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Moderate Preservation for Kitchen

Miss. Snehal Mokashi[1]*, Miss. Snehal Ghatage[2], Rajendra S. Bardol[3]

[1]Department of Electrical and Electronics Engg., HIT, Nidasoshi, India

[2]Department of Electrical and Electronics Engg., HIT, Nidasoshi, India

[3]Department of Electrical and Electronics Engg., HIT, Nidasoshi, India

Abstract – In this project we are putting our effort, in preserving valuable nutrients at the lowest cost and affordable to everyone. Vegetables & Fruits are the valuable nutrients which need to be maintained at suitable temperature range, so that majority of the nutrients get unaffected from decay. Actual temperature need of local vegetables and fruits for preserving is around 15℃- 20℃ in most of the areas of country like India, to achieve this range at minimum electrical energy, so as to protect nutrients round the clock, we are using following technique.

Index Terms: Preservation, Moderate, Vegetables, Fruits, Clay Pot, Refrigerator

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INTRODUCTION

Now days it is very common practice to preserve vegetables and fruits in the refrigerators without knowing the most advantageous storage temperature for fruits and vegetables. In remote areas of a country, the power is shut down in order to save or spread electricity all over the country. This means that for around 45 min - 2 hours the material in the fridge will be able to melt or defrost. They also give out CFCs (Chloro-Fluoro Carbons) which result in ozone layer depletion. The refrigerator is very expensive depending on its quality. Some people cannot afford it. If the quality is low, then it will easily break down and cost of repair is even more, also the refrigerator is a big part of our electricity bill. Usage of refrigerators are not possible for all the income groups. Complexity in the construction and operation of the refrigerator can be avoided with low cost moderate preservation system.

DRAWBACKS OF REFRIGERATORS OR COLD STORAGE SYSTEMS:

Chilling-sensitive fruits often produce a burst of ethylene when reconditioned at ambient temperature after cold storage. This has led some chilling injury (CI) may be induced. Therefore ethylene production may influence chilling injury. When tomato is stored at 2-12°C, and is then allowed to ripen at ambient temperature (20°C), physiological and biochemical responses can damage the fruit. These responses include a failure to ripen, water-soaking, poor appearance and susceptibility to disease. This poses a problem, when storing fruits or vegetables like, tomato postharvest: low-temperatures are needed to delay the adverse effects, but this simultaneously increases the risk of chilling injury (CI). When power failure of domestic refrigerator occurs this leads to decay the contents of certain fruits and vegetables.

But it is better to store these vegetables in a cool and dry place in our kitchen or pantry as the refrigerator's cold temperature can harm their flavor and texture. We should never put potatoes, in the refrigerator. As Bananas stored in the fridge can turn brown (just the skin, not inside). Mangoes lose their taste. Once we picked a fresh food, nutritional value declines quickly. Fruit or vegetables start decaying and losing vitamins, even at lower temperatures. For example, the nutritional value of green beans is highest in the first five days after picking. Better to eat immediately! Fresh things are fresh things.

Common Need: In simplest and affordable way, every citizen needs to maintain the nutrition, flavor, texture, natural freshness of vegetables and fruits, along with saving electricity, preservation round the clock. Actual climatic conditions needed by the fruits and vegetable are entirely different than refrigerator.

Once a crop is harvested, it is almost impossible to improve its quality. Losses of horticultural crops due to improper storage and handling can range from 10 to 40 %. Proper storage conditions, mainly temperature and humidity are needed to lengthen storage life and maintain quality once the crop has been cooled to the most favorable storage temperature.

Fresh fruits and vegetables are living tissues, although they are no longer attached to the plant. They breathe, just as humans do, and their

composition and physiology continue to change after harvest. They continue to ripen and, finally, they begin to die. Cellular breakdown and death (senescence) are inevitable, but can be slowed with optimal storage conditions. Fresh fruits and vegetables need low temperatures (32 to 55°F) and high relative humidity (80 to 95 percent) to lower respiration and to slow metabolic and transpiration rates. By slowing these processes, water loss is reduced and food value, quality and energy reserves are maintained.

Proper storage conditions, temperature and humidity needed to lengthen storage life and maintain quality of harvested fruits and vegetables. Fresh fruits need low temperature and high relative humidity to reduce the respiration and slow down the metabolic process. The table below indicates optimal temperature and moisture condition for some common fruits and vegetables.

