GLOBAL JOURNAL OF BIOLOGY, AGRICULTURE & HEALTH SCIENCES
(**Published By**: Global Institute for Research & Education)
www.gifre.org

ESSENTIAL OIL PROPERTIES OF *NEPETA* L. SPECIES IN AZERBAIJAN FLORA

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Abstract

This article has been devoted to widespread study of properties of essential oil of Nepeta L. species in Azerbaijan flora. There are extracted Essential oils from plants in different phases (0, 12-1, 61%), their physical and chemical constant symptoms, there has been determined the quality and quantity of essential oil depending on environmental conditions. It was found that the quantity and some extent of quality compositions of the various organs of essential oil components have been changed. The components of explorations are Nepetalactones and Epinepetalactones, essential oil dominated in leaves but in flowers species dominated Aldehidydes. Essential oil of Nepeta L.species has acute lemon, mint aroma smells. Essential oil extracted from these plants is transparent, lightweight from water. There are determined the physical and chemical features of species during clarifying their specific gravity to ($D^{20}_{20)}$, broken coefficient to ($n^{20}_{D)}$, acidity quantity, essential oil quantity, essential oil quantity after after acetylation. There are carried out Nepeta L.species fresh essential oil and after condensation comparative analysis of the dynamics and the physical-chemical properties of constants.

Keywords: Nepeta L., essential oils, component composition, physical-chemical constants.

Materials and Methods

The research work was conducted during 2002-2012 years. It was revealed that Nepeta L. species have existed in gravel stone rocky places and grow in ruin places. They have appeared in forestry and suburb forestry meadow areas. There are several ways and methods to deriving of essential oil.

One of the easy methods of deriving them is by distillation them. [Ibadullayeva et al. 2007]. Output rate of the essential oil was defined by the Ginsberg Method [Ginzberg, 1932].

Essential oil is incorporated with anhydrous sodium sulfate. Determination of physical- chemical compound of essential oil is led by according to State standards. [Persidskaya et al. 1981], the composition of the gas-liquid component of essential oils has been selected by the determination method. The amount is calculated by the method of normalization of the internal components of peaks [Stolyarov et. al. 1978].

The experimental part

There are 27 species belonging to the genus of Nepeta L. in Azerbaijan Biodiversity. They each have possessed essential oil. As a result of conducted research work of Nepeta L. genus essential oil species are divided into several groups. 72-75% of good smelling species of essential oil plants is in stone and gravel part of Azerbaijan land. The essential oil of these plants is reach of terpenoids and their derivatives. 39-42% of these species grow in forest ecosystem. By mesophyll life the plants have essential oil in flower and in roots. In component of this essential oil plant group has not appeared cyclic terpenes, for them is characterized acyclic terpene compounds and ketones. Researched Nepeta L. essential oil species have different flavor of green-yellowish, yellow-whitish color, light-moving liquid, so they are watery.

Essential oil is gathered in surface parts of plants (in leaves and in bushes), at most in seeds and in flowers. There are samples of many various phases and in different years derived from plants both in natural and cultural conditions. There are differences in comparison in amount of essential oil composition (table 1).

Table 1

Nepeta species in nature and cultural conditions Yield of essential oils in different phases

№	*Names of plants in Latin language*	*Collected area*	*Phases of the whole plant*	*The essential oils amount of -%*
1	*N. betonicifolia* C.A. Mey.	Lankaran	Leaf time	0,20± 0,016
-	*N. betonicifolia C.A.Mey.*	cultural conditions	Leaf time	0,15±0,014
2	*N. buhseii* Pojark.	Lankaran	flowering period	0,22±0,017
3	*N. buschii* D. Sosn. et Mand.	Nakhchivan AR.	Leaf time	0,31±0,022
4	*N. cyanea* Stev.	Quba	flowering period	0,50±0,046
5	*N. daghestanica* Pojark.	Quba	seeds period	traces
6	*N. grossheimii* Pojark.	Nakhchivan AR.	-	0,34±0,028
7	*N. fissa* C. A. Mey. Verzeichn.	Nakhchivan AR.	-	0,27±0,020
8	*N. lamiifolia* Willd. Enum.	Quba	-	0,43±0,043
9	*N. longituba* Pojark.	Quba	flowering period	0,20± 0,016
10	*N. noraschenica* Grossh.	Nakhchivan AR.	-	0,42±0,041

