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TECHNOLOGICAL STUDIES ON KAKI FRUITS

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ABSTRACT

Persimmon fruit (*Diospyros kaki L.*) has a nutritional and economic value. Physico-chemical composition were affected by storage at 5 ± 1 °C for 6 weeks, such as viscosity (mpa. s), TSS%, AIS%, total acidity %, total sugars %, and reducing sugars %, as well as tannins content%. Results of total activity of pectinases indicate that the kaki fruit contained a high level of natural enzymes especially in the over ripe fruits. The addition of 200 ppm of pectinex USP as a commercial pectolytic enzymes and 6% from concentrated serum-pulp from over ripe kaki pulp separately at 30°C for 2 hrs. in the kaki pulp gave a kaki pulp characterized by higher total soluble solid, and lower AIS and viscosity in both treatments. Meanwhile soluble tannins clearly decreased when 6% of concentrated serum-pulp were added.

Organoleptic evaluation revealed that the nectar prepared from pectinex treated pulp had a higer score of color and appearance perciption. Whereas the nectar prepared from concentrated serum-pulp had a higher score of taste, aroma and the overall acceptability at room temperature after 3 months storage period. Statistical analysis ascertained that, there were significant differences between some of organoleptic parameters such color and aroma of the nectars after the end of storage.

INTRODUCTION

Persimmon fruits (*Diospyros kaki L.*) have now an important situation owing to its distribution in the reclaimed land, nutritional and economic value. The major producers of persimmon are China, Japan, Brazil, Korea and Italy, secondly by USA, Newzeland, Spain, Egypt, India and Chili (Morton, 1987 and Mowat and Chee, 1992).

The annual Egyptian yield of kaki fruits is about 6618 tons produced from 1413 fedans (Anon, 2001). There are two major kinds of persimmon fruits based on astringency. The first group is the non astringent type, which would be eaten, while the fruit is still mature and firm. Fruits of the other group must be soft before astringency is lost (Parker, 1993).

The astringent substance in the persimmom classified as a condensed tannin proanthocyanid of a complex structure. Japanese persimmon contained in each 100 gm of edible portion 78.6 gm moisture, 0.7 gm protein 0.4 gm fat, 19.6 gm carbohydrates, 26 mg phosphorus, 174 mg potassium, 2.710 IU carotene and 11 mg ascorbic acid (Morton, 1987).

Miller (1984) reported that kaki fruits are delicious in the fresh state or when being used in a variety of baked products such as puddings, breads, and cookies. The non astringent types such as fuyu and Jiro, may be consumed when the fruit is completely colored, and can be eaten while stille firm. Moreover the astringent varities, such as Hachiya, are usually used in backed products.

Astringency is the major problem in the quality and utilization of persimmom. An immature persimmon fruit is markedly astringent, this is due to water soluble tannins, which spread easily over the cut surface, have a

strong binding capacity and had been widely used as deproteinizing agents in the brewing of sake. Chewing and action of salvia releases the tannins, which is absorbed by the tongue resulting in the bitter taste. (Seymour, *et al.*, 1993)

Refrigeration after softening prolongs the storage life of Hachiya fruit for a longer time, persimmon may be peeled, pureed, frozen or and whole frozen in plastic bags. Maru and Hachiya fruits may be peeled when firm and dried as drying removes astringency (Chia *et al.*, 1989).

Nectar are usually prepared by grinding the fruits, adding water, acids and sugars then homogenization. Pectolytic enzymes have been found to be of increasing use insolving technolcgical problems in the fruit industry. The fruit and vegetable pulps can be treated with enzymes to ultimately achieve almost complete liquiraction (Bock *et al.*, 1971).

Abd El-Hady (2002) summarized that the enzymatic treatment of persimmon pulp proved to be a powerful tool for the production of high quality persimmon juice, and the resultant juice was characterized by high yield, high content of total soluble solids and ascorbic acid and better clarity and sensory properties when the pulp was treated with 100 ppm of pectinex for 2 hrs at 30°C. The aim of this work was to study the effect of cold storage on some physico chemical properties of kaki fruits, and the effect of addition of pectinex and the concentrated kaki serum-pulp on the characteristics of kaki pulp, and in the nectar prepared from them separately.

MATERIALS AND METHODS

Materials :

Kaki fruits (*Diospyros kaki L.*) were purchased, from private farm in El-Sharkia Governorate, Egypt. The fruits were at the ripe firm stage and characterized by having spherical shape like tomato and yellow-orange to dark orange – red color. Pectinex, USP, a commercial product from (Novo Nordisk, Switzerland).

