A STUDY OF EVAPORATIVE COOLING ON LEAFY VEGETABLES

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ABSTRACT

Evaporative cooling is an energy efficient and environmentally friendly air conditioning technology. Direct evaporative cooling system technology which involves adiabatic humidification and cooling of air with supplementary heat exchange facilities to lower final temperatures and try to reduce relative humidity. This concept is enhanced in all engineering fields due to its characteristics of zero pollution, energy efficiency, simplicity and good indoor air quality. This cooling effect has been used on various scales from small conducted. The review covers direct evaporative cooling prototype design which is made for testing the life time of the leafy vegetables.

INTRODUCTION

India is the second largest producer of fruits, vegetables and leafy vegetables in the world after Brazil and China respectively. Production of fruits, vegetables and leafy vegetables account for 209.72 million tonnes (MT) of which 73.53 MT & 136.19 MT are fruits, vegetables and leafy vegetables respectively. Storage of fresh horticultural produce after harvest is one of the most pressing problems of a tropical country like India. Due to their high moisture content, fruits and vegetables have very short life and are liable to spoil. Moreover, they are living entities and carry out transpiration, respiration and ripening even after harvest. Metabolism in fresh horticultural produce continues even after harvest and the deterioration rate increases due to ripening, senescence and unfavorable environmental factors. Hence, preserving these types of foods in their fresh form demands that the chemical, bio-chemical and physiological changes are restricted to a minimum by close control of space temperature and humidity.

Due to the short shelf life of these crops, it is estimated that about 30 to 35% of India's total fruits, vegetables and leafy vegetables production is lost during harvest, storage, grading, transport, packaging and distribution in a year which reduces the growers share. Only 2% of these crops are processed into value added products. Hence, there is a need for maximum commercial utilization of fruits and vegetables. If the nutritive value of the processed food products could be maintained, this sector will emerge as a major value-added food industry. At present, the grower is getting hardly 25–35 paisa of out of a rupee of the consumer. Therefore, there is a need to evolve a marketing system where benefit is prevailed to both growers and consumers.

The fruits, vegetables and leafy vegetables need immediate post-harvest attention to reduce the microbial load and increase their shelf life, which can be achieved by storing them at low temperature and high relative humidity conditions. These conditions are usually achieved in cold storages.

Farmers and traders still practice their age-old storage methods leading to large-scale wastage during storage and transportation. Traditionally, after harvest, most of the fruits, vegetables and leafy vegetables are kept in temporary wooden/bamboo huts constructed near the residential buildings or production catchment. In the warm plains of India, fruits, vegetables and leafy vegetables are stored in pits or cool dry rooms with proper ventilation on the floor or on bamboo racks. Inside the hut, fruits and vegetables are kept on floor or over racks and covered are with straw or plant leaves to avoid exposure to the atmosphere. By this method fruits and vegetables can be stored for few days without much damage and farmers sell it in local village weekly market according to their financial needs

In this papert, an attempt is made by fabricating 3 different dimensions evaporative cooling cabinet setup to study how the temperature and humidity inside the evaporative cooling cabinet setup vary from outside the evaporative cooling cabinet setup by placing leafy vegetable inside the evaporative cooling cabinet setup.

DESIGN AND EXPERIMENTAL SETUP

DESIGN 1

DIMENSIONS:

Length : 300mm

Width : 300mm

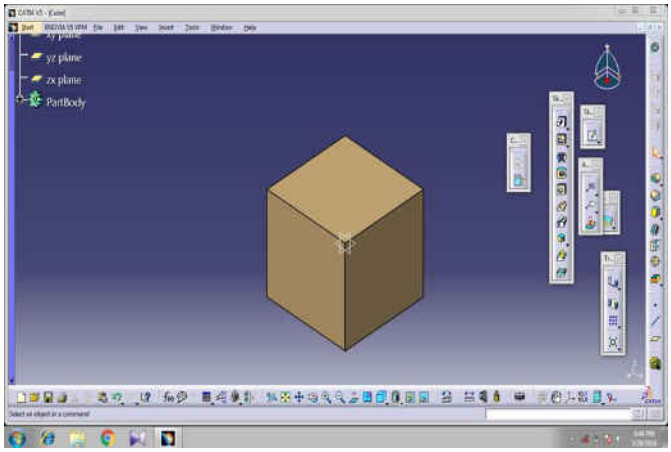
Here in our project we have made three types of prototypes which are majorly different in their dimensions, water flow and the material used. A cubic structure is made and covered with the jute bag that wetted frequently.

Prototype 1 is made for the same length, width and height as 300mm and the material used here are steel rods that is being welded in the cubic shape and covered with the jute bag in which that water is sprayed in frequent interval time.

