"نهال و بذر"
جلد ۲۳ ، شماره ۱، سال ۱۳۸٦

حفظ کیفیت و افزایش عمر انباری سیب محلی گلاب کهنز با استفاده از روش بسته‌بندی در اتمسفر تعدیل یافته*

Maintaining of Quality and Extending Storability of Iranian Local Apple Golab Kohanz by Modified Atmosphere Packaging

!"#$ %ا'"   (" "

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چکیده

مستوفی، ی.، سید حاجی زاده، ح.، طلائی، ع.، ابراهیم‌زاده موسوی، م. ع. ۱۳۸۶. 1 0 / !.'- ا,+ +) * (* 4* 3 20*.* *
+ 5 $#) + 8 $ 78 '6' !# 9 نهال و بذر ;:› ==<@?9

یکی از عوامل مؤثر در کاهش عمر انباری سیب وجود اتیلن در محیط نگهداری میوه است. به منظـور حفـظ کیفیت و افزایش عمر انباری سیب‌های زودرس گلاب کهنز آزمایشی به صورت اسپلیت فاکتوریل در قالب طرح پایه کاملاً تصادفی با چهار تکرار انجام شد. تیمارها شامل سه دمای متفـاوت (۱، ۴ و ۲۰ درجـه سـانتی‌گـراد)، دو ترکیب گازی (ترکیب گازی اول: (O_2 ٪۳ + CO_2 ٪۲) و ترکیب گازی دوم: (O_2 ٪۱ + CO_2 ٪۴) و دو نوع پوشش (پلی‌اتیلن و پلی‌پروپیلن) بود. در طول مدت نگهداری در هر چهارده روز یک بار پارامترهـایی از قبیـل سـفتی بافت، مقدار مواد جامد محلول، pH ، EC ، شاخص طعم میوه، اسیدیته قابـل تیتراسـیون و مقـدار تولیـد اتـیلن اندازه‌گیری شد. نتایج آزمایش‌ها نشان داد که مقدار تولید اتـیلن در دمـای ۱ درجـه سـانتی‌گـراد کمتـر بـود. میوه‌های بسته‌بندی شده در ۱ درجه سانتی‌گراد، ترکیب گازی دوم و پوشش پلی‌پروپیلن، مواد جامـد محلـول، اسیدیته قابل تیتراسیون، طعم و سفتی خود را بهتر از سایر تیمارها حفظ کردند. در طول دوره انبـارداری مقـدار pH و طعم میوه روند افزایشی و مقدار مواد جامد محلول و اسیدیته قابل تیتراسیون روند کاهشی نشان داد و این تغییرات نسبت به میوه‌های شاهد با سرعت کمتری اتفاق افتاد. اعمال تیمارهای مختلف نشان داد که بسته بنـدی در اتمسفر تعدیل یافته باعث افزایش ماندگاری و کندتر شدن سرعت نرم شـدن میـوه در مقایسـه بـا میـوه‌هـای شاهد شد.

واژه‌های کلیدی: سیب گلاب کهنز، بسته‌بندی در اتمسفر تعدیل یافته، اتیلن، کیفیت، عمر انباری.

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* $C # B'A ا #0 (Fا+ ا E +4 D,ا 9

مقدمه

* S+ " " I ("4)
5+ * / I*0 / *C S / B +
* 9 * + * T'+ *8 6*,C (* L AS
*U *0 *+ " + (7# E C+
* .* (+ $* #*P *2 5 #$*4 AS
- X 9 "P / I0 (HV G+"W
* (+ I*0 GY"Z* 2 "*8 6 C
[*W * *0 * 8 *P D* * +
6*'Y * "*P * * \"8] * #X (* *2
+ **^ [Z** **8 ** \"8 **U ^+] ** #X
%*B G 7' * + *H 9 "*P * G 7' *
* *8 (* (.,* * "* + / *P
* F#$* *0 / P b X8 a:`>?_
%*B G (c"\" d8 eV L"Z f"
g*7 (Wills *et al.*, 1981) + / *P
(* N" 7 ") 4 ! ("
#**P (#I** (+ **2F / ** C **0 b**'
"*P * / *P A + 6,C P
9 ILiu and Samelson 1986 kj ;@` * !i
1* + + * 2 - *H .*) * (#$
GY"Z* / P %B (+ 4 / 0
** 0 ** ** ' m**' "8 ** n L"** + **8
O_2 / o D - 0 9(Samogyi *et al.*, 1990)
(* #$* $* 8 + CO_2 / *o D - ' .*!
/ *** \ 7! $*** \" # L"Z*** (***
+ *C pq*8 / 8 $! 6 ($ 4+ d
**' (+ **2F / ** C) ** 8 8 b' ** **#! 4
- ' .*! L"Z* / *P %*B (+ 4 *