№	Names of plants in Latin language	Collected area	Phases of the whole plant	The essential oils amount of -%
11	*N. teucrifolia* Willd.	Lankaran		0,17±0,009
12	*N. transcaucasica* Grossh.	Absheron, BC	flowering period	0.70±0,01
13	*N. trautretteri* Boiss.	Nakhchivan AR.	Leaf time	0,71±0,014
14	*N. schischkinii* Pojark.	Nakhchivan AR.	seeds period	0,27±0,021
15	*N. somkhetica* Kapeller.	Nakhchivan AR.	flowering period	0,14±0,008
16	*N. Sosnovskyi* Asker.	Quba	-	traces
17	*N. strictifolia* Pojark.	Nakhchivan AR.	-	0,21±0.061
18	N. *supina* Stev.	Quba	-	1,46±0,130
19	*N. velutina* Pojark.	Nakhchivan AR.	Leaf time	1,61±0.155
-	*N. velutina*	cultural conditions	flowering period	1,54±0.132
20	*N. zangezura* Grossh.	Nakhchivan AR.	Leaf time	0,25±0,009
21	*N.ucrainica* L.	cultural conditions	Leaf time	0,15±0,013
22	*N. camphorata*	cultural conditions	Leaf time	0,12±0,008
23	*N.italica*	cultural conditions	flowering period	0,11±0.005
24	*N. latifolia*	cultural conditions	Seeds period	0,81±0,231
25	*N. tuberoza*	cultural conditions	Leaf time	0,31±0,246

As seen from the table 1 essential oil derived from 25 species in different phases and the amount of essential oil in percent fluctuate between 0, 12- 1,61.

We have studied dynamics of essential oil derived from Nepeta L. species depending on ecological circumstances and have studied component content. We have studied relations of natural aspects to deriving essential oil from plants, in other words, zone of height above the sea level, spreading in mountain or in plain zone, distinguished depending on north or south slope zone of same region (Table 2). As seen from the table of essential oil derived from plants they have not similar oil percentage in different years and in different environmental conditions. This phenomenon shows itself also in cultivated species.

Table 2

Amount of Taxons of Essential oil in different years, in different organs depending on circumstance of environment (with dry weight amount)

Name of species	Area of plant collection	Date of collection	Organ	The essential oils obtain in (%)
1	*2*	*3*	*4*	*5*
N.zangezura	Nakhchevan AR, Shahbuz region, around of Bichenek village, form of shrub, 1100 m	2006	L	1,19±0,003
		2010	S	1,25±0,023
			L	0,30±0,026
	Shahbuz region, Kuku mountain 2400 m	2007	F	0,30±0,026
		2009	S	1,32±0,018
		2010	L	0,15±0,004
N. lamiifolia	The Big Caucasus, Gabala lava subalpine zones, mountain zones area, 2600 m	2000	L	0,67±0,047
		2003	F	0,73±0,070
	Nakhchevan AR, Shahbuz region, Kuku mountain, high mountain zones, mountain zones area, 2400 m	2010	L	0,40±0,037
		2011	F	0,41±0,023
N.trautvetteri	Nakhchevan slope, north part, gravelly valleys, 1400 m	2002	L	0,17±0,006
	Small Caucasus, Dashkesen, around of Zogali village, middle mountain zone, south slopes, mountain zones area, 1400 m.	2006	L	0,32+0,009
N. grossheimii	Nakhchevan AR, Sherur region, Akhura village, middle mountain zone, clay-plastered valleys, mountain zones area, 2800 m.	2006	L	0,34±0,028
			S	1,48±0,138
	Nakhchivan AR, Shakhbuz region, Kuku village, high mountain zones, mountain zones area, 2400 m.	2007	S	1,13±0,013
		2010	L	0,95±0,039
	Nakhchivan AR, Julfa region, Daridag, mountain zones area, 1507 m	2010	L	0, 51±0,040
		2011	F	1,07±0,165
N. velutina	Nakhchivan AR, Julfa region, dry-clayey rocky	2001	L	0,85±0,074
		2007	S	1,62±0,198
	By Araz plains, mountainous zones	2002	T	1,65±0,150