Methods :

Preparation of fruits :

The fruits were divided into two portions, the first was washed with tap water, well dried, packed in carton box and stored at 5 C ± 1 °C for 6 weeks. The second portion was washed, peeled, and the seeds were separated, then the pulp was frozen and stored at – 18 °C until utilization.

Enzymatic treatment of kaki pulp :

One-third of the frozen kaki pulp was thawed, then treated with pectinex USP using various concentrations 50, 100, 150, 200, 250 and 300 ppm and stirred well. The reaction time was performed at 30 °C for 2 hrs.; Second – one third was thawed and treated with concentrated serum-pulp (40 °BX) from the over-ripe refrigerated kaki fruits after 6 weeks storage period. The concentrations of 2, 4, 6 and 8% from concentrated serum-pulp were used as a source of various native enzymes. The reactrion was carried out at 30 °C for 2 hrs. Both treatments were inactivated at 90 °C for 5 min in water bath and directly cooled. The last one-third was thawed and used as a control.

Preparation of kaki nectar :

Kaki nectar was prepared from 50% of fruit pulp content from the final product, strained through an ordinary muslin cloth. The nectar formula contained 0.1% sodium benzoate and 0.3% citric acid (Sulieman, *et al.*, 2004). Total soluble solids of kaki nectar was adjusted to 15% by sucrose solution, then homogenized by a homogenizer at full speed for 1 min. The nectar was bottled in 200 ml sterilized glass bottles, then pasteurized at 90 °C for 10 min., cooled directly and stored at room temperature (25 – 30 °C) for 3 months .

Analytical method :

Physical properties :

Cloud stability was measured according to Krop (1974). Viscosity was measured by Brookfield viscometer at rotation speed of 60 rpm and 100 rpm using spindle No. 4 in the case of kaki pulp, and No. 1 in the case of kaki nectar at room temperature according the methods of Askar and Treptow (1992).

Chemical Analysis :

Total soluble solids, moisture content, pH value, titratable acidity, ascorbic acid, total sugars, reducing and non-reducing sugars were determined according to the methods of AOAC (1990). Alcohol insoluble solids (AIS%) were determined according to Ting (1970).

Total activity of pectinex and native enzymes was measured using Ostwald Capillary Viscometer at 30 °C in a water bath. This was determined by monitoring the decrease in viscosity of the pectin solution as a function of the reaction time; 9.5 ml of a 0.5% (w/v) solution of high methoxyl pectin (DE 89%) in 0.01 M sodium tartrate buffer pH 3.6 was pipetted into an glass capillary Viscometer at 30 °C. Enzyme solution (0.5 ml) was injected into viscometer and mixed by passing air bubbles through it before measuring the flow time (Siliha, 1985). Tannins content was determined according to the methods of Martin and Larry (1977).

Organoleptic properties :

Sensory properties was evaluated using the method described by Larmond (1970) using 1 – 9 point hedonic scale ranging from like extremely to dislike extremely. The panelists were requested for score the samples for color, appearance, taste, aroma, and overall acceptability. The organoleptic data were statistically analyzed using the ANOVA procedure of the SPSS statistical pakage for IBM Computer (SPSS, 1990)

RESULTS AND DISCUSSION

Effect of storage on physical and chemical properties of kaki fruits :

Physical properties :

Table (1) illustrated that the viscosity decreased by 36.9% after 6 weeks storage period compared to the fresh fruits. This decreament may be due to the action of native enzymes such as pectinesterase (PE) and polygalacturonase (PG) being active during prolonged at 5 °C. Pectin methylesterase PME and peroxidase showed activity even at 1 – 4 °C and pH4 (Carle *et al.*, 2001). Versteeg *et al.* (1980) reported that at 5 °C only a

thermally tolerant PME was capable of rapidly (less than 4 weeks) precipitating the orange juice cloud. This would be due to its action to transform soluble pectin into the insoluble pectic acid.

Table (1) : Effect of storage on physical and chemical properties of kaki fruits.

