EFFECT OF DIFFERENT DRYING CONDITIONS ON COLOUR AND TEXTURAL PROPERTIES OF POMEGRANATE PESTIL

İsmail Tontul[1,2] Ayhan Topuz[2,*]

[1] Necmettin Erbakan University, Department of Food Engineering, Konya, 42050, Turkey
[2] Akdeniz University, Department of Food Engineering, Antalya, 07058, Turkey
* mail: atopuz@akdeniz.edu.tr, Tel: +902423102447

Short shelf-life of the fruits forced people to produce more stable products such as jams, marmalades, pestil (fruit leather), over centuries. Among this products, pestil is a restructured product produced using fruit juice, honey and starch. This mixture was boiled, to jellify the mixture and spread in a thin layer then dried to water activity below 0.6 which is under the microbiological risk region. Traditionally, sun or shade drying was used in pestil production. However, these drying techniques take long drying time and have some microbiological risks. Therefore in the present study, two different pestil formulation was dried using different drying systems and conditions (hot air drying at 50, 60 and 70ºC; microwave assisted hot air drying in two different microwave levels (90 or 180W) at 50, 60 and 70ºC and refractance window drying at 90, 95 and 98ºC) and the physical characteristics of the pestils were evaluated. Drying According to the results hot air drying resulted in highest L and chroma values and the lowest hue angle. Microvawe assisted hot air drying in both microwave levels increased the hue angle but decreased the L value and chroma value of the pestils. Refractance window drying provided closer color properties to the hot air drying. Hardness, springiness and chewiness of the pestils were evaluated as textural properties according to texture profile analysis. While refractance window drying provided the highest hardness, pestils produced with microwave assisted drying especially at 180W power had the lowest hardness values. This could be related with the diffusion channel formed due to the high diffusion during microwave assisted drying. All pestils had springiness higher than 0.87 which is a desirable property for this type of products. Chewiness is a function of the hardness and springiness of the product, therefore, it was the highest in the samples produced with refractance window drying. Generally, increasing drying temperature resulted in decreasing of chewiness of the pestils. In conclusion, refractance window is a promising alternative for rapid, sustainable and cheap pestil production with good physical properties.

