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Effect of ethyl oleate pretreatment and packaging on rheological and sensory properties of stored dried mulberry

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Abstract

Evaluation of dried mulberry texture is important due to consumer preference. Although sensory testing is the most direct method for evaluating the eating quality of dried fruits, it is time consuming, difficult to carry out properly and requires a large sample. The aim of pre-treatment drying of mulberry was to reduce the moisture content to a level that allows safe storage over an extended period. Two varieties of mulberries were dried industrially (cabinet drier) after different combination of ethyl oleate pretreatments. Dried mulberries packed in polyethylene and polystyrene and preserved for 5 months in 20°C. Hardness, Adhesiveness, Springiness and Chewiness of dried mulberries were measured by a texture analyzer. Statistical method was 2 factors factorial in frame of completely randomized design with three replicates. It is concluded that dried white mulberry pretreated with combination of ethyl oleate 2% and potassium meta bisulfate 0.5% and packed in poly styrene preserved its qualitative, sensory and rheological characteristics after 150 days at 20°C .

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Introduction

Fruit-based snacks can be modest in bulk as well as rapidly edible; sustaining without providing excessive residues; simple yet glamorous and satisfying to eye, mouth feel and memory. Their consumption can be a positive cultural move towards a more healthy existence (Bourne, 1994).

White Mulberry has been grown widely from India west through Afghanistan and Iran to southern Europe for over a thousand years for leaves to feed silkworms. The fruit are also eaten or often dried or made into some products such as wine, Pekmez etc. (Doymaz, 2004). Iran has produced about 26000 tones of mulberry in 2005.

The sensory attributes associated with the eating quality of dried fruits are commonly determined by trained panelists using arbitrarily selected hedonic scales. Sensory measurement of texture by the panelists is often a preferred and most reliable technique, but it is time consuming, labor intensive, and requires a large sample size so instrumental techniques such as texture profile analysis can be used for evaluating the texture of dried mulberry.

Drying of fruit normally needs to be carried out where it is produced and while it is very fresh. There is a great variation in processing of different fruits to achieve the wide consumer preference and so that practically every fruit requires different processing cycles. For example, a readily reconstitutable fruit salad may require quite different dried fruits than general specifications of fruit destined for use in a composite fruit snack bar (Koul *et al*., 1993).

"Case hardening" of the fruit pieces is important as water can normally evaporate after it reaches the surface of the piece. Sometimes the injection of steam into a dryer at certain points is helpful in avoiding of case hardening. Subjectively, important characteristics expected of dried fruit are to be tough and chewy and fruit should not stick to the teeth when chewed which, if excessive, may be regarded as unacceptable (Kader *et al.)*.

The drying rate can be improved by methyl and ethyl ester emulsions which check the fruit skin and increases their permeability to water. Dipping waxy fruits for several seconds in solutions of ethyl oleate or other suitable compounds (usually fatty acid derivatives used as wetting agents and emulsifiers) greatly reduces drying time (Petrucci *et al*. 1974).

The fatty acid esters are applied to the surface of the fruit by dipping, resulting in a coating which apparently breaks down the waxy cuticular fruit surface, resulting in a reduced resistance to moisture loss.

The aims of this research were a):to standardize optimum dehydration conditions and to develop improved pre treatments and process variables in different types of mulberries and also to obtain better dehydrated tomato product with higher storage stability. B): to select suitable varieties of mulberry for drying, study on the effects of pretreatment by ethyl oleat solution and packaging type on qualitative, sensory and rheological properties of dried mulberry fruits in storage.

Materials and methods

Fruits harvesting

Two varieties of mulberry fruits (*sefid & Rasmi*) were harvested in Mashhad during 2012 and after sorting they preserved in 4 degrees centigrade up to 24 hours.

Treatments

Fruits treated by different ethyl oleat solutions and dried by a cabinet dryer (60 ± 2 degrees centigrade) to 15 % moisture content.

