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TURKISH ROSE OIL: The Queen of Essential Oils

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The history of the rose is as old as human history. The strong and pleasant fragrance attributed to roses has been known to mankind since ancient times. Reference is made in old Chinese and Sanskrit texts to rose fragrance. It is widely believed that the so-called "Rose Oil" mentioned in these ancient texts was prepared by macerating fresh rose flowers in a liquid fixed oil.

Rose damascena

According to Hippocrates during the 4th century B.C. "Rosaceum oleum" (Rose Oil) was prepared in Anatolia by macerating fresh roses in olive oil. A similar description of rose oil manufacture was given by Dioscorides in the 1st century AD in his Materia Medica. To the best of our knowledge, these are the earliest reports of rose cultivation and its use in Turkey (1-3).

Ibni Haldun mentioned the production and the use of rose oil and rose water for the first time in his books. He reported that the best quality rose oil was obtained by hydrodistillation. The distillate waters were used as rose water which was traded to India and China as an important commodity in the 8th and 9th centuries (3-5).

Although no definite information exists, in our estimation the production of rose oil by distillation probably originated in Iran. By the 17th century, rose cultivation had spread from Iran to India and Turkey. There is evidence of rose cultivation for the production of rose water in European Turkey dating to the 17th century. Towards the end of that period, rose cultivation was introduced by a Turkish merchant to Bulgaria, which was then a province of the Ottoman Empire. By the middle of the 18th century, Bulgaria had already become a world center for the cultivation of roses and the production of rose oil. A variety of fragrant rose species was used for oil production until, finally, R. *damascena* established itself as the singularly desirable source. In late 19th century, rose oil cultivation was initiated in several provinces of Turkey through a royal decree. Over time, however, the Isparta and Burdur provinces in southwest Anatolia have become the only cultivation and production sites.

Since 1934, a cottage industry of rose oil production has been replaced by modern factories (3, 6).

Anatolia's first rose oil and rose water were produced in Bursa in 1885 followed by Cavusbasi Farm owned by Sultan Abdülhamid II in 1886. Towards the end of the century a royal decree was issued for the spread of rose cultivation, and with the backing of Melhame Selim Pasha several other Turkish provinces began to grow roses for rose oil. In time some provinces abandoned rose farming, leaving the provinces of Isparta and Burdur in Southwestern Anatolia to become the country's only region cultivating roses for rose oil production. Prior to World War I production levels of rose oil here rose to 800 kg (7).

Rose oil is produced in Turkey and Bulgaria by water distillation of fresh flowers of R. *damascena Miller* (damask rose). It is a cultivated hybrid of *R. gallica* L. and R. *phoenicia* Boiss. Both of these parents grow wild in Turkey. The cultivated variety is called "trigintipetala," meaning "having 30 petals." The characteristic scent given off by these flowers is highly regarded by perfumers (6).

Rose oil is produced by water distillation of the freshly picked flowers. Oil is generally obtained in 0.02 percent yield; the aqueous distillate, which is left out of distillation, is sold as rose water. Rose concrete is produced by n-hexane extraction of fresh rose flowers. Annually, an average of 7,000 tons of roses are processed to produce about 1,600 kg of rose oil and about 2,400 kg of rose concrete. To produce 1 kg of rose oil via distillation, 3,500-4,000 kg of fresh roses are needed. One kg of rose concrete may be solvent extracted from 400 kg of fresh roses. Rose absolute production has also started in Turkey in recent years. It is obtained by ethanol-extraction of the rose concrete (6, 8-11). Table 1 shows the production figures for rose oil and concrete in Turkey for the years 2003-2007.

Cultivation and Distillation

Picking the roses for distillation

In December and January, rows of ditches 50 cm in depth and 50 cm in width are prepared and manured. Rose twigs cut at the soil level are placed in the ditches which are then covered with soil. It takes at least three years for a rose plant to attain maturity. A mature rose field normally yields 5 tons of fresh roses per hectare. However, in a carefully nurtured field the yield may go up to 7-8 tons per hectare. It is normal for a field to be productive for up to 20-30 years. Once in every six years, plants are cut to soil level to rejuvenate the field. Blossomed flowers are hand picked during the early hours of the day. A skilled worker can pick about 40 kg of roses in 8 hours (3, 12).

In cottage scale production, the rose petals are distilled in galvanised iron or copper retorts with a capacity ranging from 150 to 1.000 litres, but most with a capacity of 300 litres. The body of the retort has carrying handles on either side, and is wider at the base than at the rim. The spherical head attached to the rim can be easily

Rose oil distillery

removed. A condenser in the form of a pipe passing through a cooling tank of warm water connects the head of the retort to the glass receiver, which has a volume of 9 litres (7).

In the case of a 300 litre retort, it is filled with 10 kg of petals and 60 litres of water, which are heated for one hour, producing two bottles (18 litres) of distillate. At this stage the distillate is not sufficiently concentrated for the oil to separate out. When 100 kg of petals have been distilled, producing 200 litres of distillate, this is distilled for a second time, producing 20 litres of the distillate. This time the rose oil rises to the surface and is drawn off. The remaining liquid is diluted with distilled water and sold as rose water (7).