+ *\ (* - r*B 9(Kays, 1997) * '
A I** **#! ' 6' **78 $** 8 **p +"**
*#! ' 6' *78 $* 8 s' *P + *0 ')
' * AS *8 #$* S "*P * (* #$*
"*P * E * #$* (* ("* + *0
A + *d *^ + 9(Maarten *et al.*, 2001)
*0 * 0 + *2t (Rocha *et al.*, 2004)
$* 8 s' *P + *P (* #$* (*) *
u *+ / * * 0 A *#! ' 6' *78
(* "* / ,$ + "U # #P (#2
A"$* 4 9 * 0 1* *#2 " + P + ,
* 0 / p (Geeson *et al.*, 1994) A + d
*P (+ *2F Cox (*) * # * *0
(** + + := G ** ** "** v **7 +
b8"* := * b8"* ; j 4 # + j`
(** "** + **0 \ ** + / **! ' - **0
**** a` CO_2 v ***7 + ***P (+ ***2F
9 / *! ' - *0 b8"** ;_ * a j_ *8 ;w` O_2
*0 * 0 A * (Salunhke and Wu, 1973)
* C ("# + x8 #! ' 6' 78 $ 8
.* ' 9 * * Uq*8 * + / *! u *+
0 #! '+ . (Wills *et al.*, 1981) A + d
$* #B (+ #! ' 6' 78 $ 8 + (#$
9 / * $*! A A / * - 0 (
(Nakhasi *et al.*, 1991) A + *d * U
L"** + #' ** + **H **0 ** 0 A **
- *0 b*' * ' * - *0 (+ + , G
8 *** 0 ***P (*** "*** *** $***' H +
A + ***d (*** *** 4 *** G+"***W

2 I* z' *#ﾉ * .*ﾉ (Jeffery *et al.*, 1984)
* (+*,ﾉ *0 / * *P / * p9 *#! ' / *
$* 8 + (* #$* *P L *#0 $* 8
/ *P %*B (+4 ﾉ ﾉ"8 #! ' 6' 78
* (.,* *' P 7VC 7VC (" (+ $
"*' ﾉ * (O'Bieme, 1990)) * ﾉ +
(Agar *et al.*,1999) (" 0 (Qi *et al.*,1999)
* 4 (Gorny *et al.*, 1999) 6 *P "*
(Gil *et al.*,1996)+ ﾉ (Gorny *et al.*, 2000)
A (Jobling, 2001) u 9 - ' .! +
L"Z* / $* CO_2 ' ' H 0 0
- *0 {* .*ﾉ - *0 b *8 +
.,* u *ﾉ+ L"|$* *0 6* ! 0 b#*!+ / *
b*' [* 9 "*P * / (., "
3 *4) * * C+ / 0 1 - rB
G * * AS * U (+ + . 20
+ (* #$* 5 + #* * *8 ﾉY"*
b*' "*P } XI* *8 "* *#! ' 6' 78 $ 8
L"Z** A"** B $** 8 6' **78 ** 5 +
"** #** * / ,$*ﾉ (#I* / * +
+ A . ﾉ"*' (* - *8 *ﾉ+ 2Fﾉ ' *P
9 + L"Z G7' - 0

مواد و روش‌ها

$* 8 + (* #$* pq*8 * + (*
+ L"* +] * #X (* + 8 #! ' 6' 78
(+*,ﾉ - ' .! / 0 1 (+ 2Fﾉ
L * + I' S . 20 3 4) ﾉ ' C+
* 2 *4 ﾉ *,D E" 4 + j;?;
(+ I**0 d I**ﾉ 'K**D m' **W E"**

"* - r*B b*' + 9 P E nﾉ A 28 FIﾉ
*HV Z! '"H8 "8 . 20 3 4 C+
+ D* j;?; L n B T'+ 8 +
+ "**^ (** **,7 + / **P **ﾉ
+ *,ﾉ 4 #ﾉ + ~ \ (+ ﾉU
•*H 8 E *nﾉ [* *0 b*' "8 9 P
(+ *0 #* * (* ,
€ * * " / P A K\ " . ﾉ z' #ﾉ
*7 + ?` h,' H8 0 A + D b L" 7 A
* * "* P 3 X#ﾉ / 64 E 8
** #! 4 + **C + ** 8 +"** A ** . +"**
+ 9 ﾉ *P (* 4 *ﾉ *oﾉ +"* (* +"#0 !
• *^"0 + $* (*) * (* #$* E *F
* 0 8 / *!S *' + ﾉ # D
(+ \ h 0 ( ) P • d 8
] * #X (+ 8 L (4 "\S ﾉ"4
"* - Pi P 3 X#ﾉ (" 9 ﾉ P 3 X#ﾉ
6*U + I / *U " d' h*,' H8 *t *ﾉ *
b B *B * B b *8 * B d # B (- P"B
* + * " A + C %B 9 ﾉ P + C
(* #$* F#* #* #$ - P"B
/ 0 ****P / U **** :__ A L **** i E"**** 0
] #X (4) 0 8 I Henkelman
, a; O_2 , a=` N_2 L (**4) ** 0 8 6 **P
, aj O_2 , a=` N_2 E (4) 0 8 a: CO_2
(* - *P"B * %/* *P *B a~ CO_2
• * 8 "8 +" F# "U s "8 d # B
(* #$* E *nﾉ %*B 9 *P (Sealed) #$*
* + :_ ~ ji ' * + * 8 * + * #$*