Storage period (weeks) Constituents	Zero Time	1 week	2 week	4 week	6 week
Viscosity (mpa.s)	130.0	127.0	119.0	104.0	82.0
Total soluble solids (TSS %)	17.8	18.0	18.7	19.9	20.8
Alcohol insoluble solids (AIS%)	3.22	3.01	2.88	2.33	2.00
Moisture content %	77.9	77.8	77.3	76.8	76.5
Total sugars %	15.30	15.50	15.86	15.54	14.62
Reducing sugars %	5.22	5.22	5.54	5.44	4.40
Non-reducing sugars %	10.08	10.28	10.32	10.10	10.22
Tannins %	1.30	1.20	0.93	0.71	0.63
PH value	5.5	5.6	5.7	5.8	5.8
Total Acidity %	0.16	0.16	0.12	0.10	0.10
Ascorbic acid mg /100gm	12.60	12.40	11.95	11.55	10.90

Chemical properties :

The total soluble solids (TSS%) increased from 17.8% in the fresh sample to 20.8% at the end of storage. On the contrary, a decrease occurred in the alcohol insoluble solids (AIS%) during storage. These results are in accordance with those reported by Ibrahim (1994) and Mahajan (1994).

As shown in Table (1), during storage of kaki fruits at 5 °C for 6 weeks, the moisture content decreased gradually. It was 77.9% in the fresh sample (after harvesting) and 76.5% after 6 weeks during storage. Omer (1998) found that the moisture content of Anna apples slightly decreased during storage at 0 °C for 4 months.

Total and reducing sugars increased through the first two weeks storage at 5 °C, and suddenly decreased after that. The sudden drop of sucrose, glucose and fructose at the beginning of the storage period at 4 °C can be explained by the fact that the apples were harvested just before the climacteric stage. This phase is characterized by a period of increased respiration during which the sugars and acids are rapidly used as substrates in the metabolic process (Ackermann *et al.*, 1992).

Soluble tannins decreased from 1.3 g/ 100 gm in the fresh sample to 0.63 gm / 100 gm after 6 weeks storage. This decrease may be resulting from activation of native tannic enzymes activated during cold storage, which break down the condensed tannins. Similar results on Anna Apple were recorded by Omer (1998).

Total Activity of pectinex and native enzymes :

Fig.(1)shows enzymatic activities from both, commercial (Pectinex USP) and the enzymes existing naturally in kaki serum-pulp especially in the concentrates prepared therefrom.This reaction was expressed as flow rate per second by ostwald viscometer as indicator for enzyme activity causing a reduction in viscosity. Enzyme activities in concentrated orange juice (45 °Bx) prepared by freeze–concentration had 3–4 fold higher than the single strength juice (Wicker *et al.*, 1987).

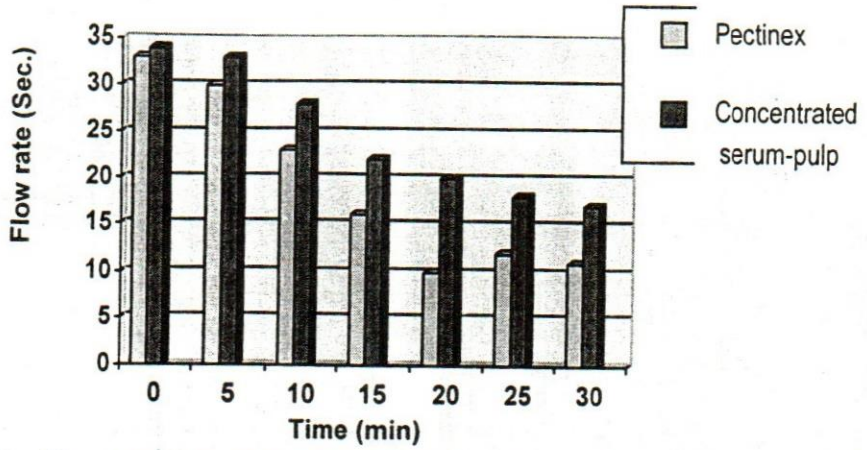

Fig. (1) Pectinex and concentrated serum-pulp enzymes activities (expressed as flow rate per sec.) using Ostwald viscometer

- **The flow rate of the buffer was 35 second.**

The flow rate decreased gradually till 20 min incubation time at 30 °C. The same for pectinex after 5 min was 30 sec., while in the concentrated serum-pulp were 33 sec. After 20 min. reaction time, the flow rate reached 10 and 20 sec. for pectinex and the concentrated serum-pulp. This means that the pectinex and the native pectic enzymes found in the concentrated serum-pulp, solublized the pectic substances into small molecules, causing viscosity reduction. Variation in PE activity has been related to several factors such as fruit variety, maturity, pulp content and processing conditions, etc. (Rouse and Atkins, 1955)

Effect of addition of pectinex and concentrated serum-pulp on some physical and chemical properties of kaki pulp and the nectars prepared from them :

Physical properties

Viscosity used to examine the enzymatic reaction of kaki pulp are shown in Figure (2). The optimum enzymatic reaction of pectinex was 30 °C for 2 hrs when 200 ppm were added.