Storage study

Dried mulberries packaged in poly ethylene and poly styrene and preserved in (20 degrees centigrade) for 5 months. Each treatment included 3 replications of 500 gram fruits. Table 1 shows the specification of treatments.

Experiments

Qualitative attributes (non enzymatic browning , total

count) , sensory characteristics (texture, color, odor, taste and total acceptance) ,rheological characteristics(hardness, cohesiveness, springiness and chewiness) were evaluated for all treatments.

Texture Study

Textural characteristics of stored dried mulberry were measured by QTS Texture Analyzer- CNS Farnell and by TPA that is for evaluating textural properties of products. Back Extrusion that is one of the TPA tests and is suitable for semi solid products was experimented. The measured characteristics were hardness, cohesiveness, cohesiveness force, springiness and chewiness (Doymaz Ibrahim, 2004).

Experimental design

Two factors Factorial test adopted completely randomized design with 3 replicates was used. Factor A was pre-treatments by 9 level and factor B was packaging type by 2 levels. After analysis of the data, Duncan multiple range test was used for comparison of data in 5% and 1% levels.

Results and discussion

Rheological properties

Hardness

Comparisons of means showed that the most and least hardness was in ethyl oleate 2%+ ascorbic acid1% and ethyl oleate 2%+ Calcium chloride 1% respectively. The pretreated and dried mulberry that was packed in poly ethylene had more hardness that poly styrene.

Table 1. Different pretreatment solutions.

1	white, Ethyl Oleate 2%
2	white, Ethyl Oleate 2% + citric acid 1%
3	white, Ethyl Oleate 2% + ascorbic acid 1%
4	white, Ethyl Oleate 2% + sodium Metabisulphide 0/5%
5	white, Ethyl Oleate 2% + calcium chloride 1%
6	white, control
7	khardar, Ethyl Oleate 2% + ascorbic acid 2%
8	khardar, Ethyl Oleate 2% + calcium chloride 1%
9	khardar, control

Cohesiveness

White dried mulberry which is pretreated by ethyl oleate 2%+ Calcium chloride 1% had the most cohesiveness among the other treatments. Dried mulberry in poly ethylene bags had more cohesiveness than polystyrene bags.

Springiness

Comparison of means showed that the most and the least springiness was in No.5 and 9 treatments respectively. Pretreated and dried mulberry that was packed in poly styrene has more springiness than poly ethylene.

Table 2. Effect of treatment on rheological characteristics of dried mulberry after 5 months storage.

Texture treatment	Hardness (N)		Cohesiveness (NS)		Springiness (NS)		Chewiness	
1	7.780	ef	1.008	c	0.9333	c	5.912	c
2	16.63	bc	1.262	c	0.9550	c	14.26	c
3	20.97	a	1.340	c	1.203	c	27.37	bc
4	13.07	cd	3.928	b	2.457	b	61.58	a
5	18.89	ab	6.148	a	0.4300	c	47.88	ab
6	4.095	fg	0.5300	c	4.975	a	10.16	c
7	10.64	de	0.4450	c	5.465	c	25.72	bc
8	3.640	g	1.930	c	1.577	e	7.497	c
9	8.357	e	1.453	c	0.8450	c	8.408	c

Chewiness

The comparison of means showed that white mulberry pretreated by ethyl oleate 2%+ potassium Meta bisulfate 0.5% had the most chewiness. The chewiness in pretreated and dried mulberry preserved in poly styrene better than poly ethylene.

Sensory attributes

Texture

Texture score of dried mulberry was significantly affected by treatments before drying and packaging. The most scores for texture score were in ethyl oleate 2%+ potassium meta bisulfate 0.5%, ethyl oleate 2%+ ascorbic acid1% and ethyl oleate 2%+ Calcium chloride 1% and the least was in control. Dried mulberries packed in poly styrene showed the better score for texture than dried mulberries packed in poly ethylene bags.

Table 3. Effect of treatment on sensory characteristics of dried mulberry after 5 months storage.