0 b' *U * 9 & *P + CI 4 #&
… *8 \"* 7 (* + *#! 4 + *C (* "*
- ' * S \ 6 + I 4 #& + :_i
* 6* 8 *'.n8 + K*\ * #!+ b
* .*& *P • *' + 9 I& # AS
6 *P *P 9 *P *#! 4 *o& + + *d8 + *2^
) * 0 8 A - P"B A 0 " ')
* + & U * ,$*& / * " + 9 *& " (*4
) * 0 8 + *2^ * * + 9 *P 1* a?`>=_
eV* - **P"B eV** 6 **P (+ ** 8
+ *2^ * • *' * *P • *' (4) 0 8
/ $* * * +) 8 8 b' 9 / P + C + d8
.*& I*' S * * + I*' S *
G+"*W * † * 9 *P + *C #$* / *
) * 0 8 * 6*'+"#0 ! / ƒ* - ' * S
h *0 *' B † * * *P + * 8 * (+ 8
(*) * 9 *P * + *d8 + *2^ * ! Z8
*** *** + #$*** 6***U + "*** "
• *' + + *2^ * W ! 0 (+ &" &
d # B (- P"B 6U P E n& +
* 0 G W o& FI' S + P ‡+ U
9 #! 4 + C ' + + +" ' 0
b 8 \"8 + H (4 & (اتیلن:
* #$* * 6*U + "* " ("
(*4 & %B P 3 X#& ! Z8 +"
d #* B (* [*t 6*U + *n A
%B 9 & P + C E"#ƒ .2n ^ "ZX
[*t (Y * *4 *&" & • *' / :~
(* *\"\ * (A " s "8 d # B

(*#\ j_ (Venoject) ‰ U / 8 (I P
6*U *4 *#\ • ' + H P I0
* (* 4 *&" & u & * s* "8 * / *d "&
L ** (GC) (**4 [4"8 ** 0 F#**
4 A " Ac #& 4 9 P •'+.8 .8 P
A"#* •*'+.8 - X (9 P # 6
** + j :_ j__ jj_) ** 8 8 ** +"**#d#'
*#\ d € * \"8 + H 9 " 4 #&
9 P A / + E 4" 0 +
+"* * "* • ' + 0 b' (سفتی میوه:
/ * "B 3 X#& I' S ! Z8
/ *2 + *2^ * + AS ' "# / $C + "
*P * m* # #& * • *' ,' H8 &
z * Š" & F#* # " # %ƒ
/ 0 ***P / U *** FT L *** Penetrometer i
) $*** (** 4 **& I **d' Wagner
9 ' 4 / P 'm # #& E 4" 0
(*** :(TA) اسـیدیته قابـل تیتراسـیون
+"* * "* * #' * + *H (* 4 &
+ Z* 3 X#& I' S ! Z8
j_ %ƒ** 9 **' 4 [**W **P ** 28 E Y
(* •* C+ (#P + + Z #\
(* 9 *P ! * AS * *VH 3S =_
* 3S + *P • C+ + Z 60 #' b 78
*F 9 *P # 8 L &_wj ' $0 +
6** ** + ?wj>?w: ** L"** pH **0
/ *,p ! Z* "* + *H] *C"# A" # 8
,* *' L"* ! # #' 9 P
9 ' 4 A W+) $

#' W+ Œ " #\ ﻻ‹)\D AY 0‹ ! Z " + H ‹ j__
" 3S n ‹ j__

6*0 L"* * "* (*4 *ﻻ (
(TSS) F#*** !+ "***#0 # *** RF40 L
#*** ***P EC 9 pH + Z*** "*** ***
Sartorius i *# pH F#* #* * .*ﻻ
$***** " z ***** EC lPP-20 L *****
+ *C (*4 *ﻻ +" lMetrohm 644 L i
9 / ! 4

