

# Importance of methods in drying apricot

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**Abstract.** This article describes the results of the research conducted on the drying of different types of apricots. Experiments were conducted to study the chemical composition of apricots, the quality of the finished product after drying in three different ways, and the duration of drying. During the research period, the biochemical composition of fruits selected as raw materials was regularly analyzed. The highest indicator of the amount of dry matter in the composition was observed, and three-year average indicators were studied. Sugar is the main part of the dry matter content of apricots. Also, the content of sugar is an important indicator of the organoleptic properties of fresh and dried apricots. During the experiments, the sugar content of the selected apricot varieties was measured over the years, and average sugar content indicators were determined. Apricots are dried in three different ways - naturally, in special drying equipment with solar batteries, and artificially in laboratory conditions in the dryer data based on drying experiments are presented.

## 1 Introduction

More than 4 million tons of apricots are grown every year around the world. In terms of apricot production, Uzbekistan ranks second after Turkey (730 thousand tons) and more than 660 thousand tons are grown. Iran (306,000 tons), Algeria (256,000 tons), Italy (237,000 tons), Pakistan (178,000 tons) and Spain (125,000 tons) are on the next places in production. Apricots contain 87% water, 11% carbohydrates, about 1% proteins and less than 1% lipids. Apricots are rich in various microelements and vitamins [1, 2].

Supplying the population of our republic with quality food products throughout the year is one of the most pressing issues today. In the Decree of the President of the Republic of Uzbekistan dated January 28, 2022 "On the Development Strategy of New Uzbekistan for 2022-2026" Especially by 2026 the volume of food products to 7.4 million tons, and the processing level of fruits and vegetables to 28 percent" is paid special attention. Ensuring the performance of these tasks, including obtaining high efficiency as a result of preparing high-quality products by drying grain fruits in various ways, is becoming important [3, 4].

Various methods of drying apricots and their properties have been studied. The aim of this study was to study the optimal method of drying dried apricots and the duration of drying [5, 6].

The findings of study on the drying of several apricot varieties are discussed in this article. The chemical makeup of apricots, the quality of the end product after drying in three distinct ways, and the length of drying were all the subjects of experiments. The

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biochemical makeup of the fruits chosen as the research's raw materials was routinely examined. Three-year average indications were examined together with the greatest indicator of the composition's dry matter content. The majority of an apricot's dry matter is made up of sugar. Moreover, the sugar content of fresh and dried apricots is a key sign of their organoleptic characteristics.

## 2 Materials and methods

Research was conducted on the following plum varieties: Subkhoni Yubileynny Navoi (control), Lolacha Bukharsky, and Sholakh.

The following were studied for the selected varieties: Biochemical composition of the selected varieties was analyzed [7-10]; Apricots were dried and analyzed in three ways: whole, split into two, and seedless.

According to the method of conducting research:

- Determination of duration and organoleptic evaluation of apricot fruits in whole, split, and seedless state without cracking.
- Determining the length of drying and organoleptic evaluation of apricots whole, divided into two halves, and in the seedless state without cracking in special drying equipment with a solar battery.
- Determination of duration of drying and organoleptic assessment of apricots in whole, split, and seedless condition in an artificial drying device.

## 3 Results and discussion

For research, 4 varieties of apricots were selected from fruit trees. Before the drying process, the fruits characteristic of these varieties were analyzed for their biochemical composition. In the process of analysis, the content of dry matter, sugar content and acidity were studied as important parameters for drying.

Yubileynny Navoi, Lolacha Bukharsky, Sholakh, Subkhoni varieties selected for experiments are regionalized in Uzbekistan and are grown mainly in the central zones of our country (Table 1).

**Table 1.** Biochemical composition of dry fruits of dried apricot varieties.

Apricot varieties	Years	Water content, %	Dry matter, %	Sugar content, %	Acidity, %
Anniversary Navoi (control)	2019	74.0	26.0	19.8	0.9
	2020	72.5	27.5	20.9	0.9
	2021	75.6	24.4	18.5	1.0
	avg	74.0	26.0	19.7	0.9
Lolacha Bukharsky	2019	78.1	21.9	16.6	1.0
	2020	76.2	23.8	18.1	1.0
	2021	77.3	22.7	17.3	1.0
	avg	77.2	22.8	17.3	1.0
Sholakh	2019	82.3	17.7	13.5	1.1
	2020	84.2	15.8	12.0	1.1
	2021	84.2	15.8	12.0	1.1
	avg	83.6	16.4	12.5	1.1
Subkhani	2019	75.3	24.7	18.8	1.0
	2020	78.2	21.8	16.6	1.0
	2021	77.3	22.7	17.3	1.0
	avg	76.9	23.8	17.5	1.0

During the research period, the biochemical composition of fruits selected as raw materials was regularly analyzed. The highest indicator of dry matter content was observed in the Yubileyny Navoi variety, the three-year average of which was 26.0%, while the lowest indicator was shown in the Sholakh variety and was 16.4%. Also, Lolacha was 22.8 and 23.8% in Bukharsky and Subkhoni varieties, respectively.