Prototype 2 is made for the length and width 300mm and height 450mm and the material used here is PVC pipe that is being joined in a cube shape where the water flow is made in that PVC pipe by making very small holes in that PVC pipe. Jute bag is being covered over the PVC pipe

Prototype 3 is made for the length and width 500mm and the height 600mm.The material used here is steel rods that are welded as like the prototype one and covered by jute bag. Here the water flow is made by flexible tube that is fixed on the top portion of the jute bag.

The images of prototype design and experimental setup are given in the figure 1 to 6 in the following.



Length : 300mm

Width : 300mm

Height : 450mm

Height : 300mm

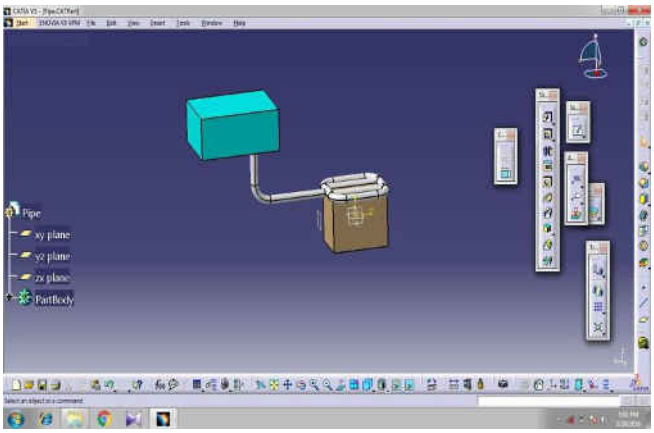


Fig 1: Design of first experimental setup

DESIGN 2

DIMENSIONS:

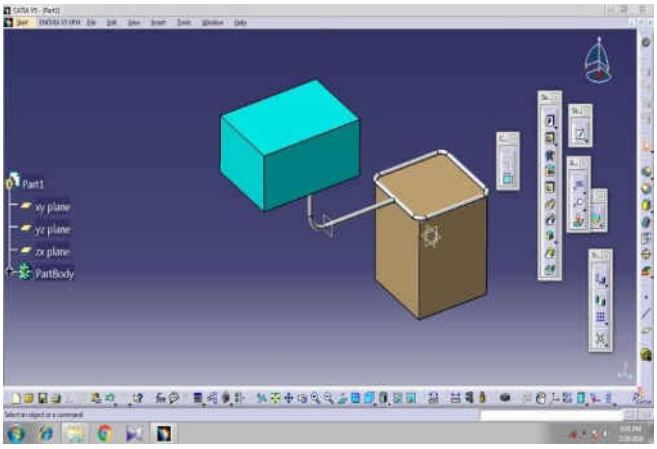


Fig 2: Design of second experimental setup

DESIGN 3

DIMENSIONS:

Length : 500mm

Width : 500mm

Height : 600mm

Fig 3: Design of third experimental setup

EXPERIMENTAL SETUP 1

DIMENSIONS:

Length : 300mm

Width : 300mm

Height : 450mm

Length : 300mm

Width : 300mm

Height : 300mm
Length : 300mm
Width : 300mm
Height : 300mm

Fig 4: Experimental setup

EXPERIMENTAL SETUP 2

DIMENSIONS:

Fig 5: Experimental setup 2

EXPERIMENTAL SETUP 3

DIMENSIONS:

Length : 500mm

Width : 500mm

Height : 600mm

COMPONENTS

The components that we use in our project are listed below with their uses.

1. Steel rods : to make the cabinet
2. Jute bag : to cover the cabinet
3. Water pipe : to wet the jute bag
4. Water tank : to store the water
5. Bamboo stick : to place the leafy vegetables in the cabinet
6. Temperature sensors: to calculate the dry bulb and wet bulb temperature inside and outside the cabinet.

TEMPERATURE SENSOR

The temperature sensor consists of digital temperature LCD displays, embedded panel, two button batteries.

Parameters

Measuring range: -50°c to70°c (108°c maximum measurable)

Classified defense rate: +/- 0.1°c accuracy:1°c

Fig 6: Experimental setup 3

Power source: DC1.5V Lr44
Unit size: 47.8*28.5*14.3mm
Display size: 36*16mm
The installation size: 46mm*26.6mm

RESULTS AND DISCUSSION

We have placed the Palak leaves both inside and outside the designed prototype model and the readings were taken for the following parameters.