شاخص طعم میـوه (TSS/TA): *7 } U *P
#' * * 6*0 L"* * " / ,$ﻻ "
%*B AS ,* (* 9 / * A" # 8 6 C
#' * 6*0 L"* * " (4 ﻻ
A "'* * TSS/TA $*0 6W A" # 8 6 C
9 / ! 4 + C ' + +" " 7 } U P
* *P) *8 (+ Sm* %B
%/* ﻻ P - ' S #\ ﻻ A" S #
6' *,8 6* L * ﻻ D (* (+ *
(* (* *0 G+"*W b' * 9 *P E *nﻻ
6' *,8 \d' + ' I'+ 6' ,8 (
(W+ (((Log x) #'+ F\
9 P # l$\arcsin\sqrt{x}$, _W`i ' 6' ,8
#* * ﻻ P L ﻻ 0 b' %B
*'.n8 +" MSTATC SAS (+ .! E ﻻ
b Fﻻ $' H #! 4 + C 6 8
9 P E nﻻ bdﻻ (^ A" S

توضیح تیمارهای مختلف

~ (‹T2 4 #ﻻ + j (‹T1
‹P2 b *8 * B - *P"B ‹P1 4 #ﻻ +
‹L (*4) * 0 8‹G1 b B *B * B - P"B
‹E (***4) *** 0 8 G2 a; O_2 , a: CO_2
9 aj O_2 , a~ CO_2

نتایج و بحث

اتیلن

+ b *8 (4 ﻻ 6W z' #ﻻ +
A I*ﻻ] * #X (A + - ' S L"
[#**U (** 4 **ﻻ (** A ** b ** **0
+ ~: 8 0 (+" / P " (+ 7
* \"8 + *H + (* x8 • * (+ + *,ﻻ %B
+ `Ž h * *0 \ + Iﻻ I b 8
- ' .*! b *8 * \"8 + *H (+ + *,ﻻ %B
6*W z' #ﻻ 9Ij L i / ! ' - 0 +
\"8 (Peak) ‡ 0 A Iﻻ - rB b'
%*B + `Ž h * . 20 3 4) + b 8
(* ' ! $* *#! * … 8 (+ + ,ﻻ
* "* / * 0 - 0 n 0 d\" #
%*B + `Ž h,' H8 "P AS (+ 5 +
* \"8 + Uq*8 b*' 9 "P DS (+ + ,ﻻ
9 "*P " (+ 4 ﻻ - ' .! n b 8
*0 "*P * I* .* ﻻ 6* H# p + +
L (4) 0 8 + P (#$ ("
.* ﻻ I: L * i *4 #ﻻ * * + ~ (*
b *8 * B - *P"B + P (#$ ("
(#I* b *8 I; L * i L (*4) * 0 8
% 8 n #ﻻ + lY # b' 0 ﻻ 0 \"8

$*' H 9 / * *P *0Š s' *P + " #I
6' *78 $* 8 + (* #$] #X (+ 8
- *P"B + 8 0 A I P (MAP) #! '
+ * 8 L (*4) * 0 8 * * b *8 B
E (*4) * 0 8 b B B B - P"B
- *P"B + * 8 *4 # * * + j (+
- *P"B L (*4) *0 8 b B *B *B
(+ E (4) 0 8 b B B B

+ (# 0 b 8 \"8 + H 4 # + ~
9I ~ L * i #*P *P (* + 8 * $' H
(*4 (*) * 0 8 p 0 + o b ^
G * # d #* B (- P"B] #X
+"* A #P V + ("4
- *0+ 6* " b' *p "*P * I* 0
*p *8 *2 b *8 * \"8 (4"* *'
9 /

. 20 3 4) " # TSS/TA TSS TA pH b 8 \"8 (+ + , A p >j L

Table 1. The effect of storage time on ethylene production, pH, TA, TSS, TSS/TA and fruit firmness of Golab Kohanz apple

A • Time (days)	TSS/TA	L" TSS (° Brix)	" A" TA (%)	# 8 6 C #' pH	#' b 8 \"8 Ethylene production ($\mu L^{-1}Kg^{-1}h^{-1}$)	" •# Fruit firmness ($kgcm^{-2}$)
14	60.0 b	11.50 a	0.191 a	4.69 b	0.100 b	2.57 a
28	59.9 b	11.45 ab	0.194 a	4.60 c	1.090 b	2.50 ab
42	61.8 ab	11.38 ab	0.186 b	4.42 d	0.085 b	2.10 c
56	63.5 a	11.15 bc	0.175 c	4.59 c	0.115 a	1.90 c
70	63.7 a	11.00 c	0.176 c	4.99 a	0.110 ab	1.80 c

9Ibd (^A" Si + (+ 7 [#U (+ S o A"# + I [(b F

Means followed by similar letters in each column are not significantly different (Duncan's Multiple Range Test).
TSS: Total Soluble Solids TA: Tetrable Acidily

" •# b 8 \"8 + H] #X ' 4 ( ) ' 8 6 H# p b F $' H >: L

Table 2. Mean comparison of interactions between temperature and different gas mixtures on ethylene production and fruit firmness

