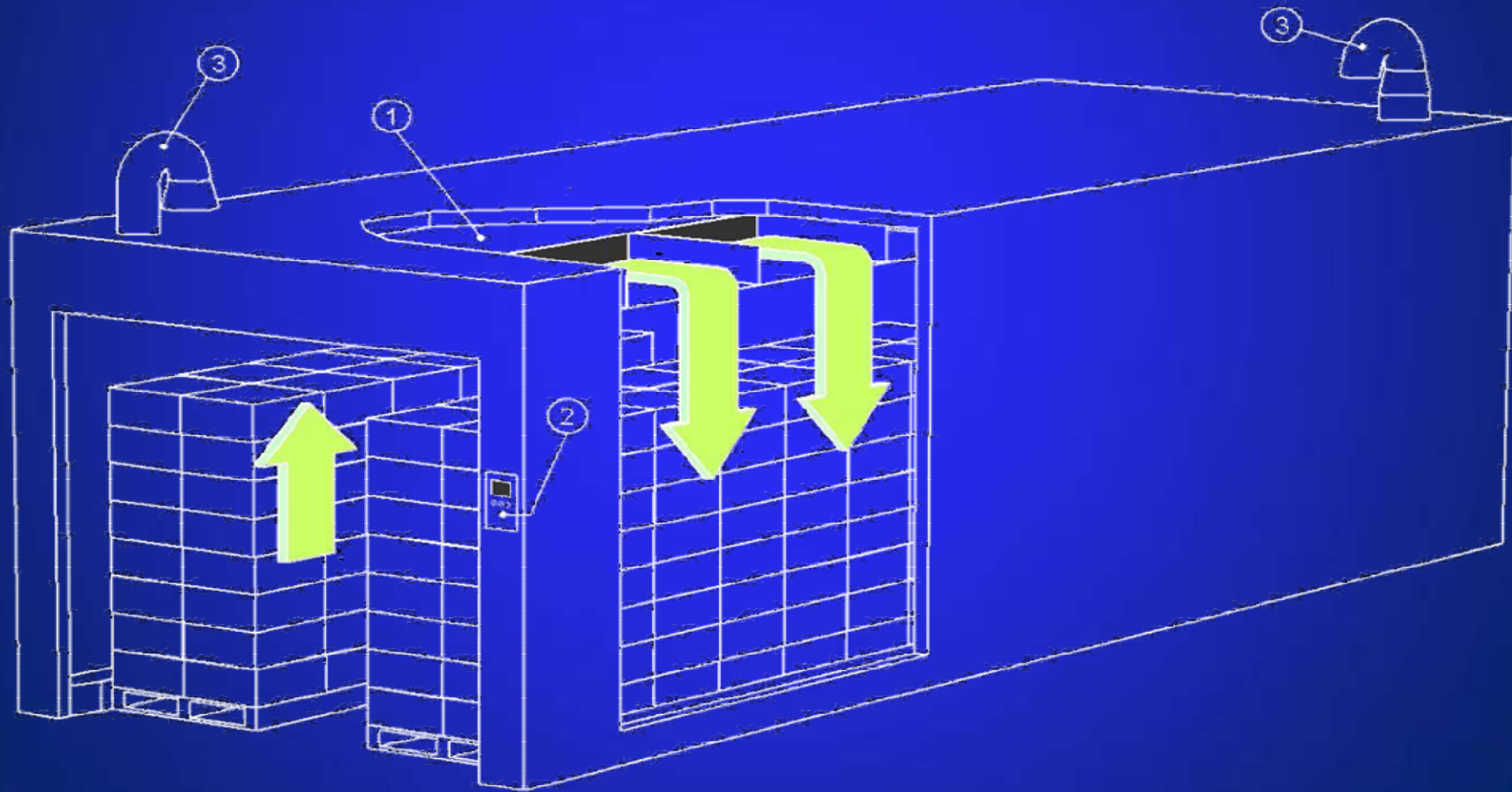
# NTH Model



- Constructed with Puf Panels vertical or Sliding Door
- Low maintenance cost, plug-in type
- All necessary sensors and microprocessor controlled
- Compatible with computers and pressurized rooms
- Uniform, premium fruit quality, longer shelf life
- Minimal product loss, consumer demanded taste
- Single Tier or multi-tier with ceiling mounted evaporators
- Functions as pre-cooler and auto-fruit ripening .
- Automatic control of Ethylene, Co<sub>2</sub>, temperature, humidity and time
- Pressurized Fruit Ripening and forced air circulation.
- Can be used on lower load of fruits if whole room not filled.
- Patented and copy righted property.