1. Dry bulb temperature inside the cabinet
2. Wet bulb temperature inside the cabinet
3. Dry bulb temperature outside the cabinet
4. Wet bulb temperature outside the cabinet
5. Relative humidity inside the cabinet
6. Relative humidity outside the cabinet
7. Weight of leafy vegetable inside the cabinet
8. Weight of leafy vegetable outside the cabinet

By knowing the values of Dry bulb temperature and Wet bulb temperature, the Relative humidity is calculated online from the website http://www.keesfloor.nl/corner/rekenen/wet.html

The above parameters were calculated for all the three prototype models by placing the

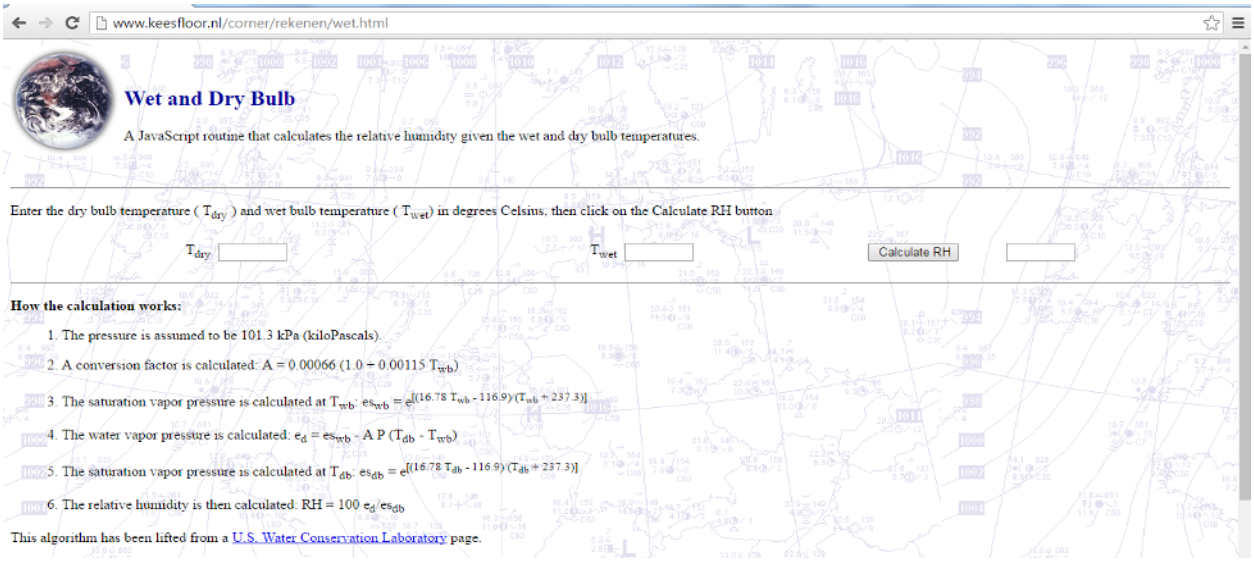


Fig 7: Web page in which Relative Humidity is calculated

READINGS OF PROTOTYPE 1

In prototype 1 the jute bag is wetted manually by spraying 250 ml water on it in regular interval of time. Here the dry bulb temperature and wet bulb temperature are calculated by placing the LCD temperature sensor inside and outside the prototype.

Fig 8: Initial setup of prototype 1

Time	Outside dry bulb temperature (^{0}C)	outside Wet bulb temperature (^{0}C)	Inside dry bulb temperature (^{0}C)	Inside Wet bulb temperature (^{0}C)	Outside Relative Humidity (%)	Inside Relative Humidity (%)	Inside weight (g)	Outside weight (g)
Day 1								
10.00 am	26	20.5	24.3	20.5	60.5	70.8	200	200
11.00 am	27.1	21.5	21.5	21.2	60.8	97.4	200	190
12.00 pm	27.9	22	21.5	21.4	59.6	99.1	200	180
01.00 pm	30.3	21	21.2	20.8	42.9	96.5	200	180
02.00 pm	30.4	20	23.5	22.9	37.5	95	200	160
03.00 pm	32.9	19.5	21.5	20.4	27	90.5	200	160
04.00 pm	32.6	20	21.2	20.4	30	93	200	160
05.00 pm	32.3	21	20.7	20.2	35.4	95.6	200	160
06.00 pm	31.1	21.5	21.5	19.9	42.2	86.4	200	150
07.00 pm	29.6	20.5	20.7	20.5	43.1	98.2	200	150
08.00 pm	28.2	21	19.3	19.1	52.1	98.2	200	150
09.00 pm	26.9	20.5	19.8	18.9	55.7	91.9	200	140
10.00 pm	26.3	19	19.5	18.6	49.6	91.8	200	140
11.00 pm	25.7	20	19.5	19.2	59	97.2	200	130
12.00 am	25.2	20.1	20.3	20.2	62.5	99.1	200	120
01.00 am	24.3	20	20.4	20.2	67.3	98.2	200	120
02.00 am	23.6	20	20.4	20.3	71.8	99.1	200	120
03.00 am	21.7	19	18.9	18.7	77.5	98.1	200	120
04.00 am	21.6	18.5	18.9	18.7	74.3	98.1	200	120
05.00 am	21.9	18	18.6	18.2	68.4	96.2	200	120
06.00 am	20	17.6	18.2	18.1	79.1	99.1	200	120
07.00 am	20.5	17.5	18.5	18.3	74.4	98.1	200	120
08.00 am	21.1	18	18.9	18.6	74	97.2	200	120
09.00 am	23.9	19	19.3	19.1	62.8	98.2	200	120
Avg.	26.3	20	20.3	19.8	57	95.1	200	143