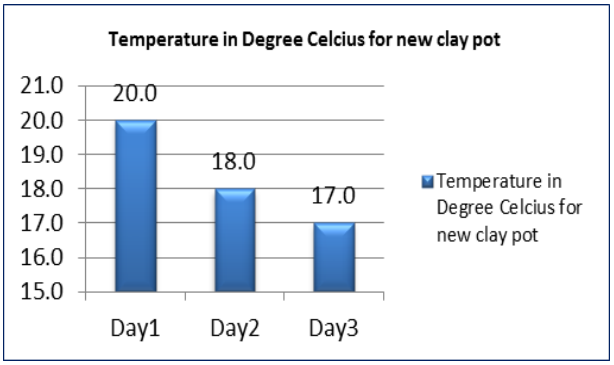
Table 1 : Actual temperature & Humidity need (Sample).

Product	Optimal Storage Temperature		Optimal Humidity
	(^{o}F)	*(^{o}C)*	%
Bananas, green	62-70	17-21	90- 95
Bananas, ripe	56-60	13-16	90
Coconuts	55-60	13-16	90
Ginger Root	60-65	16-18	65-70
Grapefruit	55-60	13-16	85
Green Beans	40-45	4-7	90
Guavas	45-50	7-10	90
Lemons	52-55	11-13	90
Mangos	50-55	10-13	90
Melons	50-55	10-13	90
Papayas	50-55	10-13	90
Pineapples	50-55	10-13	90
Pomegranates	41-50	5-10	90
Potatoes	45-50	7-10	90
Watermelon	55-70	13-21	90
Tomatoes, ripe	55-70	13-21	90

IMPLIMENTATION :

In our project we are designing a moderate preservator for kitchen to preserve vegetables and fruits. The key concept of our project is to maintain humidity and temperature only up to the general preservation requirement of commodities, by circulating a breeze around the commodities. In this concept we are using a mud pot as water reservoir for storing water to circulate in front of the cooling fans to reduce the temperature of the preservation chamber. Further, we planned for the separate compartments to accommodate sensitive commodities.

Evaporative cooling: Evaporative cooling is responsible for the chill effect to the contents of the moderate preservation unit. The ancient Egyptians hung wet mats in their doors and windows and wind blowing through the mats cooled the air which was the first attempt towards the air conditioning. This basic idea was refined through the centuries: mechanical fans to provide air movement in the 16th century, cooling towers with fans that blew water, cooler air inside factories used in the early 19th century, flood coolers in the 20th century. Addition to this we have used a clay pot, which is having micro pores containing water evaporate by absorbing the heat from the clay pot and cools the containing water, water level falls day by day in room-temperature.



Graph 1. Clay pot water temperatures observed

It has been observed that a newly purchased clay pot needs proper soaking of the water. So, new or dry pot results a regulated 17°C of temperature at second or third day, if the ambient temperature is between +17°C and above. This regulation will not be applicable below +17°C, i.e it remains more or less as unaltered. In our project clay pot temperature at 17°C is pumped to the cooling chamber, fans blow through the cooling pads and breeze is blowed through the perforated jacket. In this process around 18.2°C is measured at the vegetable and fruit chambers. This fulfills the need of the fruits and vegetables. Preserving unit is having a separate compartment for the below mentioned things. (Table.2)

Table 2 : Special care is needed for certain things.

Garlic	**Stored in a dry and well-ventilated area.**
Onions	Should not be preserved with potatoes as they will both spoil faster.
Potatoes	Must be Kept away from onions, must be stored store in a cool, dry area.
Sweet Potatoes	Keep away from heat and light.
Pumpkin	Store in a cool, dry place.
Germination of seeds and conversion of milk to curd environment	As seeds need water, air and temperature. Milk seeded with curd, will not be processed into curd if preserved in refrigerator.

We are designing a perforated jacket for better breeze circulation. A Battery is used for storing electricity to feed fans and a mini pump to serve round the clock, even if mains electricity fails. We are also using a solar panel to charge the battery to electricity charges. Thus reducing the running cost of the preservation nearer to zero as compared to fridge.

KEY CONCEPT : A breeze passing through the perforated jacket reaches the nutrients and cools, evolved hot gases pushed away, through the exhaust. For reducing the temperature of the breeze with respect to ambient temperature, a mud pot filled with water is pumped through the perforated jacket containing cooling pads.

EXPERIMENT:

The working mechanism consists of Fans, mud pot with water and a perforated jacket with filler material (like Aspen pads/ Evaporative Cooler Pads and Rolls). Kinetic energy in fan accelerates the air molecules that increase evaporation rate, reduces the temperature. Thus cooling is achieved.

- Due to the presence moisture, heat carried away by the water vapors increases and hence the decrease in the temperature is faster than that of dry case.
- water stored in a mud pot is always cool even if we place the mud pot in Hot sun. Mud pots have minute pores and when we store water in these pots tiny portion oozes out. This tiny portion gets evaporated absorbing heat from water stored inside mud pot. This process is happening continuously and end result is cool water inside the mud pot.
- Therefore in our proposed preservator the mud pot continuously or Intermittently provides cool water to the perforated jackets.
- The fans blow air over this perforated jacket so, heat present inside the sub preservation chambers is drawn out, due to natural convection process.
- The exhaust fan takes away this heat from the preservator. Hence the temperature inside is maintained at lower temperature.