Attribute treatment	Texture		Color		Odor		Taste		Overall Acceptance	
1	2.8	bc	3.05	bc	2.75	b	2.55	c	2.75	bc
2	3.2	ab	3.35	b	3.15	ab	3.2	ab	3.25	ab
3	3.35	a	3.55	b	3.35	a	3.35	a	3.25	ab
4	3.5	a	4.15	a	3.2	ab	3.45	a	3.45	a
5	3.35	a	3.15	bc	2.95	ab	3.4	a	3.15	ab
6	2.6	c	2.7	cd	2.9	ab	3	abc	2.85	bc
7	2.8	bc	2.25	de	2.95	ab	2.75	bc	2.5	c
8	3.3	ab	2.1	ef	2.8	b	2.8	bc	2.7	bc
9	2.65	c	1.7	f	2.9	ab	2.65	c	2.55	c

Color

Color score was significantly affected by different treatments before drying. The results showed that the most color score was in ethyl oleate 2%+ potassium Meta bisulfate 0.5% and the least score in *Rasmi* variety control.

Odor

The most and the least score for odor were respectively in ethyl oleate 2%+ ascorbic acid1% and ethyl oleate 2%+ Calcium chloride 1%.

Taste

Taste score was significantly affected by treatments and packaging. Comparison of means showed that white dried mulberry pretreated by ethyl oleate 2%+ potassium meta bisulfate 0.5% , ethyl oleate and control had the most and the least score for taste score. Poly styrene preserved the taste of dried mulberries better than poly ethylene.

Overall acceptance

The most and the least score for odor were respectively in white, Ethyl Oleate 2% + sodium Metabisulphide 0/5% and Rasmi variety, Ethyl Oleate 2% + ascorbic acid 2%.

Non enzymatic browning

The least intensity of non enzymatic browning was observed in ethyl oleate 2%+ ascorbic acid1% and then in ethyl oleate 2%+ potassium Meta bisulfate 0.5% treatments.

The results showed that Least intensity of brown color was in dried white mulberry pretreated by ethyl oleate 2%+ ascorbic acid1% and then in ethyl oleate 2% +potassium meta bisulfate 0.5% treatments . The lowest total count was in white mulberry in ethyl oleate 2%+ potassium Meta bisulfate 0.5%.

The results of rheological tests showed that the highest score for chewiness was in white mulberry pretreated with ethyl oleate 2%+ potassium Meta bisulfate 0. 5%. Besides white mulberry pretreated and packaged in poly styrene had the lowest scores

for brown color and total count after 5 months storage. The results of Panel tests showed highest score for texture, color, odor, taste and overall acceptance in pretreatment of fruits with ethyl oleate 2%+ potassium Meta bisulfate 0.5%.

The reduction of drying time after pretreatment of fruits with ethyl oleate was mentioned in some research papers (Doymaz, 2004, Petrucci *et al*. 1974). Doymaz (2004) stated that application of citric acid and ascorbic acid in addition to ethyl oleate can lead to reduction of drying time but it was not as effective as ethyl oleate. The possibility of producing off flavour and odor should be noted during application of ethyl oleate. Application of combined solution of ethyl oleate and other compositions such as citric acid, ascorbic acid, potassium Meta bisolfite and calcium chloride in this research was considered as a solution to improve taste and odor. Doymaz (2004),considered indices for dried fruits quality including color, pathogen microorganisms, taste (sweetness, sourness, sulfur residues and off flavor), moisture content and texture (chewiness) . Rahman and Al Farsi (2003) measured textural characteristics of date and concluded that by decreasing fruit moisture the hardness and chewiness of date were enhanced. Although cohesiveness and springiness increased, in critical moisture (21.5%) it reached to its peak point.

Conclusions

Totally it is concluded that dried white mulberry pretreated with combination of ethyl oleate 2% and potassium meta bisulfate 0.5% and packed in poly styrene preserved its qualitative, sensory and rheological characteristics after 150 days in 20°C.

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