Table 1: Day 1 readings of prototype 1

Time	Outside dry bulb temperature (^{0}C)	outside Wet bulb temperature (^{0}C)	Inside dry bulb temperature (^{0}C)	Inside Wet bulb temperature (^{0}C)	Outside Relative Humidity (%)	Inside Relative Humidity (%)	Inside weight (g)	Outside weight (g)
Day 2								
10.00 am	25.9	20	20.5	20.1	57.9	96.4	200	120
11.00 am	27.3	21	20.3	20.1	56.9	98.2	200	120
12.00 pm	28.4	21	20.9	20.7	51.2	98.2	200	120
01.00 pm	30.2	22.5	21.1	20.9	51.2	98.2	200	120
02.00 pm	31.1	22	21.3	21.1	44.7	98.2	200	120
03.00 pm	31.8	23	22.3	21	46.9	89.1	200	120
04.00 pm	31.9	22	22.5	21.6	41.6	92.4	200	120
05.00 pm	32.1	23	22.5	22.1	45.7	96.6	200	120
06.00 pm	30.8	23	22.7	22.2	51.2	95.8	200	120
07.00 pm	29.8	23.5	22.5	22	58.7	95.7	200	117
08.00 pm	27.9	24	22.3	21.9	72.3	96.6	200	117
09.00 pm	27.1	22	22.3	21.8	64	95.7	200	115
10.00 pm	27.3	23	22.5	21.3	69.3	89.9	200	115
11.00 pm	26.5	20.5	20.9	19.4	57.8	87	200	115
12.00 am	25.7	21	20.3	20.1	65.6	98.2	200	112
01.00 am	25.2	20.5	19.2	19	65.2	98.1	200	112
02.00 am	23.6	19.5	18.9	18.8	68.2	99.1	200	110
03.00 am	23.1	19	18.8	18.5	67.8	97.2	200	110
04.00 am	23.1	18.5	19.6	19.2	64.2	96.3	200	110
05.00 am	21.3	18.3	19.5	19.2	74.9	97.2	200	108
06.00 am	21.5	18.5	19.2	19.1	75.1	99.1	200	107
07.00 am	20.5	18	18.3	18.2	78.5	99	198	104
08.00 am	20.8	19	19.2	19.1	85.4	99.1	195	98
09.00 am	24.8	20.5	21.2	20.8	67.6	96.5	193	91
Avg.	26.6	21	20.8	20.3	61.7	96.2	199.4	113.4

Table 2: Day 2 readings of prototype 1

Time	Outside dry bulb temperature (°C)	outside Wet bulb temperature (°C)	Inside dry bulb temperature (°C)	Inside Wet bulb temperature (°C)	Outside Relative Humidity (%)	Inside Relative Humidity (%)	Inside weight (g)	Outside weight (g)
Day 3								
10.00 am	26.5	22	21.5	21.4	67.5	99.1	193	86
11.00 am	28.1	24	21.3	21.1	71.1	98.2	190	82
12.00 pm	29.1	21.5	21.2	20.9	50.7	97.4	188	76
01.00 pm	30.8	21	21.5	20.5	40.9	91.4	187	72
02.00 pm	30.8	21	21.1	20.8	40.9	97.4	182	72
03.00 pm	32.8	22	20.6	19.8	38.3	92.9	175	70
04.00 pm	32.3	22	20.9	19.2	40.1	85.3	171	70
05.00 pm	32	21.5	20.5	19.4	38.8	90.3	169	62
06.00 pm	30.6	22.5	20.5	19.5	49.4	91.2	166	58
07.00 pm	29.3	22.6	20.3	19.5	56	92.9	160	58
08.00 pm	28.4	23	20.5	20.3	63	98.2	153	58
09.00 pm	27.9	19.5	20.5	19.7	45	92.9	148	52
10.00 pm	27.3	21	20.6	19.6	56.6	91.2	144	48
11.00 pm	26.7	21.5	20.6	19.6	63	91.2	143	48
12.00 am	25.9	20.8	20.1	19.6	63.1	95.5	143	48
01.00 am	25.4	20.5	20.1	19.8	64	97.3	140	46
02.00 am	24.8	19.5	19.7	19.3	60.8	96.4	136	46
03.00 am	24.1	19.8	20.1	19.1	67.1	91.1	135	44
04.00 am	22.9	19	19.5	19.3	69.1	98.2	133	44
05.00 am	22.2	18.8	19.4	18.7	72.4	93.6	130	44
06.00 am	22.2	18.5	19.8	19	70.1	92.8	128	44
07.00 am	22	18.5	19.8	19.6	71.5	98.2	125	42
08.00 am	21.6	18	18.9	18.7	70.5	98.1	124	42
09.00 am	25.2	21	21.2	21	68.6	98.2	120	40
Avg.	27	20.8	20.4	19.8	58.3	94.5	138.5	56.3

Table 3: Day 3 readings of prototype 1

READINGS OF PROTOTYPE 2

In prototype 2 the jute bag is wetted automaticallywith the help of water flow in PVC pipe. Here the dry bulb temperature and wet bulb temperature are calculated by placing the LCD temperature sensor inside and outside the prototype.