The optimum decrease of viscosity was 40.0 mpa. s, when 200 ppm of pectinex were added. Concerning the addition of concentrated serum-pulp, the kaki pulp characterized by highly reduction in viscosity when 6% was added Fig. (3).

The decrease of the viscosity may be due to the activation of natural enzymes like PE., PG., and other enzymes existing in added concentrated serum-pulp, and also the substrate itself activated in these conditions. Ishii and Yokotsuka, (1973) reported that the drop in viscosity is usually due to the combined action of PE and PG. on the highly estrified fruit pectin on solution.

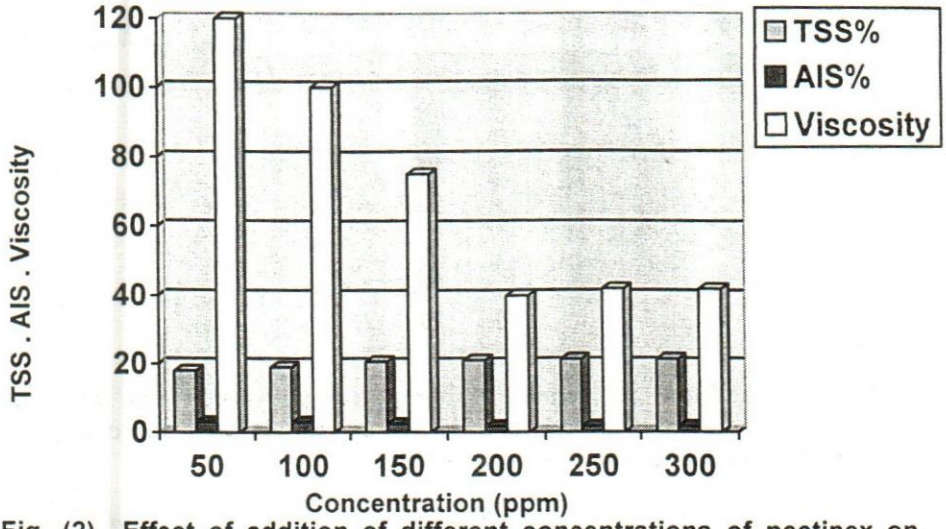

Fig. (2) Effect of addition of different concentrations of pectinex on some properties of kaki pulp during reaction time at 30 °C for 2 hours.

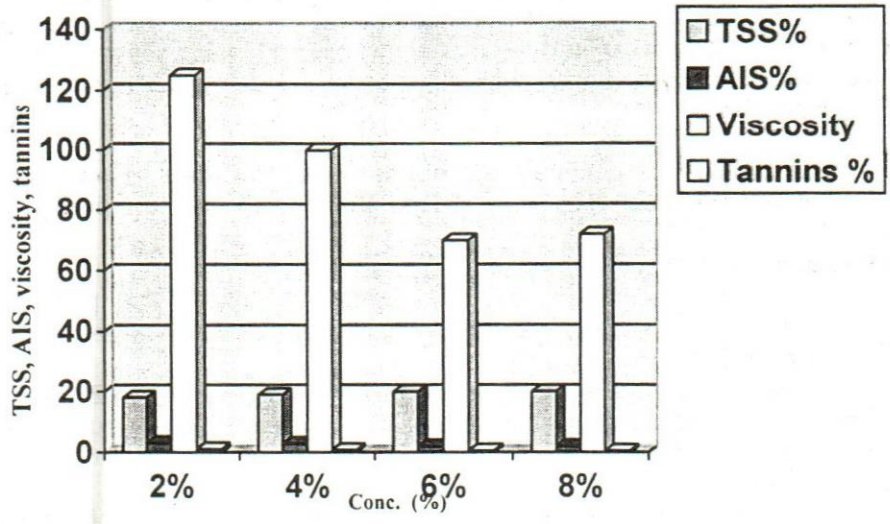

Fig. (3) : Effect of addition of different concentrations of concentrated serum-pulp on some properties of kaki pulp during reaction time at 30 °C for 2 hours.