+ 8 Treatments	b 8 \"8 + H Ethylene production ($\mu L^{-1}Kg^{-1}h^{-1}$)	" # Fruit firmness ($Kgcm^{-2}$)
T1G1	0.092 b	2.00 bc
T1G2	0.093 b	2.20 b
T2C1	0.121 a	1.75 c
T2G2	0.094 b	2.75 a

9Ibd (^A" Si + (+ 7 [#U (+ S o A"# + I [(b F

Means followed by similar letters in each column are not significantly different (Duncan's Multiple Range Test).
T1: 1° C T2: 4° C
G1: 2% CO_2 + 3% O_2 G2: 4% CO_2 + 1% O_2

EC b 8 \"8+ H] #X ' 4 ( ) ' 8 - P"B 6 H# p b Fﻟ $' H >; L

Table 3. The mean comparison interactions between film and different gas mixtures on ethylene production and EC

+ 8 Treatments	b 8 \"8+ H Ethylene production ($\mu L^{-1} Kg^{-1} h^{-1}$)	d' #d\ / ' EC (dsm^{-1})
P1G1	0.11 a	3.28 a
P1G2	0.07 b	3.20 a
P2G1	0.08 b	3.19 a
P2G2	0.09 b	3.06 b

9Ibdﻟ (^A" Si ﻟ+ ﻟ(+ 7 [#U (+ S oﻟ A"# + I [(b Fﻟ

Means followed by similar letters in each column are not significantly different (Duncan's Multiple Range Test).

P1: Polyethylene P2: Polypropylene

G1: 2% CO_2 + 3% O_2 G2: 4% CO_2 + 1% O_2

هدایت الکتریکی (EC)

*p (+ * S *'.n8 6*W z' *#ﻟ * +

(*4] * #X (*) * ' 8 - *P"B 6* H#

*W+ + *H b' *# 0 0 A IﻟI; L i

- *P"B + * 8 * "* *d' #d\ / ' *

* b ^9 / E (4) 0 8 b B B B

b B *B * B #I* ('K*BŠ" ﻟ 0 + oﻟ

* / ,$*ﻟ AS *# 0 / X* 4 / ,$ﻟ

3"* V $* 8 1 + (#I pq8 b 8 B

(* B 4 * + b#U *ﻟ Uq*8 * (*

9 / #P \" (ID) ' X8

pH

0 A IﻟjL 6W z' #ﻟ +

+ *H *oﻟ (4 ﻟ] #X (A b

(+"* 9 / P " (+ 7 [#U pH

~wŽ (+ + *,ﻟ %B +@_ pH + H 0

+ (**2#ﻟ + ~w= ** - ' ** S f **P +

** "** 8+ **, ** **' ** + (+ + **,ﻟ

(* - ' * S z' *#ﻟ z' #ﻟ b' 9 ﻟ P 8b' P

A + ***d \"***0 + s*** "8 ***P E ***nﻟ

*ﻟ 0 A * *0 (Rocculi *et al.*, 2004)

*0 *P 7VC 7VC . I \ A 4 C+ ( )

+ G * * *#! ' 6' 78 $ 8 s' P +

pH *P (* "* $' H + #! 4 + C

1* *#2 + "*U * 0 G W"Z*U ' *

(+ 8 $' H b " 9 + / H V ﻟ 0

+ * 8 *0 A I*ﻟ *P * MAP] * #X

+ E (*4) * 0 8 b B *B * B - *P"B

(*# 0 G * x8 *4 #ﻟ + ~ j (

*0 / *P ' * "* * $*' H + pH oﻟ

*oﻟ * b * ^9I~ L i ﻟ " Iﻟ (#$

(* #$*] #X (+ 8 L 0 +

1* + (*' 6 $ﻟ #B #! ' 6' 78 $ 8 +

/ * #P P (" / ,$ﻟ " pH

b*' * * b B *B * B - *P"B #

+ *P *n' $* 8 1* + (4) 0 8

- ' .*! (4"* +"*o * #$* 6*U

(* '.*ﻟS #I* / * \ 7! "* % *8 G P

- *P"B 8 p•* \" * + "*' 0 '.n8

9 / " b 8 B

G # (+ P #! ' 6' 78 $ 8 + (#$] #X (+ 8 b F\ $' H >~ L

. 2' 3 4) " •# TA - pH b 8 \"8 + H o\ (+ + ,\

Table 4. Mean comparison between different modified atmosphere packaging storage temperatures for fruit firmness, TA, pH and ethylene production of Golab Kohanz apple