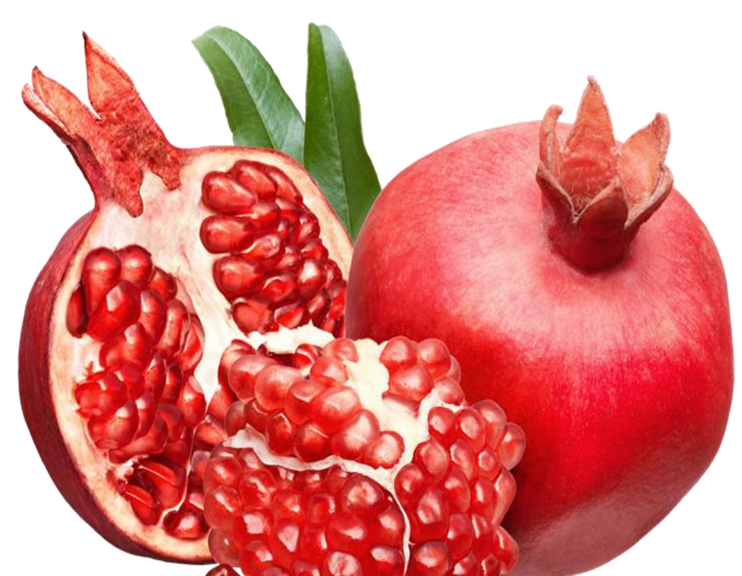
INTRODUCTION

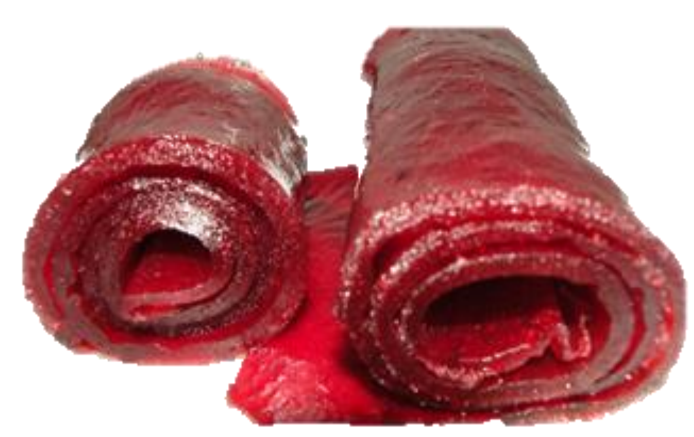
Pomegranate is a rich source of functional phytochemicals such as anthocyanins, phenolics and ascorbic acid (Fischer et al 2011). Some biological functions of this phytochemicals are antioxidant activity, prevention of several tumors, antiproliferative activity and antimicrobial activity (Sepulveda et al 2011). However, this phytochemicals are very sensitive to environmental and processing conditions.

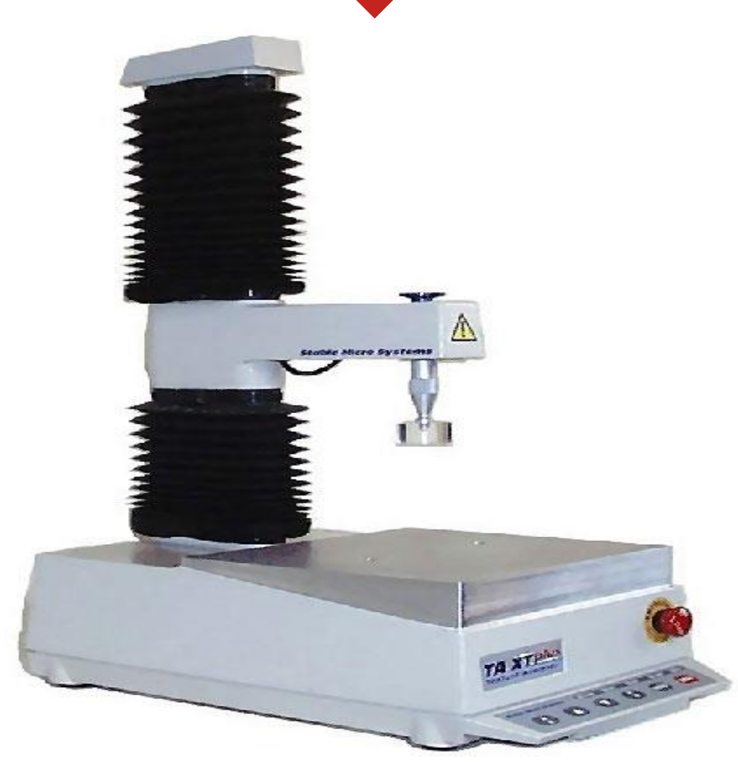
Pestil is a traditional fruit product of Turkey. There are similar products named as "Bastegh" in Armenia, "Qamar al deen" in Lebanon and other Arabian countries and "fruit leather" in USA (Ruiz et al 2011). According to Turkish Standards, pestil is defined as "Concentration of grape, plum, apricot and mulberry juice and pulps with the addition of edible starch, sugars, and additives and dried in thin layer form". However, different fruits such as fig, and peach can also be used in the pestil production. Although, Nabais (2010) reported pomegranate is not suitable for fruit leather production, it has been used in pestil production in Turkey. The processing steps of pestil is mainly processing the fruit into juice or pulp form, concentration, starch addition, spreading, drying and packaging (Suna et al 2014).

Pestil has a pleasant appearance, practical to eat, nutritious, stable and suitable for packaging. This properties made the pestil a very good food to addition of fruit based micronutrients, phenolic antioxidant and dietary fiber in the diet of children and adults (Suna, et al 2014; Valenzuela & Aguilera, 2013). However, during concentration of the juice and pulp and gelation of the starch, some toxic compounds such as HMF and acrylamide can be formed. Additionally, the sensitive phytochemicals of the fruits are decreased due to the detrimental effect of heat. Therefore, pestil processing without using heat treatments must be developed to produce the highly functional product.

The aim of the present study was to compare two different formulation and four different drying systems at three different temperature on the color and textural properties of the pomegranate pestils. L, hue angle and chroma was analyzed and calculated for the determination o the color hardness, resilience and gumminess were determined as textural properties.