Concerning cloud stability, the nectar treated with pectinex had a higher cloud stability, followed by the nectar treated with concentrated serum-

pulp during and after storage (Table 2). Weiss and Sämann (1972) concluded that the addition of pectolytic enzyme preparations, either separately or in combination with homogenization, gave a cloud stable apricot nectar. Grampp, (1969) found that carrot and tomato tissues with Rohment P gave a pulpy juice with high yield, color and cloud stability.

Table (2) : Effect of storage at room temperature on some characteristics of kaki nectars.

Nectars	Uutreated (Control)				Nectar treated with pectinex				Nectar treated with concentrated serum-pulp			
Storage period (month) Characteristics	0	1	2	3	0	1	2	3	0	1	2	3
Cloud stability [A] (660 nm)	0.724	0.690	0.630	0.570	1.530	1.310	1.300	1.280	1.130	1.106	1.090	0.940
Total Acidity %	0.12	0.10	0.07	0.04	0.17	0.14	0.10	0.08	0.16	0.13	0.09	0.07
PH value	5.60	5.61	5.64	5.67	5.54	5.56	5.58	5.63	5.56	5.59	5.62	5.65
Ascorbic acid mg/100gm	4.3	4.0	3.2	2.4	4.6	4.3	4.0	3.8	4.8	4.6	4.2	4.0
Tannins %	0.60	0.57	0.51	0.45	0.49	0.46	0.41	0.37	0.23	0.20	0.17	0.14

Chemical properties

Total soluble solids and AIS % are also used to examine the enzymatic reaction of kaki pulp (Figs 2 and 3).

TSS% increased to about 17.9%. Abd-El-Hady, (2000) found that the total soluble solids of persimmon pulp increased about to 9.9 % when 100 ppm pectinex were added. Schobinger *et al.*, (1981) summarized that total soluble solids increased when fruit juices were liquefied with commercial enzymes preparations.

The optimum decrease of AIS % occurred when 200 ppm of pectinex were added, reached to 1.75%. These results are in accordance with the results of (Sreenath *et al.*, 1987).

The effect of addition of concentrated serum-pulp at different concentrations on some properties of kaki pulp were illustrated in Figure (3). Under the previous conditions, the optimum increasing of TSS% was 10.5% at the concentration of 6% from concentrated serum-pulp. On the contrary, the optimum decreasing of AIS % was at the concentration of 6% of concentrated serum-pulp.

Concerning the soluble tannins of kaki pulp the optimum reaction occurred when 6% concentrated serum-pulp were added, and the reduction reached a ratio of 60.7% (Fig. 3). This reduction may be due to the action of tannic enzymes found naturally in the concentrated serum-pulp and in the substrate activated in these conditions and also due to other factors such temperature etc.

Table (2) shows the decrease in total acidity, pH value and ascorbic acid of the nectars during and after storage at room temperature (25 – 30 °C) for 3 months. Sulieman *et al.*, (2004) found that total acidity, pH value and

ascorbic acid of mandarin nectar decreased gradually during storage at room temperature.

Table (2) also shows that tannins content decreased during storage. The nectar treated with concentrated serum-pulp characterized by having a low level of tannins compared with two other nectars after storage. Matter, (2003) mentioned that the reduction of tannins during pasteurization and storage of pomegranate juice at 5 °C may be due to the oxidation of some phenols during browning reactions and also the formation of protein / tannins complex which were precipitated during 6 months storage period.

Organoleptic properties :

The organoleptic data tabulated in Table (3) show that the nectar prepared from pectinex treated had a higher score of color and appearance perception. Whereas, the nectar prepared from concentrated serum-pulp had a higher score of taste, aroma and overall acceptability after 3 months storage at room temperature. Statistical analysis revealed significant differences between some of organoleptic parameters such color and aroma of the nectars until the end of storage.

Table (3): Sensory evaluation of kaki nectars after three months storage period at room temperature.