The current industrial rose oil distillation in Turkey is as follows: The process is a batch operation. Fresh rose flowers (400-500 kg) and water (1,500- 2,000 L) are charged into 3,000L jacketed stainless steel or copper stills. Distillation lasts for 1.5 h. Condenser temperature is kept at 35°C to avoid solidification of the oil due to paraffins. The distillate is collected in stainless steel separators called Florentin flasks. Rose oil starts separating in the distillate only after the third or fourth batch. When enough oil separates, it is decanted and kept separately. This greenish yellow oil is called "crude oil," "first oil" or "direct oil." Distillation waters are accumulated in 5,000 L stainless steel tanks and redistilled in 3,000 L stills to yield "second oil" — also called "indirect oil" or "cooked oil." The distillate of this second distillation, after removal of oil, is diluted with distilled water and sold as rose water. The first and second oils are mixed to produce Turkish rose oil (3, 5, 13).

Rose oil in Florentine flask

Table 1. Rose flower, rose oil and rose concrete production in Turkey.

	2003	2004	2005	2006	2007
Rose Oil* (kg)	454,00	488,45	694,60	613,29	623,84
Average price ($/kg)	4.150	5.600	5.700	4.100	6.000
Rose Concrete* (kg)	1.137,54	604,62	703,77	476,97	877,00
Average price ($/kg)	650	725	650	400	600
Rose Flowers** (kg)	6.000.000	6.000.000	6.500.000	7.500.000	6.500.000
Average price ($/kg)	1.39	1.41	1.54	0.81	1.14

* Processed volume and price of Gülbirlik, the major rose oil manufacturer in Turkey
** Estimated total (Turkey).

Table 2. Twenty one years of Gülbirlik rose oil (1986-2007)

Compound	Maincomponents (%)	
	Min.	Max.
citronellol	30.9	43.9
geraniol	9.3	19.1
nonadecane	8.3	14.7
nerol	5.2	8.7
1-nonadecene	2.4	4.9
methyl eugenol	2.4	4.0
heneicosane	2.5	4.2
geranyl acetate	1.0	2.2
linalool	0.6	2.1
phenylethyl alcohol	1.2	1.9
b-caryophyllene	0.7	1.6
citronellyl acetate	0.7	1.4
germacrene D	0.7	1.4
(2E, 6E)-farnesol	0.6	1.4

Main components of Turkish rose oil are terpene alcohol such as citronellol, geraniol, nerol, linalool and phenylethyl alcohol. Methyl eugenol, geranyl acetate, citronellyl acetate and sesquiterpenes like b-caryophyllene, germacrene D and (E, E)-farnesol are also characteristic constituents. Rose oil solidifies below room temperature. This is due to the occurrence of paraffins such as nonadecane, nonadecene, heneicosane, etc. Limits of main constituents of Turkish rose oil can be seen in Table 2.

Damask rose (*Rosa damascena*) is a delicate plant requiring very special soil and climate conditions. In Turkey and Bulgaria it grows only in certain regions to yield oil which is profitable. Although attempts have been made to cultivate it in Iran, India, China and Morocco, those oils have not been appreciated. Iran produces rose water and Morocco produces rose concrete. Indian and Chinese rose oils are used domestically.

Rose oil is an ingredient of highly esteemed perfumes and is a highly precious material for a creative perfumer. It is regarded as a perfume of its own. Due to extremely complex nature of rose oil its synthetic version is not so easy to produce. Therefore, rose oil is regarded as the "Queen" of essential oils.

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RELATIVITY.

There was a young lady named Bright,
Who travelled much faster than Light,
She started one day in a relative way,
And returned the previous night.

(A limerick written to commemorate the Theory of Relativity of Albert Einstein when it became experimentally validated during a solar eclipse in 1919)

DEMOCRACY

Democracy is not just an electoral ritual, but the power of people to shape their destiny, determine how natural resources are owned and utilised, how water, food, and energy are distributed, and how children are educated.

Dr. Vandana Shiva.

SCIENCE & THE PUBLIC MIND.

"Science really is great but only when it is shared. .... Securing people's trust in Science has been one of the key goals of outreach activities. And yet scientists often ask why an appreciation of the benefits of science still seems as distant as ever in the public mind. There are many factors effecting this;

* Education
* Development of a generally differential society, unwilling to placidly follow whatever "experts" tell them.
* A tendency towards secrecy.

(A Lack of transparency in some areas of science can play a significant part in limiting public confidence in science.)

- Mark Peplow
- Chemistry World (2008). April Editorial.

WINE.

"Like rain for plants, wine promotes the growth of the body. Like fire grading gold, it also shows up people as superior, average, or inferior, in terms of their response to drinking. For, those who drink wine with due attention to propriety in method, quantity, food and time, wine is a nectar.

To others who act in total disregard of propriety, wine is better than poison"

Archarya Charaka. Chikitsa 24, 26-28. Quoted in: M.S.Valianathan (2003): The Legacy of Charaka. Chap 58. p.41. Orient Longmans Pvt. Ltd., Chennai, India. (2004).