Sugar is the main part of the dry matter content of apricots. Also, the content of sugar is an important indicator of the organoleptic properties of fresh and dried apricots. During the experiments, the sugar content of the Yubileyny Navoi variety, which was selected as a control, was 19.8% in 2019, 20.9% in 2020, and 18.5% in 2021, while the three-year average sugar content was 19.7%.

The lowest level of sugar content was observed in the Sholakh variety, the three-year average of which was 12.5%. Also, 17.3% three-year average was recorded in Lolacha Bukharsky variety.

Experiments were carried out on drying apricots in three different ways - natural, in special drying equipment with solar batteries, and in artificial drying equipment. Apricots for drying were placed in three types - with seeds and without seeds. Initially, experiments were conducted to determine the optimal duration of drying when whole apricots are dried.

During experiments, Yubileyny Navoi variety, selected as a control, was dried in a natural way. On average, 27.6 kg of finished dried product was obtained from 100 kg of raw materials when dried in grain form. 28.7 kg of dry product with grains was obtained when dried in a special drying equipment with a solar battery. Also, 29.8 kg of finished product was obtained when dried in an artificial drying device.

Subkhoni variety had the highest yield of dried apricots, and an average of 28.1 kg of dried apricots was obtained from 100 kg of raw material in natural method, 28.7 kg in special drying equipment with solar battery and 31.0 kg in artificial drying equipment. In particular, when dried naturally, Yubileyny Navoi (control) yielded 27.5 kg in 2019 research, 29.7 kg in 2020 research, 25.6 kg in 2021 research, three-year average of 27.6 kg. During natural drying, an average of 28.4 kg of Lolacha Bukharsky variety and 26.0 kg of dried product of Sholakh variety were prepared in three years.

Also, the duration of the drying process when whole apricots are dried varies by variety. That is, the process lasted 244 hours in Yubileyny Navoi, which was selected as a control when dried naturally, and was recorded as the shortest duration. Lolacha Bukharsky the process took the longest and was 288 hours. On the other hand, the drying process of Sholakh variety lasted 260 hours, and Subkhani variety lasted 252 hours. During natural drying, the air temperature during the day was 30-35°C (Fig. 1).



**Fig. 1.** The drying process of apricots taken for research in special drying equipment with solar batteries.

When dried in special drying equipment with solar batteries, the process for all varieties was almost 3 times faster. For example, it took 288 hours for Lolacha Bukharsky to dry naturally, and 96 hours for special solar drying equipment. The reason for this is that the equipment is adapted to maximize the use of sunlight effectively (Fig. 2).



**Fig. 2.** The process of drying apricots taken for research in artificial drying equipment in laboratory conditions.

At the same time, the duration of artificial drying for all varieties was 6-8 hours. When the finished product was assessed by organoleptic method, a significantly higher index was noted in artificially dried products compared to other drying methods (Table 2).

**Table 2.** Process duration and output of finished product in drying whole apricots by different methods (2019-2021).

Varieties	Drying method	Product output from 100 kg of raw materials, kg				Drying time, (hours)	Tasting grade, max 100 points
		2019	2020	2021	Average		
Anniversary Navoi (control)	Natural method	27.5	29.7	25.6	27.6	244.0	75.4
	Special drying with solar battery in the equipment	28.6	30.9	26.6	28.7	81.3	81.1
	Artificial in laboratory conditions in the dryer	29.7	32.1	27.6	29.8	6.8	88.1
Lolacha Bukharsky	Natural method	28.3	30.6	26.3	28.4	288.0	76.1
	Special drying with solar battery in the equipment	29.4	31.8	27.4	29.5	96.0	81.8

	Artificial in laboratory conditions in the dryer	30.6	33.0	28.4	30.7	8.0	88.9
Sholah	Natural method	25.9	28.0	24.1	26.0	260.0	72.0
	Special drying with solar battery in the equipment	26.9	29.1	25.1	27.0	86.7	77.4
	Artificial in laboratory conditions in the dryer	28.0	30.2	26.0	28.1	7.2	84.1
Subkhani	Natural method	28.6	30.9	26.6	28.7	252.0	76.9
	Special drying with solar battery in the equipment	29.7	32.1	27.7	29.8	84.0	65.8
	Artificial in laboratory conditions in the dryer	30.9	33.4	28.7	31.0	7.0	89.9
<i>EKF</i> <sub>05</sub>		0.8	0.8	0.8	0.8	0.7	0.8
<i>Sx</i>		4.8	4.8	4.8	4.8	4.8	4.8

Before drying, the process parameters were unique when the apricot was split into two stages and dried in the seedless state (Table 3).