+ 8	" •#		A" #8 6 C #'		#'		b 8 \"8	
Treatments	Fruit firmness ($Kgcm^{-1}$)		TA (%)		pH		Ethylene production ($\mu L^{-1}Kg^{-1}h^{-1}$)	
	T2	T1	T2	T1	T2	T1	T2	T1
P1G1	2.5 ab	2.2 abc	0.183 bc	0.182 bc	4.63 ab	4.66 a	0.110 abc	0.07 c
P1G2	1.5 c	2.0 bc	0.186 abc	0.183 bc	4.61 abc	4.58 abc	0.115 abc	0.09 bc
P2G1	1.9 bc	2.0 bc	0.177 c	0.190 abc	4.63 ab	4.55 bc	0.08 bc	0.11 abc
P2G2	2.9 a	2.5 ab	0.190 abc	0.193 ab	4.50 c	4.47 d	0.067 c	0.07 c
Control	1.6 c	1.5 c	0.178 c	0.170 d	4.67 a	4.65 ab	0.140 a	0.12 ab

9 I b d \ (^ A" Si \+ \ (+ 7 [#U (+ S o\ A"# + I [(b F\

Means followed by similar letters in each column are not significantly different (Duncan's Multiple Range Test).
T1: 1° C T2: 4° C P1: Polyethylene P2: Polypropylene
G1: 2% CO_2 + 3% O_2 G2: 4% CO_2 + 1% O

مواد جامد محلول (TSS)

' * A * b * *0 A I*\ z' *#\ •* +
* "* + *H *o\ (*4 \ ] #X
* 9 / *P "* (+ * 7 [#*U L"*
f ***P + j j w~= AS + ***H ***0 (+"***
(+ ***2F\ + (***2#\ + j j *** - ' *** S
z' ***#\ *** z' ***#\ b***' 9 I j L *** i *** +
d\Y ** - ' ** S ** S / ** **
*\ ' A * ** (Salunhke and Wu, 1973)
* C ("# + x8 #! ' 6' 78 $ 8
/ *H V *\ * Uq*8 * + / *! u\+
+) * % *8 G *P *0 b*' "* 9 +
(* + 8 L * * ^ "ZU b ' B (
- *0 + $* d #* B (* - *P"B (4
G * + L"* * "* - *0 * '
* 'S ! + AS [Z p +) (+ 2F\
9 / % 8 d \" #

اسیدیته قابل تیتراسیون (TA)

* b F\ * $*' H 6*W z' *#\ +
(*4 *\ ] #X (A b 0 A I\
G * 8 A" * #8 6* C #' * + *H *o\
AS + H 0 (+" / P " (+ 7
(*2#\ + _wj@ * - ' * S f *P + _wj=
6* C #' * + *H 9 I j L i + - ' S
pH * * F#$*, "8 . \ A" # 8
G * * + + - *0 *\ + • *' + Z*
* z' *#\ * z' *#\ b*' 9 * A I*\ (+ + *,\
A + *d U \ (- ' S S /
+ *H \ 0 A ' (Nakhasi *et al.*, 1991)
* ' - 0 (+ + ,\ G L" + #'
+ *P (* #$* (* "* + - 0 b'
*P (* " $' H + #! ' 6' 78 $ 8
(* 9 + / H V 4 G+"W 8 0
z' *#\ * . * \ (Jeffery *et al.*, 1984) A + d

(0 + ol 9 #!' / 2 I
* ^"Z*U *) +Z + " " \S
G L" + / ")\D 0 • \
$* 8 /*\7! *p + +*,l +) * (+ 2Fl
I* b ” 9 ' - 0 P [Z
-*P"B+* 8+ "* #' * + *H *0 *P
#I* 4 #l + j (b B B B
*P l * b*' *0 /* "* + 8 '
$* 8 b'*B (* + " % 8 0G P
b B *B *B -*P"B *p + P n' 3"V
]*#X (* + 8 $*' H 9I`L * i /*
-*P"B * *0 A I*l *P * MAP
*P +0 (4 ( ) 0 8 d# B

#' * 1* + *4 #l + j (+
+* 8 *4 #l* * + ~ (* 8 p•*
* z' *#l * z' *#l b*' 9I~L * i l " P
A+**d ** Ul - r**B **S /**
+ *H l 0A ‘ (Nakhasi *et al*., 1991)
* ' - 0 (+ +,l G L" + #'
+ *P (* #$* (* "* + - 0 b'
(* "* * $*' H + *#! '6' *78 $* 8
9 + /*H V *4 * G+"*W 8 0 P
* + j (* *0 * + * *ol * b*^
G *P - *0+ (*8 *2 -*Hl *4 #l*
"* * 0 ^ "*U x8 (4" % 8
9/ #P

A" #8 6 C #' + H (+] #X d# B (-P"B 6 H# p >`L

Table 5. Interaction between temperature and different plastic films on titrable acidity

+ 8 Treatments	T1P1	T1P2	T2P1	T2P2
TA (%)	0.182 b	0.191 a	0.185 b	0.184 b

9Ibdl (^A" Si l+ l (+ 7 [#U (+ S ol A"# + I [(bFl

Means followed by similar letters in each column are not significantly different (Duncan's Multiple Range Test).
T1: 1° C T2: 4° C
P1: Polyethylene P2: Polypropylene