Sensory attributes	Color (10)		Appearance (10)		Taste (10)		Aroma (10)		Overall acceptability (100)	
Storage (month) Nectar	0 Mean ± S.D		0 Mean ± S.D	3	0 Mean ± S.D	3	0 Mean ± S.D	3	0	3
Un treated (control)	8 ± 0.0	5.16±0.28	8 ± 0.0	5.0±0.0	7 ±0.0	5.66±0.76	8.83±0.28	8±0.5	78.32	59.5
Treated with pectinex	9.5±0.0	8.5±0.5	9.33±0.28	8.5±0.0	7.3±0.57	6.83±1.04	8 ±0.0	7±0.5	85.4	77.0
Treated with concentrated serum-pulp	8.66±0.28	8±0.5	8.33±0.28	8.16±0.28	8.83±0.28	8.16±0.28	8.66±0.28	8.16±0.28	86.2	81.6
F value	6.72 *		0.95		2.57		8.61 *			

* P < 0.05

Finally from the previous results, it could be concluded that the kaki fruits can successfully be stored at 5 °C for 6 weeks with improvement of some properties, and the kaki fruits containing a high level of natural enzymes can be used in the fruit processing.

REFERENCES

Abd El-Hady, M. (2002). Technological studies on some fruit products. Ph. D. Thesis. Fac. Of Agric Dept. of Food Sci. Zagazig Univ. Zagazig, Egypt.

Ackermann, J. ; M. Fisher and R. Amado (1992). Changes in sugars, acids and amino acids during ripening and storage of apples (*Cv. Glockenapfel*). J. Agric. Food Chem. 40, 1131 – 1134.

Anon, (2001). Ministry of Agric. and Land Reclamation, Economic Affairs Sector. Area, Yield and Production of Fruits by Varieties. 288 – 289.

AOAC. (1990). Official Methods of Analysis. 15th edition. Association of Official Analytical Chemists, Washington, DC.

Asker, A. and H. Treptow (1992). Trubstabile und hochwertige nektar aus tropischen früchten.Confructa Studien,36,130 –138,140–145,148– 153.

Bock, W. ; M. Krause and G. Dongowski (1971). Patent Schrift No. 84317 der Deutschen Demokratischen Republik.

Carle, R.; P. Borzych ; P. Dubb ; H. Siliha and O. Maier (2001). A new process for firmer canned cherries and strawberries. Food Australia 53 (8) 343 – 348.

Chia, C. L.; S. Clark and O. Dale (1989). Persimmon. Commodity Fact Sheet Pers – 3 (A) Fruit. Hawaii Cooperative Extension Service, CTAHR, Uinv. Of Hawaii.

Grampp,E.(1969). Die verwendung von enzymen in der lebensmittelindustrie. Deutsche Lebensmittle – Rundschau 65 : 343 – 347.

Ibrahim, F. (1994). Studies of some treatments affecting fruits quality of "Anna" apples during storage. Ph. D. Thesis. Hortic. Dept. Pomplogy. Fac. Agric. Cairo Univ. Egypt.

Krop, J. J. (1974). The mechanism of cloud loss phenomena in orange juice. Ph. D. dissertation, Center for Agricultural Publishing and Documentation, Wageningen, Netherlands.

Larmond, E. (1970). Methods for sensory evaluation of food. Canada Dept. of Agric. Publication No. 1284.

Mahajan, B. (1994). Biochemical and enzymatic changes in apple during cold storage. J. Food Sci. and Tech. India, 2 (31) : 142. C.F. Food Sci. Tech. Abst., Vol. 26, 8.

Martin, I. and G. Larry (1977). Rapid visual estimation and spectrophotometric determination of tannin content of sorghum grain. J. Agric. Food Chem., 25 (6) 1268.

Matter, A. (2003). Studies on Pomegranate Juice. Ph. D. Thesis. Dept. of Food Sci. Fac. Of Agric. Zagazig Univ. Zagazig – Egypt.

Miller, E. (1984). Oriental persimmon (*Diospyros kaki L.*). in Florida. Proc. Fla. State Hort. Sci. 97 : 340 : 344.

Morton, J. (1987). Japanese persimmon. In : Fruits of warm climates. Miami, FL., pp. 411 – 416.

Mowat, A., and A. Chee (1992). A Study of the influences on Fuyu fruit quality and maturatuion in different growing districts of New Zealand. Report for the New Zealand Persimmon Export Council. 54 pp.

Omer, M. (1998). Technological studies on fruit juice concentrate. Ph. D. Thesis. Fac. Of Agric. Dept. Food Sci. Zagazig Univ. Zagazig – Egypt.

Parker,M. (1993). Growing oriental persimmon in north Carolina. North Carolina A & T state Univ. US. Dept. of Agric. and local governments cooperating.