Time	Outside dry bulb temperature (^{0}C)	outside Wet bulb temperature (^{0}C)	Inside dry bulb temperature (^{0}C)	Inside Wet bulb temperature (^{0}C)	Outside Relative Humidity (%)	Inside Relative Humidity (%)	Inside weight (g)	Outside weight (g)
Day 1								
10.00 am	25.9	20	20.5	20.1	51.9	96.4	200	200
11.00 am	27.3	21	20.3	20.1	56.6	98.2	200	190
12.00 pm	28.4	22.5	20.9	20.7	51.2	98.2	200	180
01.00 pm	30.2	22	21.1	20.9	51.2	98.2	200	180
02.00 pm	31.1	23	21.3	21.1	44.7	98.2	200	170
03.00 pm	31.8	22	22.3	21	46.9	89.1	200	160
04.00 pm	31.9	23	22.5	21.6	41.6	92.4	200	150
05.00 pm	32.1	23	22.7	22.1	45.7	96.6	200	150
06.00 pm	30.8	23.5	22.5	22.2	51.2	95.8	200	150
07.00 pm	29.8	24	22.3	22	58.7	95.7	190	150
08.00 pm	27.9	22	22.3	21.9	72.3	96.6	190	150
09.00 pm	27.1	23	22.5	21.8	64	95.7	190	140
10.00 pm	27.3	20.5	20.9	21.3	69.3	89.9	190	130
11.00 pm	26.5	21.2	20.3	19.4	57.8	87	190	130
12.00 am	25.7	19.5	19.2	20.1	65.6	98.2	180	120
01.00 am	25.2	19	18.9	19	65.2	98.1	180	120
02.00 am	23.6	19	18.8	18.8	68.2	99.1	180	120
03.00 am	23.1	18.5	19.6	18.5	67.2	97.2	180	120
04.00 am	23.1	18.3	19.5	19.2	64.2	96.3	180	120
05.00 am	21.3	18.5	19.2	19.2	74.9	97.2	180	120
06.00 am	21.5	18	18.3	19.1	75.1	99.1	180	120
07.00 am	20.5	19	19.2	18.2	78.5	99	170	110
08.00 am	20.8	20.5	21.2	19.1	84.4	99.1	160	110
09.00 am	24.8	20.2	21.4	20.8	67.6	96.5	160	110
Avg.	26.6	20.9	20.7	20.3	61.4	96.2	187.5	137.1

Table 4: Day 1 readings of prototype 2

READINGS OF PROTOTYPE 3

In prototype 3 the jute bag is wetted automatically with the help of water flow in small tube fitted above the jute bag. Here the dry bulb temperature and wet bulb temperature are calculated by placing the LCD temperature sensor inside and outside the prototype.

Time	Outside dry bulb temperature (^{0}C)	outside Wet bulb temperature (^{0}C)	Inside dry bulb temperature (^{0}C)	Inside Wet bulb temperature (^{0}C)	Outside Relative Humidity (%)	Inside Relative Humidity (%)	inside weight (g)	Outside weight (g)
Day 1								
10.00 am	31.1	27.1	27.8	27.2	73	95	200	200
11.00 am	32.4	25.1	27.2	24.9	55	90	200	190
12.00 pm	33.2	25.4	28.3	26.4	53	86	200	180
01.00 pm	33.8	25.1	28.1	26.2	49	79	200	180
02.00 pm	34.7	24.7	29.1	25.9	44	77	200	160
03.00 pm	34.9	24.3	28.3	25.4	41	79	200	160
04.00 pm	35.4	24.3	28.8	25.4	40	76	200	160
05.00 pm	34.8	24.7	28.9	25.8	43	78	200	160
06.00 pm	35.1	25.2	27.4	25.6	45	87	200	150
07.00 pm	34.2	24.7	27.3	25.9	46	89	200	150
08.00 pm	33.5	24.8	27.5	25.4	49	84	200	150
09.00 pm	32.8	24.9	27.9	25.2	52	80	200	140
10.00 pm	32.5	25.1	27.8	26.2	55	88	200	140
11.00 pm	30.9	26.1	27.3	26.9	68	91	200	130
12.00 am	30.1	26.1	27.3	26.4	73	92	200	120
01.00 am	29.3	25.8	27.4	26.2	76	91	200	120
02.00 am	29.6	26.1	27.3	26.7	76	95	200	120
03.00 am	28.2	25.4	26.9	25.4	80	89	200	120
04.00 am	28.2	25.2	26.9	25.4	78	89	200	120
05.00 am	28	25.2	26.7	25.4	80	90	200	120
06.00 am	28	25.1	26.5	25.4	79	92	200	120
07.00 am	27.9	25.2	26.6	25.9	80	95	200	120
08.00 am	28.8	25.6	27.3	26.4	77	93	200	120
09.00 am	29.8	26.1	27.5	26.9	75	95	200	120
Avg.	31.55	25.30	27.59	25.94	61.96	87.5	200	143.75

