The Andhra Agric. J 56(2):226-231, 2009

Effect of Different Gauges of Polythene Bags with Different Ventilation Levels on the Shelf Life of Kakrol (*Momordica dioica* Roxb.) Fruits

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ABSTRACT

The studies on the effect of different gauges of polythene bags (200 and 300 gauge) with different ventilation levels (0%, 0.5%, 0.75% and 1%) on the shelf life of kakrol fruits revealed that zero per cent ventilation recorded lowest physiological loss in weight irrespective of gauges. While the spoilage percentage was lower at 0.5 per cent ventilation irrespective of gauges. The TSS, titrable acidity, ascorbic acid content, reducing sugars and organoleptic score were higher at 0.5 per cent ventilation with 200 gauge polythene bags followed by 300 gauge polythene bags .There was gradual increase in physiological loss in weight and spoilage percentage with increase in days of storage. The titrable acidity, ascorbic acid content, reducing sugars and organoleptic score decreased with increase in days of storage. Whereas, TSS increased in the initial days of storage but at later stages decreased TSS.

Key words : Kakrol, Polythene gauges, Shelf life,Ventilation.

Kakrol (*Momordica dioica* Roxb.) (2n = 2x = 28) is a cucurbitaceous, dioecious perennial vegetable. The fruit of *M. dioica* is nutritious and recognized as diuretic and laxative possessing vitamin C. Fruits are used against diabeties, malaria, allergy and inflammatory problems. Fruits are also used to cure ulcers, piles, sores and obstruction of liver and spleen. It also posesses several other medicinal properties and is good for those suffering from cough and digestive problems. The unripe fruits are sweet, oily and laxative. The seeds are used for chest problems and stimulate urinary discharge. The root contains a triterpenoid saponin which can be used as substitute for soap. Vegetables are highly perishable because of their higher respiration rate. Extension of storage life of perishable fruits and vegetables can be achieved by a variety of techniques. An inexpensive way to extend shelf life is the use of modified atmosphere packaging wherein the produce is sealed in semi permeable plastic packages to enable the development of beneficial gas (CO_2) in the pack. The availability of a range of new food grade polymeric films with different permeabilities to the atmospheric gases has received the interest in packaging in sealed bags.Therefore studies were conducted to find out suitable polythene gauge and ventilation.

MATERIAL AND METHODS

In persuasion of envisaged objectives, the experiment was carried out at Agricultural Research Institute, ANGRAU, Rajendranagar, Hyderabad-30 from June 2005 to November 2006 . The experimental materials were held in the laboratory at ambient room temperature and the treatments were T_1 : 200 gauge polythene + 0% ventilation,T_2 : 200 gauge polythene + 0.5% ventilation,T_3 : 200 gauge polythene + 0.75% ventilation,T_4 : 200 gauge polythene + 1% ventilation,T_5 : 300 gauge polythene + 0% ventilation,T_6 : 300 gauge polythene + 0.5% ventilation,T_7 : 300 gauge polythene + 0.75% ventilation,T_8 : 300 gauge polythene + 1% ventilation and T_9 : Control.The experiment was laid out with 3 replications and FactorialCRD.Shelf life was studied at different intervals and following observations recorded were Physiological loss in weight,Percentage of spoilage,Total soluble solids,Titrable acidity,Ascorbic acid content, Reducing sugars and organoleptic score. The data were subjected to statistical analysis as per the procedure out lined by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

Polythene is relatively inexpensive and has several desirable physical and chemical characteristics not possessed by other packing materials. It was observed that the transmission rates of low density polyethylene (LDPE) were about three times more than high density polyethylene. Polythene was first tested and used for storage of Golden Delicious apples by Smith (1945) at America.

In the present investigation, the effect of storage in polyethylene bags of two different gauges viz., 200 and 300 with zero, 0.5, 0.75 and 1.0 per cent ventilations were studied .It was observed that storage of kakrol fruits in polythene bags reduced the PLW. At room temperature it ranged from 0.61 with 200 gauge polythene + 0% ventilation to 6.85 with control(Table 1). There was a remarkable reduction in PLW of kakrol fruits stored in zero per cent ventilated polybags in all gauges because unventilated polybags arrested moisture loss and maintained turgidity. Besides oxygen depletion, CO_2 accumulation occurs in polybags reaching equilibrium and as a result the respiration processes were slowed down. Attri *et al.* (2002) in chilli reported increase in PLW with increase in storage life.There was a direct relationship between PLW and the number of vents and an indirect relationship between PLW and gauge. Increasing gauge decreased the aeration in which the PLW was reduced. Mangal *et al.* (2001) in brinjal reported increase in PLW with increase in days of storage and percentage of ventilation.

