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Evaluation of Different Sun Dried Apple Slices during Storage

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Abstract

The present research work was conducted to prepare shelf stable apple slices through dehydration and different treatment of KMS. The fruit was washed, peeled and sliced. The whole lot was divided into 5 parts. One part was kept as control (To) and the remaining was treated with KMS solution. Apple + 0.2% KMS solutions for 1 min (T1), Apple + 0.2% KMS solutions for 2 min (T2), Apple +0.3% KMS solutions for 1 min (T3). Apple + 0.3% KMS solutions for 2 min (T4). All the samples dried in two different dryers (cabinet and pilot solar) for 3 days. Pilot solar dryer require 2 days more than that of cabinet dryer. The samples were studied for physicochemical characteristics (moisture, acidity, ascorbic acid, PH, TSS) in fresh form and in dried form.

Key words: Apple slices, KMS, cabinet dryer, Physicochemical Analysis

Introduction

The apple fruit (Malus sylvestris) belong to family Rosaceae. It is one of the most beneficial, delicious and nutritious tree fruits of the world, which was probably originated in the Central and South/Western Asia.

In Pakistan it is mostly cultivated in northern hilly areas of Punjab and NWFP, and the Quetta region of Balochistan. Some important verities of apple grown in Pakistan are: Kashmiri, Kandhari, Amri, Banki, Kulu, Qalat Special, Kapai, Red Beauty of Bath, Delicious, Kashmir Amri, Golden Delicious, Red Delicious, and Sky Spur (Chaudhary, 1994).

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Total area under apple cultivation in Pakistan was 47.5 (000, hectares) with an average of 0.4(000, hectares) in Punjab, 0.1(000. hectares) in Sind, 9.0(000, hectares) in NWFP and 35.0 (000 hectares) in Balochistan. While total production of apples in Pakistan was 315.4 (000. tones) with an average production of 3.6 in Punjab, 0.1 in Sind, 110.1 in NWFP and 201.6 in Balochistan. (Agricultural Statistics of Pakistan, 2000-03).

Hussain, 1985, reported that 100g of apple contain 84.5g moisture, 0.4g protein, 0.3g fat, 13.6g carbohydrate, 0.8g fiber, 0.3g ash, 14 mg calcium, 10 mg phosphorus, 0.7 mg iron, 0.04 mg thiamine, 0.04 mg riboflavin, 0.2 mg niacin, 39ug
(3-carotene and 15 mg ascorbic acids.

In Pakistan apple is mostly consumed in fresh form, but at the peak harvesting time it become abundant in the market. Severe losses of apple occur due to its perish-ability and improper handling. Keeping in view the importance of apple and its wastage possibilities both in season and off season, preparation of different apple products is

economical practice to preserve surplus apple (Mehmood, 2002).

During growth, the reducing sugars & sucrose increase continuously whilst the starch reaches a peak & than declines before harvesting. The concentration of phenolic & chlorogenic acid falls continuously during growth. The anthocyanin concentration in the skin of many varieties increase during maturation, the red color being manly due to the presence of cyaniding-3-galactoside. Ethylene & carbon dioxide are important metabolic products which are synthesized during the ripening process.

Oxidizing enzyme (poly-phenolase, polyphenole oxidase, catechol oxidase) are also present in the flesh and these lead to the oxidation of chlorogenic acid and catechins. The darkening and browning of the tissue when exposed to air results from these interactions.

The texture of apples is determined by the interactions of pectin with hemi cellulose, cellulose, pentosans and hexosans. During the ripening process there is some breakdown of the protopictin resulting in softening of the tissue. Protopictin consists of poly galacturonic acid (pectin) crosslinked with metallic ions (Ca2+or Mg2+) with hydrogen bonding between the hydroxyl groups.

Dry Food: Drying or dehydration, the oldest method of food preservation, is particularly successful in the hot, dry climates found in plan area of Pakistan. Quite simply, drying reduces moisture content which is necessary for bacterial growth that eventually causes deterioration. Successful dehydration depends upon a slow steady heat supply to assure that food is uniformly dried. Drying is also an exact art, Size of pieces, relative moisture, and the method selected all affect the time required to dehydrate a food adequately.

Drying is one of the most ancient methods of food preservation. By removing a large portion of water content from such foods as fruits and vegetables, their keeping qualities are extended well beyond normal storage life.