Table 5: Day 1 readings of prototype 3

Time	Outside dry bulb temperature (^{0}C)	outside Wet bulb temperature (^{0}C)	Inside dry bulb temperature (^{0}C)	Inside Wet bulb temperature (^{0}C)	Outside Relative Humidity (%)	Inside Relative Humidity (%)	inside weight (g)	Outside weight (g)
Day 2								
10.00 am	31.3	26	27.8	26.8	66	92	200	120
11.00 am	31.7	25.8	28.1	26.8	62	90	200	120
12.00 pm	33.7	26.2	28.2	27.2	55	93	200	120
01.00 pm	34.9	25.1	27.3	26.8	46	96	200	120
02.00 pm	35.6	25.4	27.7	27.2	44	96	200	120
03.00 pm	35.9	25.1	27.6	26.8	41	94	200	120
04.00 pm	36.5	22.2	25.9	24.1	28	86	200	120
05.00 pm	36.1	22.4	25.2	24.1	30	91	200	120
06.00 pm	35.2	23.1	23.9	23.2	35	94	200	120
07.00 pm	33.9	23.9	25.4	23.1	43	82	200	117
08.00 pm	32.9	23.9	26	23.8	43	83	200	117
09.00 pm	32.4	23.4	26.8	24.4	46	82	200	115
10.00 pm	31.1	23.8	24.5	24	54	96	200	115
11.00 pm	30.1	23.8	25.9	24.8	59	91	200	115
12.00 am	29.2	23.6	25.5	25.2	62	98	200	112
01.00 am	29.2	24.2	26.1	25.7	66	97	200	112
02.00 am	28.7	24.5	26	25.6	71	98	200	110
03.00 am	27.8	23.1	25	24.5	68	96	200	110
04.00 am	26.8	22.3	25.3	24.5	68	94	200	110
05.00 am	26	22.8	25	24.3	76	97	200	108
06.00 am	26.3	22.9	25	24.3	75	94	200	107
07.00 am	26.6	23.1	25	23.9	74	91	198	104
08.00 am	27.2	24	25.9	24.2	77	87	195	98
09.00 am	29.5	24.4	26.3	25.9	66	97	193	91
Avg.	31.9	23.9	26.1	25.1	56.5	92.3	199.41	113.38

Table 6: Day 2 readings of prototype 3

Time	Outside dry bulb temperature (^{0}C)	outside Wet bulb temperature (^{0}C)	Inside dry bulb temperature (^{0}C)	Inside Wet bulb temperature (^{0}C)	Outside Relative Humidity (%)	Inside Relative Humidity (%)	inside weight (g)	Outside weight (g)
Day 3								
10.00 am	30.4	23.8	25.4	25.1	66	98	193	86
11.00 am	32.2	23.6	25.8	24.8	48	92	190	82
12.00 pm	34.1	23.9	24.2	23.5	42	94	188	76
01.00 pm	34.4	22.4	24.9	23.8	35	91	187	72
02.00 pm	35.1	22.6	25.2	24.4	33	94	186	72
03.00 pm	35.4	23.1	25.4	24.4	34	92	182	70
04.00 pm	36.1	23.5	26.3	25.2	34	91	182	70
05.00 pm	35.1	23.1	26.4	25.6	35	94	180	62
06.00 pm	34.7	22.7	25.8	25.3	35	96	178	58
07.00 pm	34.2	22.8	25.7	25.1	37	95	175	58
08.00 pm	33.5	22	24.4	22.9	36	88	174	58
09.00 pm	32.8	21.1	24.1	23.2	34	93	172	52
10.00 pm	32.3	20.8	24.8	23.8	35	92	168	48
11.00 pm	31.1	20.9	24.2	22.6	39	87	168	48
12.00 am	30.7	21.3	24.5	23.1	43	89	166	48
01.00 am	29.1	25.4	26.3	25.6	74	95	166	46
02.00 am	29	25.1	25.9	25	73	93	166	46
03.00 am	27.9	24.8	25.2	24.4	78	94	166	44
04.00 am	26.8	21.9	25.6	24.6	65	92	166	44
05.00 am	26.1	21.8	25	23.9	69	91	166	44
06.00 am	26.8	21.9	22.8	22.1	69	94	166	44
07.00 am	28.2	22.2	23	22.1	59	92	166	42
08.00 am	28.9	22	23.5	22.8	55	94	166	42
09.00 am	30.3	24	25.3	24.3	59	92	164	40
Avg.	32	22.8	25	24.1	49.5	92.6	174.2	56.33

