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Development of Optimized Perforated Area Based MA Packages for Tomatoes and Guava

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Abstract

For retail size MA package, optimized the area of % perforation (guava- 0.0019% and tomatoes-0.0040%) for achieving the recommended level of gas composition for prolonged storage of guava and tomatoes. Storage study of guava and tomatoes in retail size MA packaging reveled that tomatoes in perforated package can be stored up to 28 days and 45 days and guava up to 9 days and 20 days at 25 and 10ºC, respectively. This technology solved the constraints of non-availability of perm selective films for fresh produce packaging applications with low cost and simplicity in performance to enhance the shelf life of commodities.

Introduction

MA packaging of fresh produce constitutes a dynamic system during which the gas transmission through the polymeric films and respiration of the fresh produce takes place simultaneously. The design of MA packaging is highly important to achieve the desired dynamic gas equilibrium condition to maintain quality and extend shelf life of the products [1-3]. The main constraints in MA packaging is that most of the films available for packaging does not meet the permeability requirement of the MA packaging of fresh produce. There are many options like active packaging using different sachets, gas flushing, development of oxygen tailored films which involves additional infrastructures/facilities, cost and skills. Whereas as the MA packaging system has been considered advantageous to other techniques because it involves low cost and simplicity in operations to enhance the shelf life of commodities especially for developing country like India [4,5]. Hence for retail size MA packaging of tomatoes and guava, the area of perforations was optimized for gas transmission so that the desired level of oxygen and carbon dioxide concentrations are achieved during the storage periods to reduce the overall metabolic processes and maintain quality for longer period [6-8].

Materials and Methods

The package size of 25x22cm and 18x16cm having fill weight of 1kg was found suitable for MA packaging of tomatoes and guava, respectively using 60µ (LDPE+LLDPE) plastic films. To attain the required gas compositions inside the modified atmosphere packages, the area of perforation was varied from 0.0010-0.0070% using 0.45mm needle. The MA packages were kept for storage study at ambient (25 ºC) and 10 ºC (Figure 1) and the quality parameters were measured at regular intervals.

Figure 1: MAP with optimized area of perforation at 0 days and 28 days.

Developed a retail size MA packages for tomatoes and guava, with optimized area of perforations for gas transmission so that the desired level of oxygen and carbon dioxide concentrations are achieved during the storage periods to reduce the overall metabolic processes and maintain quality for longer period. The package size of 25x22cm and 18x16cm having fill weight of 1 kg was found suitable for MA packaging of tomatoes and guava, respectively using 60µ (LDPE+ LLDPE) plastic films. To attain the required gas compositions inside the MAP, the area of perforation was varied from 0.0010-0.0070%.

Results and Discussions

MA packages having perforation area of 0.001%, 0.0019%, 0.0032%, 0.0040%, 0.0051%, 0.0063%, and 0.0073 % attained

the final gas composition of O2 and CO2 as 1.8, 11.00; 4.5, 6.2; 7.4, 6.1; 11.3, 5.5; 13.4, 5.3; 15.6, 4.8 and 17.8, 2.1, respectively. Hence it was found that 0.0019% area of perforation maintained the required gas concentration of 4.5 % oxygen and 6.2% carbon dioxide inside the package during storage. The perforation areas of 0.0019-0.0070% MA packages were successful in maintaining the quality of the tomatoes. However the best quality was maintained in MA package of 0.0019% area of perforation up to 28 days and 45 days as compare to control and other perforated films at ambient and 10ºC temperatures, respectively as shown in Table 1. Similar levels of perforations were done for MA packaged guava and storage study was carried out. It was found that 0.0040% area of perforation maintained the required gas concentration of 5.1 % oxygen and 4.2 % carbon dioxide inside the package during the storage. All the packages except 0.001 and 0.0019% area of perforation maintained the quality of guava but best quality was maintained at 0.004% area perforated MA packaging (a*= -4.3, firmness = 170.36, PWL (%)=1.25) as compared to control sample as shown in Table 2. This package maintained the quality of guava up to 8-9 days and 20 days at ambient (25ºC) and 10ºC, respectively as shown in Figure 1. Similar results were found by Mangaraj et al. [3] Babitha & Kiranmayi [9], Arazuri et al. [10].

Table 1: Variations in quality parameters of tomatoes in perforated MA Packages.

Perforated area in MAP	a*			Firmness (N)			PLW (%)			TSS		
	0 days	28 days at 25 ºC	45days at 10 ºC	0 days	28 days at 25 ºC	45days at 10 ºC	0 days	28 days at 25 ºC	45days at 10 ºC	0 days	28 days at 25 ºC	45days at 10 ºC
P2	-10.93	-5.67	-4.34	100.69	72.13	69.14	0	1.7	1.7	3.9	4.5	4.8
P3	-10.93	-3.24	-2.13	100.69	65.67	63.56	0	1.7	1.8	3.9	4.5	4.8
P4	-10.93	-2.95	1.23	100.69	62.13	59.1	0	1.8	1.8	3.9	4.6	4.8
P5	-10.93	4.35	5.45	100.69	61.02	57.43	0	1.9	1.9	3.9	4.7	4.9
P6	-10.93	9.03	13.42	100.69	58.34	55.61	0	2	1.9	3.9	4.7	4.9
P7	-10.93	15.06	18.9	100.69	55.97	53.14	0	2.1	2.1	3.9	4.8	5
CS	-10.93			100.69			0			3.9		

Table 2: Variations in quality parameters of guava in perforated MA Packages

Perforated area in MAP	a*			Firmness (N)			PLW (%)			TSS		
	0 days	09 days at 25 ºC	20 days at 10 ºC	0 days	09 days at 25 ºC	20 days at 10 ºC	0 days	09 days at 25 ºC	20 days at 10 ºC	0 days	09 days at 25 ºC	20 days at 10 ºC
P3	-18.9	-4.34	-3.34	298.13	220.45	167.34	0	1.25	1.45	9.2	10	10.4
P4	-18.9	-3.31	-2.21	298.13	201.28	155.34	0	1.26	1.46	9.2	10.1	10.5
P5	-18.9	-2.65	-1.98	298.13	194.56	125.44	0	1.25	1.47	9.2	10.2	10.5
P6	-18.9	2.12	3.89	298.13	184.56	120.45	0	1.26	1.5	9.2	10.4	10.6
P7	-18.9	5.21	6.71	298.13	174.9	115.62	0	1.23	1.52	9.2	10.4	110.7
CS	-18.9			298.13	57.21		0			9.2		

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