Moreover, storage space is saved due to reduction in size of the food. There is large consumer demand for certain dried fruit product. Prunes, figs, raisins, apricots, apple, pears, and dates are popular dried fruits and are valued for their sweet flavor, which is markedly different from that of the fresh fruit (Peckham, 1969). The large quantities of apples are dried in the United State of America, Canada, Australia, South Africa, and Italy. Dried apples are marketed on large scale, and their utilization has been expanding in recent years. Federal standards of U.S.A define dried apples as "apples that have been peeled, cored, and cut into segments and contain 24% moisture" (Woodroof and Luh, 1985).

Dehydration is supposec to avert spoilage through the removal of water to such a degree that microbia growth become no longer feasible, even in favorable temperature. However, at each stage of the drying process, there is risk of additional contamination. No dehydrated food is sterile (Borgstorm, 1982).

Dried fruits are storej for fairly long periods after processing; consequently several type of sooilage may take place like darkening of fruit, insect infestation, and microbal deterioration (Peckham, 1969). Storage of dehydrated apples at semitropical and summer temperature results in darkening and flavor bettering. Dried fruit is favorable medium for the growth of microorganisms. Irradiation may prove benefit in preventing growth of all kinds of organisms (Woodroof and Luh, '985).

The present experiment v/as therefore undertaken to investigate the effect of solar drying of apple fruits after treating with potassium Meta bisulfate solution.

Materials and Methods

Raw Materials: Fresh, healthy and mature apples were purchased from the local market of Tarojaba. The fruit was brought to the food processing & Analytical Laboratory, Food Science Division, Nuclear institute for Food & Agriculture (NIFA). Peshawar where the research work was carried out. Fresh are analyzed for moisture content, percent acidity, ascorbic acid, PH and TSS while dried apple slices are evaluated for moisture content, percent acidity and ascorbic acid.

Pre Drying Treatments: The fruit was thoroughly washed with potable water. Peeled and cut into 1/4 thick slices with a vegetable cutter (Model VA20. Nihon Choriki Seizoco Co.. Ltd. Tokyo, japan). And also the undesirable portions were removed. Then weight the whole slices & divided them in equal parts eg, P1& P2. We supposed that P1 was placed in the cabinet dryer & P2 was placed in the pilot solar dryer.

Then P1 & P2 were divided into five equal parts. This was subjected to different treatments as follow.

Table 1. Research Plan of proposed study

To	Control sample + cabinet dryer
T1	Apple + 0.2%KMS for 1 mint + cabinet dryer
T2	Apple + 0.2% KMS for 2 mint + cabinet dryer
T3	Apple + 0.3% KMS for 1 mint + cabinet dryer
T4	Apple + 0.3% KMS for 2 mint + cabinet dryer
T5	Control sample + pilot solar dryer
T6	Apple + 0.2%KMS for 1 mint + pilot solar dryer
T7	Apple + 0.2% KMS for 2 mint + pilot solar dryer
T8	Apple + 0.3% KMS for 1 mint + pilot solar dryer
T9	Apple+ 0.3% KMS for 2 mint + pilot solar dryer

After this we triplicate each sample (approximately equal size) & arranged them into a wire trays & than placed it into the dryers

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Methods of Drying

- Sun drying
- De hydrator
- Freeze drying

Sundrying Steps

1. Prepare the apples as described in steps 1 to 3 above.
2. Dip apple slices in KMS solution.
3. Lay treated slices on -/ays.
4. Cover with cheesecloth and place in a well-ventilated area in full sunlight.
5. Turn slices every few hours.
6. Take trays inside at n'ght. Drying takes two to three days.

Pretreatment

Foods to be dried must be washed, & some peeled & cut.
Others may be precooked. Cut fruits are subject to darkening through enzyme action, & must be either balanced, treated with salts or exposed to the fumes of burning sulfur. Sulfuring may also be required to limit non enzymatic browning (Millardreaction).
Browning refers to development of brown color. However by holding the product at 54.4℃ for seme hour after drying, & disease -causing bacteria which might have survived or even increased in the product during the natural fermentation process should be eliminated.
Since prunes are naturally coated with a thin layer of wax, drying is greatly speeded up by pre dipping the fruit in dilute lye solution, then in hot water, prior to drying.

Cabinet dryer: This dryer consist of a self enclosed cabinet approximately 8 feet long & 4 feet width. It is made up of wood & pliboard. The hide or upper portion is made up of white polythene. It has the ability to create hotness inside the dehydrator. The apple slices were arranged on the tray in triplicate form and placed in the cabinet dryer. The dryer has the capacity of holding 3 trays.