Storage of kakrol fruits in polybags at different ventilations and gauges resulted in reduction of spoilage compared to control . The spoilage was in the form of shriveling, ripening of fruits and appearance of fungal growth especially in the control fruits followed by fruits of one per cent ventilation.

The spoilage was however high in unventilated bags in all gauges . At room temperature, it ranged from 23.11 with 200 gauge polythene + 0.5% ventilation to 44.99 with control (Table 2). The fruits become discoloured, slimy and moldy in appearance and produced off flavours and off odours at zero per cent ventilation irrespective of gauges. With zero per cent ventilated polybags increase in spoilage might be due to increased relative humidity and carbondioxide which might have favoured the growth of anaerobic organisms. Venkatesh and Venkatesh Reddy (2005) in coccinia reported that the spoilage increased with increase in days of storage and percentage of ventilation.

Fruits stored in 200 gauge polythene bags were more free from spoilage than 300 gauge polythene bags. This might be due to very high transmission rates of 200 gauge polythene bags compared to other gauges which may be presumably due to the high of gases through the film to prevent anaerobic respiration (Chadha, 2001).

The retention of total soluble solids, titrable acidity, ascorbic acid content and reducing sugars were better in polythene bags compared to control. At room temperature, the TSS ranged from 5.04 with control to 5.47 with 200 gauge polythene + 0.5 per cent ventilation (Table 3). Titrable acidity ranged from 0.075 in control to 0.088 in 200 and 300 gauge polythene with 0.5 per cent ventilation (Table 4). Ascorbic acid content ranged from 20.70 with control to 22.27 in 200 gauge polythene + 0.5 per cent ventilation (Table 5) and reducing sugars ranged from 1.58 in control to 1.81 in 200 gauge polythene + 0.5 per cent ventilation (Table 6). Within the sealed packages, a micro atmosphere developed which was saturated with water and possessed elevated CO_2 and decreased O_2 concentrations. It is well known that both these changes in atmosphere gas composition are beneficial for extending post harvest life of fruits and vegetables (Khader, 1980).

In the present study it was observed that the storage of fruits in 0.5 per cent ventilated polythene bags irrespective of gauges retained the quality to a greater extent. Deak *et al.* (1987) in sweet corn have also reported that there was better retention of total soluble solids and other quality parameters in shrink wrapped sweet corn over the unwrapped control. The soluble solids and other quality parameters of the kakrol decreased during storage and these losses were more pronounced in control fruits.

The organoleptic score of fruits stored in polythene bags was better compared to control. The organoleptic score of fruits stored in 200 gauge polythene + 0.5 percent ventilation recorded higher score. At room temperature, it ranged from 7.66 in control to 9.11 in 200 gauge polythene + 0.5 per cent ventilation. Storage of kakrol fruits in 0.5 per cent ventilated polythene bags irrespective of the gauges were organoleptically superior (Table 7). This might be due to retention of moisture which prevented shriveling and ripening of kakrol fruit. The decrease in organoleptic score during storage was due to sensitiveness of fruits to storage.

Table 1. Effect of different gauges of polythene bags and ventilation and storage on physiological loss in weight (%) of kakrol fruit at room temperature

Treatments	Days of storage				
	1 Day	3 Day	5 Day	Mean	7 Day
T_1 200gauge polythene + 0% ventilation	0.21	0.52	1.12	0.61	-
T_2 200gauge polythene + 0.5% ventilation	0.33	0.95	1.88	1.05	3.34
T_3 200gauge polythene + 0.75% ventilation	0.41	1.18	3.28	1.62	4.58
T_4 200gauge polythene + 1% ventilation	0.50	1.42	5.53	2.48	6.68
T_5 300gauge polythene + 0% ventilation	0.19	0.51	1.11	0.60	-
T_6 300gauge polythene + 0.5% ventilation	0.30	0.94	1.87	1.03	3.16
T_7 300gauge polythene + 0.75% ventilation	0.39	1.14	3.39	1.64	4.35
T_8 300gauge polythene + 1% ventilation	0.44	1.27	5.28	2.33	5.95
T_9 Control	2.12	5.94	12.46	6.85	-
Mean	0.54	1.54	3.99		3.12