The duration was somewhat shorter when raw apricots were split into two halves and dried pitted. Yubileyny Navoi variety, which was selected as a control for research, was naturally divided into two phases, and when dried in the seedless state, an average of 22.6 kg of ready-dried product was prepared from 100 kg of raw material.

The highest productivity was reflected in the Subkhoni variety when three-year indicators were analyzed when dried naturally, and 23.5 kg of dried product was obtained. The lowest productivity was recorded in the Sholakh variety, the three-year average of which was 21.3 kg.

In special drying equipment with solar batteries dry product yield was slightly higher when dried compared to natural drying. This situation is explained by the short duration of drying. Because the longer the duration of drying, the less amount of dried product due to decomposition as a result of biochemical processes in addition to dehydration. When dried in this way, from 100 kg of raw materials, 23.5 kg of Yubileyny Navoi variety, Lolacha Bukharsky 24.2 kg of dry product was obtained from Sholakh variety, 22.2 kg from Subkhoni variety, and 24.5 kg from Subkhoni variety. These amounts were established based on three-year results processed and averaged.

Artificial drying is one of the fastest methods. Productivity was also the highest among the three drying methods selected for the experiment. In particular, when 100 kg of raw materials were dried, 24.4 kg of Yubileyny Navoi variety, 25.1 kg of Lolacha Bukharsky variety, 23.0 kg of Sholakh variety, and 25.4 kg of Subkhoni variety were prepared.

Also, in the experiments conducted on the duration of drying in the seedless state, dividing the apricot into two stages, the process was of different duration depending on the drying method. It should be noted that when dried in two stages, removing the pulp, the process took less time than when dried whole. That is, when dried naturally, Yubileyny Navoi, which was selected as a control, took the least amount of time - 210 hours. The drying process lasted 248 hours for the Lolacha Bukharsky variety, 224 hours for the

Sholakh variety, and 217 hours for the Subkhani variety. During natural drying, the air temperature during the day was 30-35°C.

**Table 3.** The duration of the process and the output of the finished product in the drying of apricots in two stages in the seedless state by different methods (2019-2021).

Varieties	Drying method	Product output from 100 kg of raw materials, kg				Drying time, (hours)	Tasting grade, max 100 points
		2019	2020	2021	Average		
Anniversary Navoi (control)	Natural method	22.6	24.4	21.0	22.6	209.8	81.0
	Special drying with solar battery in the equipment	23.5	25.3	21.8	23.5	69.9	82.9
	Artificial in laboratory conditions in the dryer	24.4	26.3	22.6	24.4	5.8	94.6
Lolacha Bukharsky	Natural method	23.2	25.1	21.6	23.3	247.7	83.8
	Special drying with solar battery in the equipment	24.1	26.1	22.4	24.2	82.6	90.1
	Artificial in laboratory conditions in the dryer	25.1	27.1	23.3	25.1	6.9	97.9
Sholah	Natural method	21.2	22.9	19.8	21.3	223.6	80.9
	Special drying with solar battery in the equipment	22.1	23.9	20.5	22.2	74.5	86.9
	Artificial in laboratory conditions in the dryer	22.9	24.8	21.3	23.0	6.2	94.5
Subkhani	Natural method	23.5	25.3	21.8	23.5	216.7	84.1
	Special drying with solar battery in the equipment	24.4	26.3	22.7	24.5	72.2	90.4
	Artificial in laboratory conditions in the dryer	25.3 5	27.4	23.6	25.4	6.0	98.3
	<i>EKF<sub>05</sub></i>	0.8	0.8	0.8	0.8	0.7	0.8
	<i>Sh</i>	4.8	4.8	4.8	4.8	4.8	4.8

The organoleptic parameters of the dried product also differed depending on the drying



method. For example, the organoleptic evaluation of Yubileynny Navoi dried product was 81 points when dried naturally, 82.9 points when dried in a special drying equipment with solar batteries, and 94.6 points when dried in artificial drying equipment. This condition was observed in all varieties tested. It turned out that the reason for this depends on the drying conditions.

That is, the drying process in natural and special solar drying methods is carried out with the help of the sun's heat, and at night the temperature drops, the humidity in the air increases, and this humidity has a negative effect on the quality of the product. In artificial drying equipment, the heat agent is artificially created and continuously transferred to the product until the end of the process. As a result, the organoleptic properties of the dried product are preserved.

Further experiments were carried out to determine the technological and quality indicators of dried apricots without cracking and without seeds.

During the experiments, Yubileynny Navoi variety, selected as a control, was naturally dried in a seedless state, and an average of 23.2 kg of finished dried product was obtained from 100 kg of raw material. 24.1 kg of dry product was obtained when dried in a special drying equipment with a solar battery. Also, 25.0 kg of finished product was obtained when dried in an artificial drying device.