Table 7: Day 3 readings of prototype 3

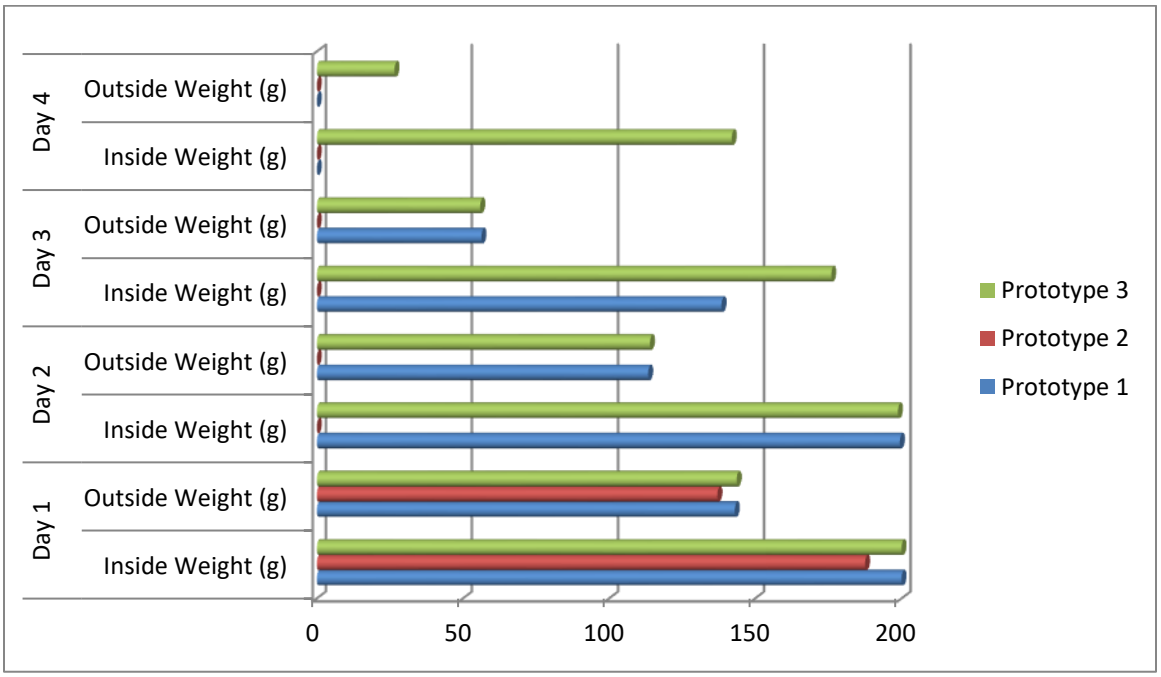
Time	Outside dry bulb temperature (^{0}C)	outside Wet bulb temperature (^{0}C)	Inside dry bulb temperature (^{0}C)	Inside Wet bulb temperature (^{0}C)	Outside Relative Humidity (%)	Inside Relative Humidity (%)	inside weight (g)	Outside weight (g)
Day 4								
10.00 am	31.3	25.3	27.9	26.2	62	87	164	40
11.00 am	32.8	25.1	27.5	26	53	89	148	38
12.00 pm	33.9	25.5	28.1	24.9	51	77	148	38
01.00 pm	35.5	26	26.5	25.8	47	95	148	36
02.00 pm	34.8	24.7	26.8	25.9	73	93	148	36
03.00 pm	35	25	27	25.8	44	91	148	34
04.00 pm	35.4	24.5	26.5	25.8	40	95	144	32
05.00 pm	35.3	24.3	26.3	25.1	40	91	144	32
06.00 pm	35.5	24.5	26.2	25.4	40	94	142	30
07.00 pm	34.5	23.5	26.5	25.7	39	94	142	28
08.00 pm	33.9	24.8	26.3	25.8	47	96	140	28
09.00 pm	33.4	25.2	26.7	25.8	51	93	138	26
10.00 pm	32.1	25.4	26.1	25.4	58	95	138	26
11.00 pm	31.2	26.1	26.4	25.5	67	93	138	24
12.00 am	31.5	25.9	25.9	25.1	64	94	138	24
01.00 am	30.9	25.7	26.1	25.6	66	96	136	24
02.00 am	30.8	25.3	26.1	25.2	64	93	136	22
03.00 am	30.2	25.9	26.4	25.2	71	91	136	22
04.00 am	29.5	25.5	26.7	25.3	72	89	134	22
05.00 am	28.3	25	26.2	25.1	76	91	134	22
06.00 am	27.3	21.3	22.5	20.5	58	83	134	22
07.00 am	26.8	22.2	26.3	25.2	67	91	134	22
08.00 am	28.8	25	26.6	25.7	73	93	134	22
09.00 am	29.7	26.1	27.2	26.2	75	92	134	22
Avg.	32	25	26.1	25.3	58.3	92	141	28