	F-test	S.Ed	CD (0.05)
Treatments (T)	*	0.051	0.099
Days (D)	*	0.029	0.058
DXT	*	0.088	0.173

* Significant at 5% level of significance

Table 2. Effect of different gauges of polythene bags with different ventilation levels and days of storage on percentage of spoilage in kakrol fruit at room temperature

Treatments	Days of storage				
	1 Day	3 Day	5 Day	Mean	7 Day
T_1 200gauge polythene + 0% ventilation	0	54.44	66.09	40.17	-
T_2 200gauge polythene + 0.5% ventilation	0	26.46	42.88	23.11	67.54
T_3 200gauge polythene + 0.75% ventilation	0	29.26	47.01	25.43	70.40
T_4 200gauge polythene + 1% ventilation	0	32.54	52.40	28.32	72.26
T_5 300gauge polythene + 0% ventilation	0	56.35	69.47	41.94	-
T_6 300gauge polythene + 0.5% ventilation	0	27.54	45.58	24.37	69.11
T_7 300gauge polythene + 0.75% ventilation	0	32.43	49.32	27.25	73.15
T_8 300gauge polythene + 1% ventilation	0	34.12	53.40	29.17	77.45
T_9 Control	0	61.44	73.54	44.99	-
Mean	0	39.40	55.53		47.77

	F-test	S.Ed	CD (0.05)
Treatments (T)	*	0.198	0.389
Days (D)	*	0.114	0.224
DXT	*	0.336	0.673

* Significant at 5% level of significance

Table 3. Effect of different gauges of polythene bags with different ventilation levels and days of storage on total soluble solids of kakrol fruit at room temperature.

Treatments	Days of storage				
	1 Day	3 Day	5 Day	Mean	7 Day
T_1 200gauge polythene + 0% ventilation	5.23	6.00	4.63	5.28	-
T_2 200gauge polythene + 0.5% ventilation	5.23	6.00	5.20	5.47	3.70
T_3 200gauge polythene + 0.75% ventilation	5.23	5.77	4.87	5.28	3.47
T_4 200gauge polythene + 1% ventilation	5.23	5.70	4.77	5.23	3.07
T_5 300gauge polythene + 0% ventilation	5.23	5.97	4.63	5.27	-
T_6 300gauge polythene + 0.5% ventilation	5.23	5.87	5.17	5.42	3.57
T_7 300gauge polythene + 0.75% ventilation	5.23	5.77	4.93	5.31	3.67
T_8 300gauge polythene + 1% ventilation	5.23	5.73	4.70	5.22	3.23
T_9 Control	5.23	5.71	4.20	5.04	-
Mean	5.23	5.83	4.79		2.27

	F-test	S.Ed	CD (0.05)
Treatments (T)	*	0.053	0.103
Days (D)	*	0.029	0.059
DXT	*	0.091	0.179

* Significant at 5% level of significance

Table 4. Effect of different gauges of polythene bags with different ventilation levels and days of storage on titrable acidity (%) of kakrol fruit at room temperature

Treatments	Days of storage				
	1 Day	3 Day	5 Day	Mean	7 Day
T_1 200gauge polythene + 0% ventilation	0.123	0.094	0.056	0.091	-
T_2 200gauge polythene + 0.5% ventilation	0.127	0.094	0.064	0.095	0.034
T_3 200gauge polythene + 0.75% ventilation	0.104	0.082	0.061	0.082	0.026
T_4 200gauge polythene + 1% ventilation	0.104	0.078	0.058	0.080	0.076
T_5 300gauge polythene + 0% ventilation	0.123	0.089	0.055	0.089	-
T_6 300gauge polythene + 0.5% ventilation	0.123	0.089	0.061	0.091	0.030
T_7 300gauge polythene + 0.75% ventilation	0.104	0.082	0.058	0.081	0.022
T_8 300gauge polythene + 1% ventilation	0.104	0.079	0.058	0.080	0.018
T_9 Control	0.104	0.076	0.050	0.076	-
Mean	0.113	0.085	0.058		0.023

	F-test	S.Ed	CD (0.05)
Treatments (T)	*	0.002	0.004
Days (D)	*	0.001	0.002
DXT	*	0.003	0.006