Subkhoni variety had the highest yield of finished product when dried by all methods, and 24.1 kg of dried apricots were prepared by natural method, 25.1 kg by special solar drying equipment and 28.3 kg by artificial drying equipment. In other varieties, the productivity index was higher than in the control. For example, when dried naturally, 23.9 kg of Lolacha Bukharsky variety, 21.8 kg of Sholakh variety, and 23.2 kg of Yubileynny Navoi variety were obtained. 24.8 kg of Lolacha Bukharsky variety, 22.7 kg of Sholakh variety, and 24.1 kg of Yubileynny Navoi variety were prepared when dried in a special drying equipment with a solar battery. Productivity in artificial drying equipment 25.0 kg in Yubileynny Navoi variety, Lolacha Bukharsky 25.8 kg of the finished product, 23.6 kg of the Sholakh variety, and 26.0 kg of the Subkhoni variety were obtained.

Also, in the experiments conducted on the duration of drying apricots without cracking, without seeds, the process was of different duration depending on the drying method. The process lasted for 227 hours in Yubileynny Navoi, which was selected as a control when dried naturally. Lolacha Bukharsky has the longest duration was observed in the variety and made 268 hours, Sholakh 242 hours in the variety, 234 hours in the Subkhoni variety. During natural drying, the air temperature during the day was 30-35°C. At night it drops to 20-25°C (Table 4).

**Table 4.** Process duration and output of finished product when drying apricots without cracking and without seeds by different methods (2019-2021).

Varieties	Drying method	Product output from 100 kg of raw materials, kg				Drying time, (hours)	Tasting grade, max 100 points
		2019	2020	2021	Average		
Anniversary Navoi (control)	Natural method	23.1	24.9	21.5	23.2	226.9	80.8
	Special drying with solar battery in the equipment	24.0	25.9	22.3	24.1	75.6	86.8

	Artificial in laboratory conditions in the dryer	24.9	26.9	23.2	25.0	6.3	94.4
Lolacha Bukharsky	Natural method	23.8	25.7	22.1	23.9	267.8	83.5
	Special drying with solar battery in the equipment	24.7	26.7	23.0	24.8	89.3	89.8
	Artificial in laboratory conditions in the dryer	25.7	27.7	23.9	25.8	7.4	97.6
Sholah	Natural method	21.8	23.5	20.2	21.8	241.8	79.3
	Special drying with solar battery in the equipment	22.6	24.4	21.0	22.7	80.6	85.2
	Artificial in laboratory conditions in the dryer	23.5	25.4	21.9	23.6	6.7	92.6
Subkhani	Natural method	24.0	25.9	22.3	24.1	234.4	82.3
	Special drying with solar battery in the equipment	25.0	27.0	23.2	25.1	78.1	88.4
	Artificial in laboratory conditions in the dryer	25.9	28.0	24.1	26.0	6.5	96.1
	<i>EKF<sub>05</sub></i>	0.8	0.8	0.8	0.8	0.7	0.8
	<i>Sh</i>	4.8	4.8	4.8	4.8	4.8	4.8

Special drying equipment with a solar battery, the duration was drastically reduced. For example, the process took 234 hours for Subkhoni variety to dry naturally, and 78 hours for special solar drying equipment. Sholah in the category of 80 hours, Lolacha Bukharsky in 89 hours, Yubileynny Navoi 76 hours in the variety during drying process take went \_

As a result of the experiments, it was found that the quality of the finished product when dried apricots depends on several factors, such as the characteristics of the variety, the method of drying, and the form of preliminary processing. Also, the speed of the drying process directly depends on several such factors.

## 4 Conclusions

As the object of our research, apricot varieties Yubileynny Navoi, Subkhoni, Lolacha Bukharsky, Sholakh were dried in a natural way, in special drying equipment with solar batteries. An in-depth analysis of the drying processes in an artificial drying device was carried out, according to the results of the analysis, the highest indicator of dry matter content was observed in the Yubileynny Navoi variety, and the three-year average was 26.0%, while the lowest indicator was shown in the Sholakh variety and 16, made up 4%. Also, Lolacha was 22.8 and 23.8% in Bukharsky and Subkhoni varieties, respectively.

Among the apricot varieties, Subkhoni variety is the most suitable for drying, with an average of 28.7% natural dried product, 29.8% in special solar drying equipment, and up to 31% in artificial drying equipment. It has been proved that Subkhoni variety has the highest productivity when it is dried in two stages in the seedless state and in the seedless state



without cracking. The maximum yield of finished product was determined when apricots were dried in an artificial drying device, and it was proved that the yield of finished product was almost 3% higher compared to the natural method.

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