Pilot solar dryer

The pilot solar dryer is room like and is 10 feet long, 7 feet high and 7 feet wide. The pilot solar dryer is completely different from the cabinet dryer. The pilot solar dryer is made up of iron sheets instead of polythene; glass sheets were used. These sheets are not fixed on the top of the cabinet, instead they are fixed on the side of the dryer & small holes were made in the walls of the cabinet, through which the heat is transferred into the cabinet. In the cabinet exhaust fan is fitted through which air circulate inside the cabinet. The pilot solar dryer has more capacity than that of cabinet dryer. Both the dryer has different condition which is shown in table 2.

Packaging: The dehydrated slices were packed in transparent polyethylene pouches of 0.04 mm thickness.

Storage: The sample were stored at room temperature for a period of three days and analyzed for physiochemical characteristics.

All the treatments were analysied physicochemically for %moisture, Total Soluble Solid (TSS), pH and %acidity.

Table 2. Drying of apple slices by pilot solar drier and cabinet drier

		Pilot Solar Drier			Cabinet drier			
Date	**Day**	**Time**	**Humidity**	**Temp**	**Time**	**Humidity**	**Temp**	**Atmospheric Temperature**
27/9/2006	Tuesday	9:00	49%	40℃	9:00	79%	37 ℃	30℃
		10:00	45%	45 ℃	10:00	69%	48 ℃	32 ℃
		11:00	42%	50 ℃	11:00	48%	63 ℃	33 ℃
		12:00	41%	51℃	12:00	41%	65 ℃	34 ℃
		1:00	39%	52 ℃	1:00	38%	68 ℃	35 ℃
28/9/2006	Thursday	9:00	50%	38 ℃	9:00	90%	39 ℃	26 ℃
		10:00	45%	47 ℃	10:00	67	52 ℃	31℃
		1 1 :00	43%	52 ℃	1 1 :00	54%	68 ℃	34 ℃
		12:00	42%	52 ℃	12:00	53%	76 ℃	35 UC
		1:00	40%	54 ℃	1:00	51%	79 ℃	37 UC
29/9/2006	Friday	10:00	47%	46 ℃	10:0	84%	48 ℃	31 ℃
		1 1 :00	45%	51℃				33 ℃
		12:00	43%	53 ℃				35 ℃

Temp = Temperature,

Result and Discussion

Titratable Acidity: Titratable acidity of dehydrated apple slices treated with different concentration of KMS was shown in table 3. The Titratable acidity of fresh apple was (1.268%), which was decreased from (16.4%) to (26.4%) in To to Tg .the decreased in acidity of all the sample were To (16.4%). Ti (19.3%) Ji (12.2%) Ta (15.C%) similarly up to Tg (26.4%).

The minimum decrease was found in sample t7 (34.5%) while minimum decrease was found in sample in t5 (8.5%) the percent acidity of all the samples was shown in the grph which gives clear picture of percent decrease in acit of all the samples.

Moisture content of dried apple slices treated with different doses of KMS was determined after sun drying in two different dryer (cabinet & pilot solar) for four days. As shown in table-2 Decrease in moisture content was observed in all samples. The moisture content of fresh apple was (78.750). The decreased observed in all samples. The decreased in To was (89.465%) in Ti was (88.436%) in T2 was (87.839%) in Ta was (88.69%) similarly up to Tg (76.165%).

Table 3. Effect of solar dryer (cabinet and pilot) and chemical preservative on %acidity

Treatments	**% acidity of fresh apple**	**Mean**	**% Acidity**
To	1.286	1.060	16.4
T1	1.286	1.023	19.3
T2	1.286	1.113	12.2
T3	1.286	1.070	15.6
T4	1.286	1.053	16.9
T5	1.286	1.160	8.5
T6	1.286	0.940	25.9
T7	1.286	0.830	34.5
T8	1.286	1.020	19.6
T9	1.286	0.933	26.4

Table 4. Effect of solar (cabinet and pilot) dryer and chemical preservative on %increase of Vit C.

Treatments	Vitamin C of fresh apple	Vitamin C mg/100gm	% increase in Vit C
To	13.300	24.761	86.1729
Ti	13.300	20.952	57.5338
T2	13.300	19.047	43.2105
Ts	13.300	25.714	93.3383
T4	13.300	24.761	86.1729
Ts	13.300	22.857	71.8571
Te	13.300	19.047	43.2105
T?	13.300	19.047	43.2105
Ts	13.300	17.142	28.8872
To	13.300	17.142	28.8872

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