# Pictorial Depiction



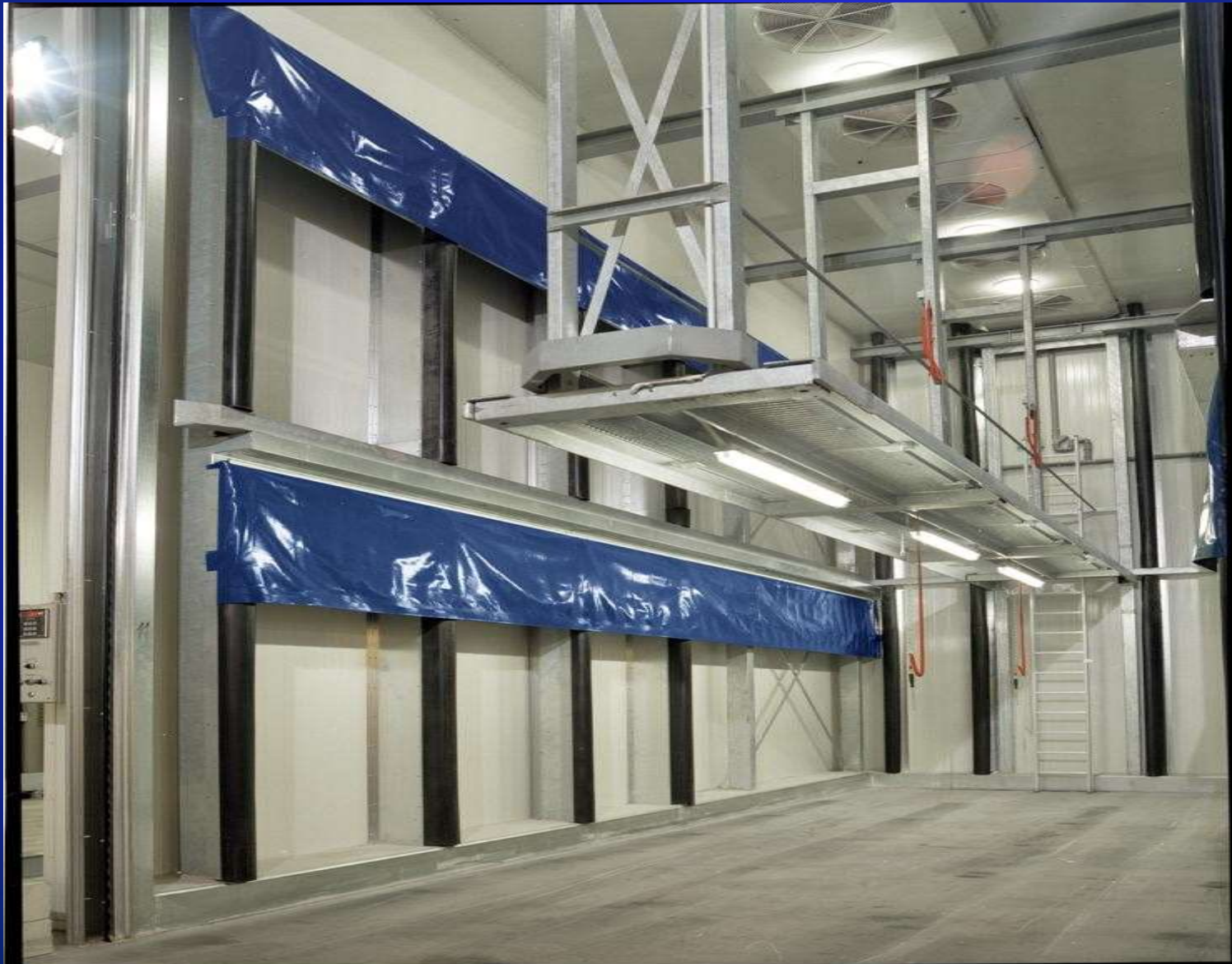
# Side Curtain Type



- Constructed with Puf Panels, vertical or sliding door.
- Suits places with space constraint as two or three Tier
- Side Curtains block air from flowing over Pallets and
- Force air flow through fruit boxes in the pallets
- Absence of moving parts in rooms reduce maintenance
- Plug-in type, ready to assemble and commission
- Premium, uniform and quality ripening of fruits
- Auto control of all criteria's for fruit ripening
- Microprocessor controlled compatible with computer
- Pre-cooling and ripening functions
- Loading, unloading by electric fork lift
- Power efficient, space saver, labour saver
- Can be used for lower load if whole room is not filled
- Costlier compared to previous model
- Patented and copy righted



# Pictorial Depiction







# Cold Room or Cold Store



- Can be constructed in bricks and mortar , but unhygienic
- Can be constructed with Puf Panels and sliding Door
- Evaporators are installed on wall
- Uniform, and equal, quality ripening is not possible
- No forced air, no pressurized ripening, no pre-cooling
- No uniformity in Temperature, humidity, Ethylene, Co2 levels
- Poor quality ripening of fruits.
- loss of taste and flavor and shelf life.
- Only a substitute to defeat provisions of Law.
- More space for same quantity of fruits than previous models
- More cost of Power and additional use of ceiling or Pedestal Fans
- Use of Humidifier is generally necessary

# Cont....



- No automatic control of Ethylene, Co<sub>2</sub>, Temperature or Humidity
- Loading of fruits is at least 3 ft lower than ceiling hence, larger space requirement
- Opening of Doors to exhaust Ethylene and Co<sub>2</sub> affects fruits or vegetables in the vicinity of cold room or cold store
- Concentration of higher level of Ethylene when injected is uncontrolled.
- Costs near about same as models above but performs poorly.
- Loading space of 4 feet is to be kept empty from the ceiling.



# Pictorial Depiction



# Some More Information



- At present, cold rooms or cold stores are being used in India as ripening rooms, with ethylene being injected from ethylene cylinders or through ethylene generators. These are faulty methods of ripening and do not achieve desirable results on our fruits for the reason that neither air distribution, nor ethylene distribution is uniform, not to say much about temperature, humidity, Carbon