شاخص طعم میوه (TSS/TA)

6* C #' * * L"* * "* /,$l
A"* * / " 7 Fl 0A" #8
pq*8 /* 8 "P #! 4 ol+ 7 }UP
+ *0 (+"* * /*! 4+ *C (+ +,l +
+ *H lU * +) (+ 2FlG L"
\ /!' - *0L" " #'
n#l+ " #I* #' - 0+ H A"^

8+, ' /!' -'.! " 7 }UP
AS+ H 0 (+" 9 l P 8b' P "
+ A*'B+ Ž;W~ * -'* Sf *P+ Ž_
9IjL i + (+ +,l

سفتی میوه

#* (*4 *l 6*W z' #l +
A I*l (+ +*,l]*#X (* A + "
(+ +*,l + L"* + " # + H 0

m* # #l E 4" 0_w@` l z'+ 8
j L * * * "8 * * /* *#! ' - *0
3 *4) * + # * - *0 + *H b' #I
7' " (+ + ,l %B + `Ž h,' H8 . 20
+ b *8 * \"8 + *H *0 l • V h,' H8
H#$ V + / \Y b' 9 / ! ' - ' .! AS
* - *0 b 8 \"8 - ' .! b " "
(* "* + (+ + *,l + L"* + "
/ ,$l ' b 8 \"8 6 \ Il (#$
b*' 9 l P E l 8m' P (#$ ("
(* - r*B * S / * * z' *#l z' #l
*0 (Rocha *et al*., 2004) A + *d *^ +
s' P + P (#$ ( ) l 0 + 2t
/ * * 0 A *#! ' 6' *78 $ 8
* / ,$*l + "*U # * #*P (*#2 u l+
l 0 1 *#2 "* + *P + ,l ("
*'.n8 6*W z' *#l * + 9 + / *H V
] * #X (*) * 0 8 * 6* H# *p (+ S
** + ~ (** + ** 8 **0 A I**l (**4
b' #I* (+ E (4) 0 8 4 #l
* + * *ol * / * " " # + H
E *l (4" + (4) 0 8 f"l pq8 0
0 I: L i / " #I " A P
" # 0 % 8 G P n #l + lY # b'
* *' CO_2 pq*8 .* l CO_2 *' ' H +
*0 / b 8 (# C+ l+ • ' A "
P d # \"#dB ('.lS / \ 7! - 0 {
z' *#l b' 9 0 (4" " A P E l
A"$* 4 - r*B * S / * * z' *#l *

/ * p *0 (Geeson *et al*., 1994) A + *d
(+ *2Fl Cox (*) * "* # * l 0
(* + + := G * * "* v 7 + P
b8"* l := * b8"* l ; j 4 #l + j`
(** "** + **0 ** + / **! ' - **0
**** a` CO_2 v ***7 + ***P (+ ***2Fl
/ ***! ' - ***0 b8"*** l ;_ *** aj_>;w` O_2
A + *****d ***** U l - r*****B .***** l
+ H l 0 A 0 (Nakhasi *et al*., 1991)
- *0 (+ + *,l G * L"* + "* # *
P (#$ (" + - 0 b' '
(* "* * $*' H + *#! ' 6' 78 $ 8 +
9 + / *H V *4 * G+"*W 8 0 P
(Rogiers and Knowles,2000) .\ l +
$**' H 9 ** #! ' / ** 2 I** z' **#l ** .** l
*0 A I*l *P MAP] #X (+ 8
(*4) * 0 8 b B *B * B - *P"B + 8 +
+ * *4 #l + j (+ E
- *P"B + * 8 .* l *4 #l * + ~ (
* + ~ (+ L (4) 0 8 b 8 B
*P (* "* 8 / " 4 #l
*ol * b * ^ 9I~ L * i *l " * + 8 '
H#$ V + (4) 0 8 f"l 0 +
+ *0 (+"* * + d #* B - *P"B f"l
+ L (**4) ** 0 8 b **8 ** B - **P"B
E *l E (*4) 0 8 b B B B - P"B
(* - r*B 9 * 0 * (4"* " A P
s* "8 *#! ' 6' *78 $* 8 *p +"* + \
.* l (Maarten *et al*., 2001) A + d b8+

$* 8 s' *P+ *0) 0 A Il
8 #$* S l"*P * (* #$ *#! '6' 78
E **l #$** (** ("** + **0 '** AS
9 l"P
+ (* #$* 5 + #* 0+"
$* 8 6' *78 * *2 8 *0 *#! '6' 78 $ 8
AS (+*,l * -'.*! { L"Z A" B
* z' *#l / 5 #$4 + "P
*0 A I*l .*l - r*B b*' *S /*
)*0 8 * * b B B B - P"B #
j (+ +*,l (* aj O_2 , a~ CO_2 (*4

(+ (*# 0 3" V *l *p *4 #l* +
{* #*P "* (t / 0 . 7
/ ' 2l + " # 0 G W"ZU 1
9 "P " (+,l -'.!