Figure 1. Front view of the unit.

Miss. Snehal Mokashi[1]*, Miss. Snehal Ghatage[2], Rajendra S. Bardol[3]

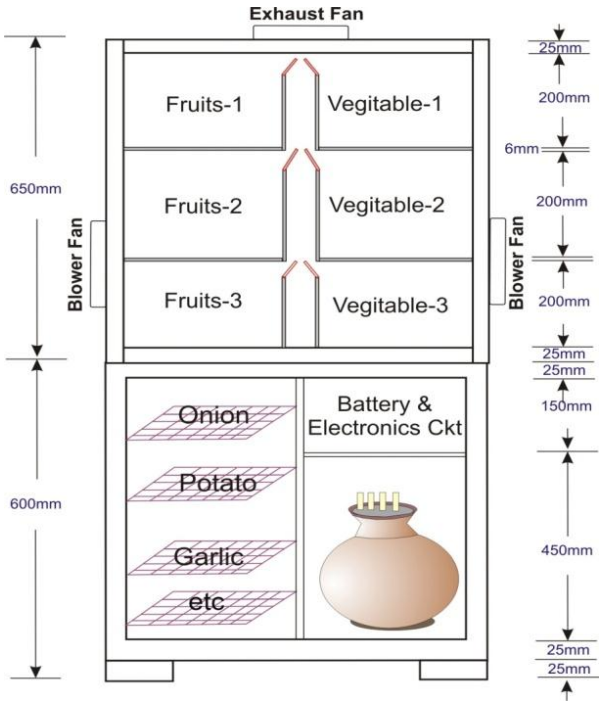


Figure 2. Cut sectional view

Addition to the above arrangements, moderate preservator for kitchen is made to reach every rural houses by using solar panel and electronic circuit to support battery storage for mains failure situations and energy efficient equipments. Block diagram of the circuit arrangement is as shown below.

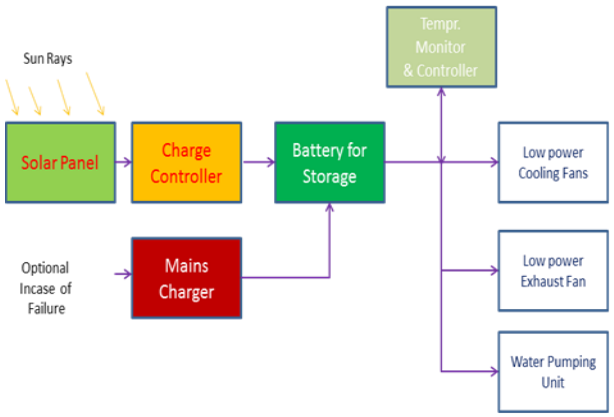


Figure 3. Block diagram

Comparison :

Table 3. Moderate Preservator Vs. Refrigerator

S.N	Description	Moderate Preservator	Refrigerator
1.	Food Storage against Insects, Rodent etc.	**Yes**	**Yes**
2.	Temperature Range to Preserve	**15℃ - 20℃**	**0℃ - 8℃**
3.	Eco Friendly	**Yes**	**No**
4.	Power consumption (Running Cost)	**Very Low**	**Very High**
5.	Reliable when electricity Fails	**Yes**	**No**
6.	Cost of Purchase	**Low**	**High**
7.	Easy to Repair/ Replace	**Yes**	**No**
8.	Accommodates & Full fills needs of every food material without loss of their quality like taste, texture, Nutrition etc, (Specially - Onion, Potato, germination of seeds, curding etc.)	**Yes**	**No**
9.	ICE Cube Produced?	**No**	**Yes**

CONCLUSION :

In this project we have designed a Moderate Preservator for the Kitchen, which is affordable to everyone. The purpose of this model is to preserve fruits and vegetables at moderate temperature without loss of their nutrients and keep them as fresh as possible.

Majority of the citizens eat regional / locally available vegetable and fruits. Fruits, Vegetable grown in this area are self sustainable for 2-3 days without much nutrient loss. Temperature need of individual vegetable/fruit species is different. So, refrigerator fails to preserve color, texture and taste of things. Some nutrients are also lost when preserved in refrigerator. As a tradition weekly marketing for kitchen requirement is common in any country. So, matter of 3 more days, can be maintained by an equipment with low cost, efficient, reliable, easy to maintain or repair, affordable to poor and rich.

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Corresponding Author

Miss. Snehal Mokashi*

Department of Electrical and Electronics Engg., HIT, Nidasoshi, India

E-Mail – snehalmokashi31@gmail.com