Dioxide control, resulting in poorer quality of ripe fruits and with short shelf life. The concentration of ethylene in cold rooms/cold stores could go up to 1000 ppm, which wipes out quality output. Besides the product loss being higher than 5% in cold rooms/cold stores, the power consumption is also much higher, since more volume is unnecessarily cooled and additional fans, humidifier, etc., are needed. A cold store/cold room does not have the required quantity of air, thus they use pedestal or ceiling fans, which are hardly of any use. Generally, in a cold storage cooler, the air quantity is not more than 400 cu.ft..per minute per ton of refrigeration load.
- The volume of cold rooms or cold stores could not be specified since somewhere large cold chambers are indulging in ripening of fruits with fruits placed in small portion of cold store and the rest remaining empty. Therefore, in a cold store the inside volume may be 11 or even 20 cubic meters per ton depending upon the size of a cold chamber and fruits loaded for ripening.

# Cont...



- Historically a country with imperfection in any technology, from pin to plane, and the major drive is not to forge ahead from the place the technology has reached elsewhere, but to begin from the beginning with the sole motive to defeat any applicable law or to drive profits without care of quality. Thus, copycat or make do/rag tag systems of banana ripening are being promoted and used to defeat provisions of Food Safety Law enacted recently. Moreover, no thought is given for other fruits like mangoes, papayas, pears, apricots, oranges lemons guavavas pineapples, plums, avacados, kiwis etc., which are still being ripened with chemicals, each of which needs different handling, processing practices and parameters for their ripening.
- In the end, it is concluded that the volume of 11 cu.m/ton is not the standard volume in pressurized ripening rooms, but for rooms loaded with pallets, it is 9 cu.m per ton and it is 8.5 cu.m/ton if fruits are loaded in plastic crates or boxes and any excess area in pressurized rooms will need more power, more refrigeration and affects performance..
- It is important to mention that the following News item appeared in a Global Fresh Produce Journal, which elaborates ill effects of uncontrolled ethylene in cold stores since concentration of ethylene in certain pockets cannot be controlled in cold stores/cold rooms and this erodes quality of fruits.