Rouse, A. and C. Atkins (1955). Pectinesterase and pectin in commercial citrus juices as determined by methods used at the citrus experiment station. Univ. of Fla. IFAS Bull. 570, Gainesville, FL.

Schobinger, M. ; P. Durr and A. Akesson (1981). Technologische und analytische Daten zur enzymatischen Verflussigung von Apfeln und Birnen. Alimenta, 20 : 37 – 42.

Seymour, J. ; J. Taylor and G. Tucke (1993). Persimmon. In : Biochemistry of fruit ripening. Champman & Hall. London, Glagow, New York, Tokyo, Melburne, Medrase, pp. 152 – 159.

Siliha, H. (1985). Studies on cloud stability of apricot nectar. Ph. D. Thesis. Agric. Univ. Wageningen, The Netherland.

SPSS (1990). SPSS / PC for the IBM PC / XI. Inc. Chicago, IL. USA.

Sreenath, H.; A. Nanjundaswamy and K. Sreekantiah (1987). Effects of various cellulases and pectinases on viscosity reduction of mango pulp. J. Food Scie., 52 : 230 – 231.

Sulieman, A, ; E. S. Abd El-Wahab and G. El- Shorbagy (2004) . Effect of the addition of commercial pectin and ethylene diamine tetra acetic acid on quality parameters of mandarin nectars. Annals of Agric. Sci, 49 (2) 557 - 570.

Ting, S. (1970). Alcohol – Insoluble Solids of Juice Vesicles of Citrus Fruit. J. of Food Sci. 35 : 757 – 761.

Versteeg, C.R. ; F. Rombouts ; C. Spaansen and W. Pilnik (1980) : Thermostability and orange juice cloud destabilizing properties of multiple pectinesterases from orange, J. Food Science 45, 969 – 971, 998.

Weiss, J. and H. Sämann (1972). Results of tests on the turbidity stability of apricot nectar. Miteilungen Rebe, Wein, Obstbau und Früchteverwertung 22 : 177 – 184.

Wicker, L. ; R. Braddock and M. Vassallo (1987). Effect of assay temperature on activity of citrus pectinesterase in fresh orange juice. J. Food Science 52 (2) 378 – 380.

دراسات تكنولوجية على ثمار الكاكى

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تمتاز ثمار الكاكى بارتفاع قيمتها الغذائية والاقتصادية . بالنسبة للتركيب الطبيعى والكيماوى لثمار الكاكى أثناء التخزين على درجة ٥ ± ١ م° لمدة ٦ أسابيع ، وجد أن هناك تأثير على بعض المكونات مثل اللزوجة ، المواد الصلبة الذائبة ، المواد الصلبة الغير ذائبة فى الكحول ، الحموضة الكلية ، السكريات الكلية ، السكريات المختزلة ، والمحتوى من التانينات . وفيما يختص بالنشاط الكلى للإنزيمات وجد أن ثمار الكاكى تحتوى على نسبة مرتفعة من الإنزيمات الطبيعية وبخاصة المتواجدة فى الثمار الزائدة النضج . واتضح أن إضافة ٢٠٠ جزء / مليون من أحد الإنزيمات التجارية المحللة للبكتين Pectinex و ٦% من لب الكاكى الزائد النضج والمركز حتى ٤٠ بركس واستخدامه كمصدر للإنزيمات الطبيعية وذلك بإضافتهم كل على حده على درجة ٣٠ م لمدة ساعتين للب الكاكى ، أدى ذلك إلى ارتفاع المواد الصلبة الذائبة فى كلتا المعاملتين ، وانخفاض كلا من المواد الصلبة الغير ذائبة فى الكحول ، واللزوجة ، فى حين انخفض محتوى التانينات بصورة واضحة عند إضافة ٦% من مركز لب الكاكى كمصدر للإنزيمات الطبيعية . أوضحت الاختبارات الحسية أن النكتار المعد بإضافة الإنزيم التجارى Pectinex سجل أعلى القيم فى كل من اللون والمظهر ، بينما تميز النكتار المعد بإضافة مركز لب الكاكى ، حيث سجل أعلى القيم فى كلا من الطعم والرائحة والتقبل العام بعد ثلاثة أشهر من التخزين على حرارة الغرفة . كما أظهرت نتائج التحليل الإحصائى للاختبارات الحسية أن هناك فروقا معنوية بين الخواص الحسية مثل اللون والرائحة فى نكتار الكاكى المختلف بعد نهاية فترة التخزين .