سپاسگزاری

† * b*' E *nl (* * ! G l d
%' B I rB E # / l 7 s "8 I rB
*! A *28 F I*l 7 , m (+ I0
' H8) 8 A 4 l+ Fl b' / P
9 l+ E + "U d I8

References

منابع مورد استفاده

9 p+ G+ I#l 9I 8i) ' ,8 m' W .۱۳۷۵ فلاحی، م.

Agar, I. T., Massantini, R., Hess-Pierce, B., and Kader, A. A. 1999. Postharvest CO_2 and ethylene production and quality maintenance of fresh-cut kiwifruit slices. Journal of Food Science 64: 433-440.

Geeson, J. D., Genge, P. M., and Sharples, R. O. 1994. The application of polymeric film lining systems for modified atmosphere box packaging of English apples. Postharvest Biology and Technology 4: 35-48.

Gil, M. L., Artes, F., and Tomas-Barberan, F. A. 1996. Minimal processing and modified atmosphere packaging effects on pigmentation of pomegranate seeds. Journal of Food Science 61: 161-164.

Gorny, J. R., Cifuentes, R. A., Hess-Pierce, B., and Kader, A. A. 2000. Quality changes in fresh-cut pear slice as affected by cultivar, ripeness stage, fruit size, and storage regime. Journal of Food Science 65: 541-544.

Gorny, J. R., Hess-Pierce, B., and Kader, A. A. 1999. Quality changes in fresh-cut peach and nectarine slices as affected by cultivar, storage atmosphere and chemical treatments. Journal of Food Science 64: 429-432.

Jeffery, D., Smith, C., Goodenough, P., Prosser, I., and Grierson, D. 1984. Ethylene-independent and ethylene dependent biochemical canges in ripening tomatoes. Plant Physiology 74: 32.

Jobling, J. 2001. Modified atmosphere packaging. Not as simple as it seems. Sydney Postharvest Laboratory Information Sheet. Good Fruit and Vegetables Magazine 11: 5.

Kays, S. J. 1997. Effect of 1- methylcyclopropene on the storage life of broccoli. Postharvest Biology and Technology 17: 127-132.

Liu, F. W., and Samelson, D. 1986. Rates of change in firmness, acidity and ethylene production of McIntosh apples in simulated low-ethylene CA storage. Journal of American Society of Horticultural Science 111: 409-408.

Maarten, L. A., Hertog, T. M., Nicholson, S. E., and Banks, N. H. 2001. The effect of modified atmospheres on the rate of firmness change in `Braeburn` apples, Postharvest Biology and Technology 23: 175-184.

Nakhasi, S., Schlimme, D., and Solomos, T. 1991. Storage potential of tomatoes harvested at the breaker stage using modified atmosphere packaging. Journal of Food Science 56: 55-59.

O'Bieme, D. 1990. Some effects of modified atmosphere packaging and vacuum packaging in combination with antioxidants quality and storage life of ready-to-use chilled apples slices. pp. 221-229. In: Zeuthen, P., Chefteol, J., Eriksson, C., Gormley, T., Linko, P., and Paulus, K. (eds.) Processing and Quality of Foods. Vol. 3. Elsevier, London.

Qi, L., Wu, T., and Watada, A. E. 1999. Quality changes of fresh cut honeydew melons during controlled atmosphere storage. Journal of Food Quality 22: 513-521.

Rocculi, P., Romani, S., and Dalla Rosa, M. 2004. Evaluation of physico-chemical parameters of minimally processed apples packed in non-conventional modified atmosphere. Food Research International 37: 329-335.

Rocha, A. M. C. N., Barreiro, M. G., and Morais, A. M. M. B. 2004. Modified atmosphere packaging for apple 'Bravo de Esmolfe'. Food Control 15: 61-64.

Rogiers, S. Y., and Knowles, N. R. 2000. Efficacy of low O_2 and high CO_2 atmospheres in maintaining the post harvest quality of Saskatoon fruit (*Amelanchier* *alnifolia* Nutt). Department of Horticulture and Landscape Architecture, Washington State University. pp. 623-630.

Salunhke, D. K., and Wu, M. T. 1973. Effects of low oxygen atmosphere storage on ripening and associated biochemical changes of tomato fruits. Journal of American Society of Horticultural Science 98: 12.

Somogyi, L. P., Ramaswamy, H. S., and Hui, Y. H. 1990. Processing Fruits: Science and Technology, Biology, Principles and Applications 13: 379-380.

Wills, R. B. H., Lee, T. H., Graham, D., McGlasson, W. B., and Hall, E. G. 1981. Post Harvest: An Introduction to the Physiology and Handling of Fruit and Vegetables. AVI Publication Co., Westport, CT.

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