# UNCONTROLLED ETHYLENE GAS PRODUCE SHELF LIFE/QUALITY EROSION



- Significant economic losses within the fruit and vegetable industry are felt each year by not properly controlling levels of ethylene gas in cold storage and processing environments. Utilized as a ripening agent, ethylene does function in serving a desired objective. However, the lingering after affects in combination with this ethylene additionally being released by most all perishable items, will not only shorten the shelf life of produce and floral but harm quality and product integrity.
- Historically, ethylene gas has been used in practice since ancient Egyptians, who would gash figs in order to stimulate ripening (wounding stimulates ethylene production by plant tissue). The ancient Chinese would burn incense thus releasing ethylene in closed rooms to enhance the ripening of pears. Before ripening rooms, farmers/wholesalers would crush apples in burlap sacks and place in a closed room with green tomatoes. Ethylene would then be released and ripening would occur.

# Cont...



- However present day, uncontrolled levels of ethylene gas causes many challenges. Some of the typical visible effects of ethylene are: accelerated ripening, discoloration, russet spotting, yellowing, wilting, decay, bitterness, sprouting and rind breakdown. Most all that have consumed produce can certainly remember the healthy looking produce at the time of purchase but prior to consumption, quality erosion and dissatisfaction are experienced.
- Other critical challenges for cold storage operators include product compatibility and venting ethylene outside the facility. Ethylene sensitive products can coexist with those that are high produces of ethylene and VOC emissions can be reduced by taking advantage of a one of a kind NASA developed air sanitation technology. This patented technology integrated with Photo catalytic Oxidation )PCO) works in unison to dismantle volatile organic compounds (VOC) like ethylene gas along with destroying harmful airborne microbes like mold and bacteria.

# Conclusion



- In conclusion it must be mentioned that significant loss within fruits are felt by not controlling levels of ethylene gas in cold storages/cold rooms, which is not possible without it being used in pressurized rooms with forced air circulation and ethylene control devices.
- Utilized ethylene serves desired objective but lingering effect after, in combination with the additional ethylene being released by almost all perishables only shorten shelf life of produce but also harm quality and product integrally.
- Uncontrolled and uneven levels of ethylene gas in existence inside cold storages/cold rooms, many times level going up to 1000 ppm.
- Cause many challenges visible effects are accelerated ripening, discoloration, yellowing, wilting, decay, loss of taste and flavour. Ethylene levels are uneven in cold storages/cold rooms and temperature and humidity pockets also exist, which effect products overall quality. More area required for same quantity of storage of fruits generally more than 11 cubic meter per tonne.



# Cont....



- Considering cost factors, economy loss of product ease of operation, automatic control of temperature ,humidity, level of ethylene,Co<sub>2</sub>,resultant effects on produce shelf life and capacities from 5 tons to 25 tons can best be ripened in India in models LOCK-SOCK or NTH type, but surely in view of above Cold storages or cold rooms are not designed for fruit ripening, which need 24 hours pre-cooling on day 1 through forced air flow, uniform gassing through fruits on day 2, ethylene and Co<sub>2</sub> experiment on day 3 along with control of temperature, and humidity and taking out produce on day 4 with top and bottom of Bananas remaining green, but which would ripen out ultimately with after effect of triggering by ethylene when out of ripening room Shelf life and premium quality are achieved in pressurized and forced air flow rooms of these types
- All these models can be from 5 tons to 25 tons per room and pressurized rooms have inherent system that a larger capacity room can be used for lesser quantity and a portion of room is closed ensuring reduction in consumption of power relatively.

# Recommendation



- We would therefore recommend that either LOCK SOCK or NTH type are most suitable designs for India though these are patented technologies but are available in India from manufacturers. These are cost, space and power efficient, automatic operation, pressurized ripening resultant with premium quality ripened products of international standard. These are available in capacities from 5 ton to 25 ton and are widely used all over the world.