Table 8: Day 4 readings of prototype 3

GRAPH 1

	Day 1		Day 2		Day 3		Day 4	
	Inside Weight (g)	Outside Weight (g)	Inside Weight (g)	Outside Weight (g)	Inside Weight (g)	Outside Weight (g)	Inside Weight (g)	Outside Weight (g)
Prototype 1	200	143	199.4	113.4	138.5	56.3	-	-
Prototype 2	187.5	137.1	-	-	-	-	-	-
Prototype 3	200	143.7	198.8	114	176	55.9	142	26.6

Table 9: Weight comparison of leafy vegetables in all 3 prototypes

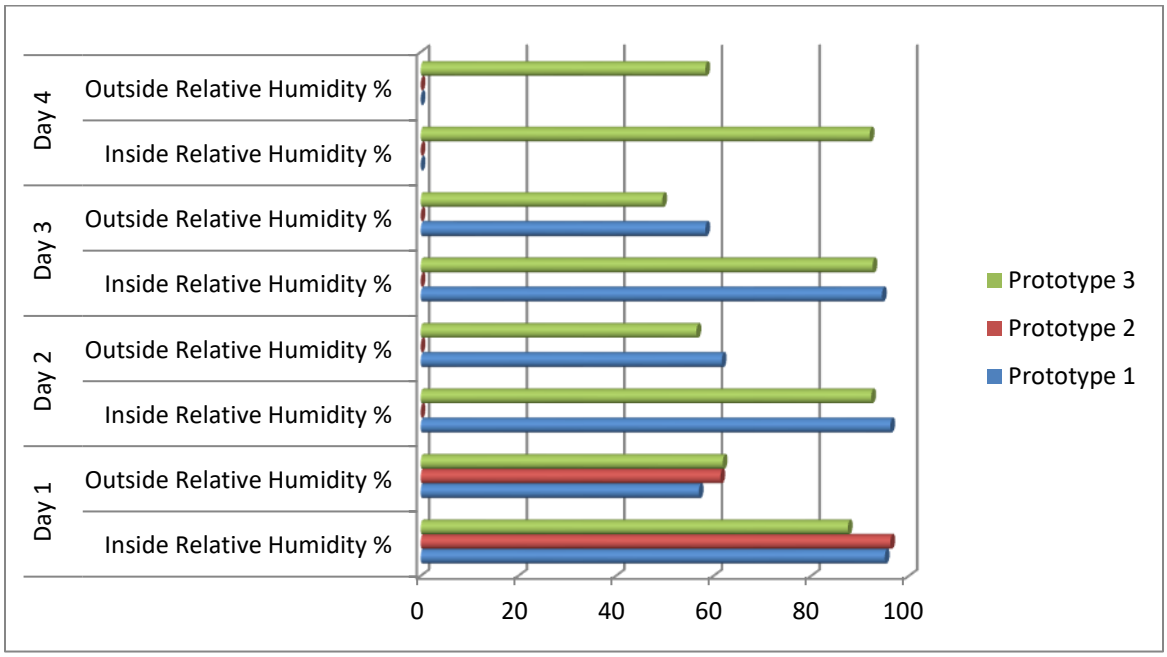


Graph 1: Weight comparison of leafy vegetables in all 3 prototypes

GRAPH 2

	Day 1		Day 2		Day 3		Day 4	
	Inside Relative Humidity %	Outside Relative Humidity %	Inside Relative Humidity %	Outside Relative Humidity %	Inside Relative Humidity %	Outside Relative Humidity %	Inside Relative Humidity %	Outside Relative Humidity %
Prototype 1	95.1	57	96.2	61.7	94.5	58.3	-	-
Prototype 2	96.2	61.4	-	-	-	-	-	-
Prototype 3	87.5	61.9	92.3	56.5	92.6	49.5	92	58.3

Table 10: Relative Humidity comparison in all 3 prototypes



Graph 2: Relative Humidity comparison in all 3 prototypes

CONCLUSION

In prototype 1 the leafy vegetables are preserved for three days without decay and without major loss in weight.

The prototype model 2 we made was not much effective than the other prototype models.

In prototype 3 the leafy vegetables are preserved for four days without decay and without major loss in weight.

From the readings we obtain in all the three prototype model, it is well known that the leafy vegetables can be preserved for 4-5 days without decay and without major loss in weight in this type of evaporative cooling setup at zero energy conservation.

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