

EFFICIENCY OF POMEGRANATE SEED OIL*

Sukru Karatas, Nihan Ozdogan

Food Engineering Department, Istanbul Aydin University, Istanbul Turkey,
email:sukrukaratas@aydin.edu.tr, email:n.cetindag@hotmail.com

ABSTRACT

In this paper pomegranate kinds that reach to harvest maturity which are produced in commercial scales in Adana, Antalya, Finike and Kilis regions in Turkey and also Hicaz and Eksilik kinds are chosen randomly to be investigated. Seed efficiencies, grain ratios, oil efficiency of these chosen pomegranate kinds were studied. According to this study, pomegranate kind taken from Kilis region is found to have the highest grain efficiency with a ratio of 71% and pomegranate kind taken from Hicaz region is found to have the highest seed oil with a ratio of 18%. Also various solvent efficiencies including Hexan, Diethylether and petroleum ether on pomegranate seed oil is examined and most efficient one is obtained with Diethylether.

Keywords:Pomegranate, Pomegranate Seed, Solvent

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1. INTRODUCTION

Pomegranate is a tropic-subtropic climate fruit which is a kind of *Punica granatum* Linnaeus type belonging to Punicaceae family [1]. In the medieval age this fruit is named after “*Pomuni granatum*” that means seedy apple [2; 3]. As Carthaginians, a Phoenician colony, started the pomegranate trade in the Mediterranean basin, in the ancient sources the pomegranate is referred to “Carthaginian (Phoenician) Diamond” (The apple of Carthage / Carthaginian apple) [4; 5]. Today it is known as seedy apple in USA.

Pomegranate name passes in all holy books and has some special meanings in religions Judaism, Christianity, and Islam. Pomegranate is also depicted in engravings and paintings found in the temples. History of pomegranate is very old and so it is not only an ordinary fruit but also has many different

usage fields. Pomegranate had been used as a national symbol and even given as a name for some settlements. It is a special fruit which is known to be good for human health and it has been used in cultural activities (wool dyeing and ornament) as well [6].

In our country, when the production amount is examined in a province scaled manner, Antalya province is seen to be the leader by far better. Antalya produces 79.112 tons of pomegranate. This number corresponds to 63.2 % of all Mediterranean Region production of 125.065 tons, and also % 37.9 of overall pomegranate production in Turkey. Antalya is followed by Mugla (26.051), Mersin (17.440), Adana (14.636), Denizli (13.667) and Hatay (9.351 tons). When year 2010 is taken into account, 54 provinces in Turkey took place in pomegranate production and those 6 province afore

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mentioned has supplied 76.8 % of all the production [7].

Some of our major pomegranate types that has become known all over the world nowadays are as follows; Hicaz pomegranate, Fellahyemez, Ernar, Eksilik, Katırbasılı, Eksi Goknar, Lefan, Erdemli Asinar and Silifke Grafting. However, some domestic varieties have special importance in pomegranate cultivation so that they have become synonymous with the field. The most typical example to this is the Dislinar-“Toothed pomegranate” (Zivzik pomegranate) which has large grains and is grown in Dislinar Village of Sirvan province situated in Siirt/Turkey [6].

Pomegranate seed is obtained by dewatering of pomegranate grains which after were washed and passed from the brushes by drying them in a natural drying tunnel. Pomegranate seed drying process on an industrial scale is also carried out in Turkey (Figure 1).



Figure 1. Pomegranate Seed Drying Plant

There are some studies on pomegranate seed oil content and fatty acid composition. In a study; punicic, linoleic, oleic, palmitic, stearic and arachidic acid ratio in pomegranate seed oil are found to be changing in values %31.8-86.6, %0.7-24.4, % 0.4-17.4, %3.7-16.7, %0.3-9.9 and %0-3.9 respectively. In another survey conducted on pomegranate seed oil; ratios determined are as follows: punicic acid %66.76-79.29, linoleic acid

%4.98-7.74, oleic acid %4.70-5.91, palmitic acid %2.99-3.83, stearic acid %1.6-2.38 [8; 9].

Pomegranate seed oil is used as vegetable cooking oil and it is desired to be imported by some countries for use in the cosmetic and pharmaceutical industries, it is known that for this purpose dried pomegranate seed is exported in recent years [10]. There are many studies showing positive effects of pomegranate seed oil in terms of health. These studies have focused on especially punicic acid. It is reported that pomegranate seed oil is effective in the prevention of the prostate and skin cancer, and lowering lipid levels in the liver [12;13;14].

In this paper oil efficiencies in the pomegranate seeds of Adana, Adıyaman, Antalya, Finike, Kilis and Hicaz ve Eksilik pomegranate kinds harvested in our country, and also various solvent effects on efficiency for extraction of pomegranate seed oil is investigated.