* Significant at 5% level of significance

Table 5. Effect of different gauges of polythene bags with different ventilation levels and days of storage on ascorbic acid content (mg/100g of fruit pulp) of kakrol fruit at room temperature

Treatments	Days of storage				
	1 Day	3 Day	5 Day	Mean	7 Day
T_1 200gauge polythene + 0% ventilation	26.20	22.66	17.02	21.96	0.00
T_2 200gauge polythene + 0.5% ventilation	26.20	22.66	17.94	22.27	16.50
T_3 200gauge polythene + 0.75% ventilation	25.50	22.14	17.54	21.73	16.46
T_4 200gauge polythene + 1% ventilation	25.50	21.86	17.28	21.55	14.94
T_5 300gauge polythene + 0% ventilation	26.20	22.44	17.06	21.90	0.00
T_6 300gauge polythene + 0.5% ventilation	26.20	22.44	17.86	22.17	15.98
T_7 300gauge polythene + 0.75% ventilation	25.50	22.12	17.52	21.71	15.91
T_8 300gauge polythene + 1% ventilation	25.50	21.85	17.22	21.52	14.65
T_9 Control	24.50	21.10	16.50	20.70	0.00
Mean	25.70	22.14	17.33		10.49

	F-test	S.Ed	CD (0.05)
Treatments (T)	*	0.024	0.048
Days (D)	*	0.042	0.084
DXT	*	0.072	0.145

* Significant at 5% level of significance

Table 6. Effect of different gauges of polythene bags with different ventilation levels and days of storage on reducing sugars (%) of kakrol fruitat room temperature

Treatments	Days of storage				
	1 Day	3 Day	5 Day	Mean	7 Day
T_1 200gauge polythene + 0% ventilation	2.53	1.68	1.19	1.80	0.00
T_2 200gauge polythene + 0.5% ventilation	2.53	1.66	1.24	1.81	1.18
T_3 200gauge polythene + 0.75% ventilation	2.50	1.49	1.14	1.71	1.05
T_4 200gauge polythene + 1% ventilation	2.48	1.37	1.07	1.64	0.97
T_5 300gauge polythene + 0% ventilation	2.52	1.66	1.17	1.78	0.00
T_6 300gauge polythene + 0.5% ventilation	2.51	1.63	1.22	1.79	1.20
T_7 300gauge polythene + 0.75% ventilation	2.51	1.46	1.12	1.70	1.06
T_8 300gauge polythene + 1% ventilation	2.50	1.35	1.06	1.64	0.95
T_9 Control	2.44	1.30	0.99	1.58	0.00
Mean	2.52	1.51	1.13		0.72

	F-test	S.Ed	CD (0.05)
Treatments (T)	*	0.008	0.017
Days (D)	*	0.014	0.029
DXT	*	0.025	0.050

* Significant at 5% level of significance

Table 7. Effect of different gauges of polythene bags with different ventilation levels and days of storage on organoleptic score of kakrol fruit at room temperature

Treatments	Days of storage				
	1 Day	3 Day	5 Day	Mean	7 Day
T_1 200gauge polythene + 0% ventilation	10.0	9.0	5.7	8.22	-
T_2 200gauge polythene + 0.5% ventilation	10.0	9.0	8.3	9.11	6.3
T_3 200gauge polythene + 0.75% ventilation	10.0	8.7	7.3	8.66	4.7
T_4 200gauge polythene + 1% ventilation	10.0	8.3	7.0	8.44	4.3
T_5 300gauge polythene + 0% ventilation	10.0	9.0	5.7	8.22	-
T_6 300gauge polythene + 0.5% ventilation	10.0	9.0	8.0	9.00	5.7
T_7 300gauge polythene + 0.75% ventilation	10.0	8.7	7.3	8.66	4.0
T_8 300gauge polythene + 1% ventilation	10.0	8.0	7.0	8.33	3.7
T_9 Control	10.0	7.7	5.3	7.66	0.0
Mean	10.0	8.6	6.9		3.2

	F-test	S.Ed	CD (0.05)
Treatments (T)	*	0.276	0.513
Days (D)	*	0.151	0.296
DXT	*	0.453	0.889

* Significant at 5% level of significance

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(Received on 15.10.2008 and revised on 12.11.2008)