MATERIALS AND METHODS

In the present study, pomegranate pestil in two different formulation was prepared and dried using four different driyng systems.

Pestils were analyzed according to their color and textural properties using a Konica Minolta colorimeter and TA.XT2 Plus texture analyzer, respectively.

RESULTS AND DISCUSSIONS

In the present study colour and textural properties of the pestil produced with two different formulation and dried using four different drying systems (hot air drying at 50, 60 and 70ºC; microwave assisted hot air drying in two different microwave levels (90 or 180W) at 50, 60 and 70ºC and refractance window drying at 90, 95 and 98ºC).

According to the results, pestil produced with hydrocolloids have higher L, hue angle and chroma values with inditaces lower colour changes probably due to lower enzymatic browning reactions. The lowest change in the colour was obtained by hot air drying and refractance window drying.

Hardness, is an important physical characteristics of the pestil since this product usually processed into other products such as rolled pestil with nuts. The hardest pestils were produced by refractance window drying. On the other hand, combined microwave drying resulted in the lowest hardness which could be related to the vapor holes formed due to the high evaporation rate.

Resilience a indicator of the elasticity of the pestils were found to be higher than 0.88. These results are in consistent with literatür (Boz 2012). Gumminess is a function of hardness and resilience of the pestil. Therefore the pestils had the highest hardness also had the highest gumminess.

CONCLUSIONS

In the light of the obtained results it was concluded that refractance window drying is a promising alternative for rapid, sustainable and cheap pestil production with good physical properties.

Variation source		L	Hue angle	Chroma
Traditional		29.08±0.52b	36.59±0.95b	15.60±0.51b
Hydrocolloids		32.51±0.29a	39.45±0.92a	23.57±0.61a
Hot air drying	50ºC	31.4±1.65ab	30.91±0.62j	23.56±4.86a
	60ºC	31.46±1.5ab	33.22±1.42i	23.05±2.71a
	70ºC	30.86±1.28abcd	36.31±0.55gh	19.17±4.4bcd
MW combined drying (90W)	50ºC	28.78±3.49e	36.93±2.07fg	18.67±4.46bcd
	60ºC	32.43±0.43a	40.27±1.26c	17.44±4.33d
	70ºC	29.45±2.14cde	37.54±2.22efg	18.18±3.42cd
MW combined drying (180W)	50ºC	29.34±1.02de	42.41±1.32b	17.28±2.44d
	60ºC	32.36±1.37a	46.72±0.94a	17.68±1.17d
	70ºC	29.93±1.51bcde	35.19±0.72h	19.85±1.34bc
Refractance window drying	90ºC	30.91±2.57abcd	38.64±3.05de	20.07±2.67bc
	95ºC	31.11±1.45abc	38.21±2.63ef	19.80±3.41bc
	98ºC	31.47±2.96ab	39.94±4.14cd	20.26±5.19b

Variation source		Hardness	Resilience	Gumminess
Traditional		20.66±0.86ef	0.92±0.01abc	18.00±0.04c
Hydrocolloids		23.51±0.74cd	0.91±0.01abcde	20.17±0.37b
Hot air drying	50ºC	25.46±0.53bc	0.91±0.01abcde	21.60±0.03b
	60ºC	21.62±1.43de	0.88±0.01ef	20.20±0.84b
	70ºC	15.03±0.21g	0.89±0.01def	12.70±0.04d
MW combined drying (90W)	50ºC	18.18±1.25f	0.90±0.01bcdef	10.69±0.11e
	60ºC	21.48±0.37ed	0.90±0.01cdef	17.97±0.12c
	70ºC	9.08±1.34h	0.93±0.00a	5.60±0.33f
MW combined drying (180W)	50ºC	8.37±0.79h	0.92±0.01abcd	6.73±0.75f
	60ºC	29.12±0.23a	0.93±0.00ab	23.67±0.05a
	70ºC	27.06±0.36ab	0.92±0.01ab	23.67±0.83a
Refractance window drying	90ºC	23.50±0.46cd	0.87±0.00f	20.35±0.99b
	95ºC	20.66±0.86ef	0.92±0.01abc	18.00±0.04c
	98ºC	23.51±0.74cd	0.91±0.01abcde	20.17±0.37b

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