2. MATERIAL AND METHOD

Samples used in the study, fruits taken by Pearson Square method in the season which they reached maturity (in October) from markets the group in all aspects that can represent the quantity and quality [15]. Varieties of pomegranate fruit weight, grain and seed rates was determined by weighting method (Analytical Precision Balances And G 200). After pomegranate fruits was grained, they passed through the stainless steel sieve to separate pomegranate juices. Residues on seeds were removed and they washed with pure water. Dry matter content of seeds was determined by dried in 105°C. Seed oil amount determined by Soxhalet extraction, refractive index determined by Reichert Abbe Mark III refractometer in 20°C. Chemical analysis like the free fatty acid, iodine and peroxide value to determine pomegranate seed oil's

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characteristic specification changes according to region and varieties was performed using TS EN ISO 660, EN ISO 3961, TS EN ISO 3960 methods [16; 17; 18].

3. DISCUSSION AND CONCLUSION

Pomegranate varieties of fruit weight, grain yield and seed rates used on research are given in Table 1.

Table 1. Some Physical Specifications of Pomegranate Species (Average±Standard Error)

Example	Fruit Weight (g)	Grain (%)	Seed (%)
Adiyama n	486.76±29.29	60.78±4.59	13±2.55
Antalya	716.96±42.30	50.5±5.19	12.1±2.54
Ekşilik	367.67±27.12	55.7±4.92	15.7±2.32
Finike	263.34±12.37	50.14±3.54	12.3±1.33
Hicaz	357.02±31.82	61.3±3.69	15.8±1.85
Kilis	267.70±27.07	73.7±4.34	22.6±2.82

* Numerical data in this study were also used in journal of Food Technology.

On the samples' physical and chemical properties, such as Pomegranate fruit variety, growing region, climatic conditions, soil type, harvest time, according to many factors, it were seen significant differences. Sample Pomegranate's varieties fruit weights were different between 263-716 g. Heaviest fruit sample average was o Antalya region samples (716.96 g), lightest one was Finike region samples (263.34 g). A study which examined twenty different varieties of Iranian pomegranate fruit has been found that weights change between 196.89-315.28 g [19]. On a study which examine

pomegranates grown in the GAP region on varieties of fruit weight was found to vary between 153.45-417.31 [20]. In a study which examined 15 different pomegranate varieties grown in Turkey, the average fruit weight ranged between 327-543 g were found to be [21]. In a study which examine the morphological characterization of five new pomegranate varieties grown in southeast Spain, the average fruit weights were ranged between 251-421 g [22]. It shows this differences may occur because of different factors such as region, climate, soil differences.

One of the physical specification which is important in fruit characterization and analyse on this work is fruit's % grain rate. Each of the samples grain rate is different. For example, on our work pomegranate which has highest grain rate is Kilis pomegranate with %73.7 and lowest one is Finike pomegranate with %50.14. On other studies which examine pomegranate seed, it was determined %55-60 [23]. On an another study about Akanar, Nabha and Chawla pomegranate, eatable part rate of pomegranate was found between %58.82-61.09 [24]. Grain rate of samples shows differences from literature datas. The diversity of species leads this reason.

Seed rates of pomegranate varieties used in this research were determined and were found to be significant differences between rates. Highest rate on this samples were in Kilis pomegranate with %22.6 ratio and there is a big gap between Kilis pomegranate rate and other pomegranate samples. Other two highest sample pomegranate species were Hicaz (%15.8) and Ekşilik (%15.7). Lowest seed rate were in Antalya (%12.1) and Finike (%12.3). These rates were found higher than literature datas. In fifteen pomegranate varieties grown in Turkey, grain rates are between %8.28 and %15.11 [21]. In another research, the seed ratio was determined with

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30-45 g / kg [9]. Results show that assesment of pomegranate seeds in Turkey is more economical other than other countries.

n this study, the fruit of the pomegranate seed dry matter and oil contents were analyzed (Table 2).

Table 2. Oil Contents and Dry Matter of Seeds of Pomegranate Species

Example	Dry Matter (%) (Average±Standard Error)	Oil (%) (Average)
Adiyaman	43.86±4.25	15.5
Antalya	37.82±4.67	14.1
Ekşilik	38.96±3.66	13.7
Finike	39.43±2.51	11.6
Hicaz	39.85±2.63	16.4
Kilis	40.93±3.23	15
Adana(dried)	–	18

The dry matter content of varieties used in the study differs from 37.82% to 43.86%. Highest dry matter content was in Adiyaman (43.86%). It followed by Kilis (40.93%) and the Hicaz (39.85%). Lowest dry matter content was found in Antalya pomegranate with 37.82% ratio. If distance from sea level and the Mediterranean climate move away, dry matter content is found increased.

One of the main objectives of the research is to identify the fat content of the seed. Samples' oil content as other features showed significant differences between varieties. Highest oil content of pomegranate species which used in our study was Hicaz pomegranate, which grown mostly in Mediterranean part of Turkey, has %16.4. After that

comes Adiyaman (%15.5) and Kilis (%15) pomegranates. Lowest oil content between samples was Kilis pomegranate with %11.6 oil content. On this research, also used dried pomegranate seed and their oil contents calculated %18. It shows that species of pomegranate has very important effect on oil content and industrial dried pomegranate seed has much more oil than fresh pomegranate. When different solvents used on dried Adana region pomegranate seeds, different results occurred. When Hexan for solvent used, oil content was %18, results for diethyl ether was %19.9, results for petroleum ether was %14.7. From this results, solvent types has a very big impact on oil content. In a study on 25 Persian pomegranate species, oil content of dry matter was found between %6.63 and %19.3[8]. On a research about three Spain pomegranate species, oil content of dry matter was found between %6.897 and %10.490 [9]. When results examined, Hicaz, Adiyaman, Antalya and Kilis pomegranates have much richer oil content than Spain and Persian pomegranates.

Pomegranate seed's importance is coming from its oil content. To reveal seed's oil characteristic, refractive index value of oil and fatty acid analysis was performed. The refractive index of pomegranate seed oil has fluctuated between 1.502 and 1.519. According to Turkish Food Codex 'Plant Oils mentioned by name', the refractive index of palm seed oil is 1.448-1.452, grape seed oil's refractive index is 1.467-1.477 [25]. Pomegranate varieties don't show significant differences on refractive index and they have higher refractive index other than other plant oils. This is one of the pomegranate seed oil's characteristic specifications.

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Table 3. Some Chemical Properties of Pomegranate Seed Oil

Örnek	% Free fatty acids (Based on oleic acid)	% Free fatty acids (Based on punicic acid)	Iodine index (Wijs)	Peroxide value (meq O ₂ /kg)
Adıyaman	0.28	0.27	17.1	4.4
Antalya	0.56	0.55	19	2
Ekşilik	0.42	0.41	12	4
Finike	0.7	0.69	21.5	2.4
Hicaz	0.42	0.41	22.8	3.6
Kilis	0.28	0.27	17.7	4
Adana (dried)	0.56	0.55	15.2	1

Products surveyed in pomegranate seed oil free fatty acid value in the range of 0.70% to 0.28% was detected. Examples of varieties with high free fatty acid value Finike (0.70%), Antalya (0.56%) and Adana (0.56%) followed pomegranate varieties. Free fatty acid value with the value of 0.28% is the lowest varieties of pomegranate varieties was Adıyaman and Kilis. Turkish Food Codex 'Plant name with the aforementioned oils communique' by the acid number of the refined oil at most 0.6 mg KOH / g oil, cold pressed and virgin oils at most 4.0 mg KOH / g of oil, natural palm oil is a maximum of 10 mg KOH / g fat are tested.

In this study pomegranate seed oils iodine index detected and highest iodine index (22.8) was determined in Hicaz pomegranate, Finike (21.5) and Antalya (19) pomegranate was followed. The pomegranate varieties with low iodine index was Ekşilik (12). Research findings showed values change between 12 and 22.8. Iodine index on the variety, grown product of the climate and soil was considered to be effective.

Resulting from the oxidation of unsaturated fatty acids are the first products peroxides. Usually detecting the presence of peroxides are used as quality indicators. Surveyed peroxide value of pomegranate seed oil was changed significantly between 1.0-4.4 meq O₂/kg. In examples, Adıyaman pomegranate has highest number of peroxide (4.4 meq O₂/kg), while Adana pomegranate has the lowest number of peroxide (1.0 meq O₂/kg). According to Turkish Food Codex 'Oils with mentioned of plant name' peroxide value is most 10 meq O₂/kg in refined oil, in cold pressed and virgin oils are most 15 meq O₂/kg.

This study examined the coresobtained from pomegranate varieties in terms of oil content was found to be an important resource. Results of this study show that, the ratio of seed and oil content of seed of these varieties grown in Turkey has significant advantages over pomegranates of other countries in world. The amount of pomegranate production in our country and considering the potential, as an economic resource of pomegranate seed will be seen in a very important position.

Scientific researches over pomegranate and pomegranate seed, which has a very big advantage because of benefit to be near Europe, are insufficient. Usual researches on pomegranate are about adaptation and housing conditions. It is thought that this type of studies will be beneficial over popularity on pomegranate.

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