Name of species	*Area of plant collection*	*Date of collection*	*Organ*	*The essential oils obtain in (%)*
N. schischkinii	Mountainous of Nakhchevan, dry, stony valley mountain zones area, 1300 m	2009	L	0,27±0, 016
	Nakhchevan AR, Shahbuz region, around of Bichenek village, dry hills, 2400 m	2009	F	0,39±0,026
	Nakhchevan AR, Aghi mountain zones, mountain zones area, 900m	2010	L	0,28±0, 017
N. camphorata	experimental area	2007	F L	0,56±0,029 0,16±0,008
	experimental area	2008	F L	0,51±0,026 0,13±0,007
N.italica	experimental area	2009	F S	0,14±0,008 0,46±0,063
	experimental area	2010	L S	0,11±0,001 1,19±0,020
	experimental area	2011	L F	0,14±0,003 1,08±0,063

Notes: F-flower; S-seed; PPS- part of the plant's surface; L-leaf

Results of obtained essential oil from *N.zangezura* and *N.grossheimii* species in different years did not coincide. There are conducted similar researches environmental condition of plants and spreading. Percentage of essential oil obtained from N.latifolia was 0.73% in Gabala forest region of mountain level height up to 600 m, the percentage of essential oil obtained from the same plant in Shahbuz region of Kuku village area in a height of 2800 m above the sea level and up to mountain zone and as essential oil obtained from raw materials was 0.41%. We come to conclusion that obtaining essential oil from plants depends on many environmental factors. In territory where the sun rays fell less the accumulation of essential oil in plants is weak in general and then the reason of hypothesis is clear.

There occur changes in quality and quantity of essential oil component composition of different plant organs. It was clear from Table 3, Nepeta velutina and Nepeta strictiflora plant surface essential oil components are equal to 28.5 and 54.1 nepetalactone, as well as 25.6 and 40.8 - epinepetalactone. In *N.velutina* surface part Puleqon synthesis reaches 17.5% and Pinen reaches to 10.4%. In *N.strictifolia* surface part this substances are less. *N.* strictifolia species composition in different dynamics of development phase components content of essential oil are coincided together. There are no changes in quality of essential oil in different phases but difference is observed in quantity. This research has been conducted in the *N.betonicifolia* species. Amount of Ketones depends on the quality of plant productivity. It will be little or very little 8.65% (Table 4).

Table 3

Component content of essential oil in development phases of various species of Nepeta velutina and Nepeta strictiflora (in%)

The components of essential oils	*N. velutina*		*N. fissa*		*N. strictifolia*	
	Part of the surface	*Flower*	*Part of the surface*	*Flower*	*Part of the surface*	*Flower*
α-pinene	10,4	6,6	3,1	9,7	0,1	0,1
camphor	2,2	0,9	0,1	0,4	0,5	0,3
izomenton	8,9	0,6	5,9	3,9	0,9	0,8
menthol	0,2	-	-	-	-	-
puleqon	17,5	1,8	5,2	3,8	0,1	__
terpinilasetat	4,2	1,1	2,4	5,2	1,5	2,8
epinepetalakton	25,6	40,0	50,7	26,6	40,8	40,8
nepetalakton	28,5	48,2	30,7	48,2	54,1	55,0

Table 4

N.betonicifolia species composition in different dynamics of development phase components content of essential oil. (in%)

Identification of components	*Begin to buds in Part of the surface*	*Flowering*			*After flowering*		
		Leaf	*Flower group*	*Part of the surface*	*Leaf*	*Flower group*	*Part of the surface*
α - pinene	0,67	0,68	2,25	0,90	0,10	trace	trace
kamfen	0,11	trace	trace	1,7	0,10	trace	0,52
β - pinen	2,69	1,71	2,02	0,22	2,06	1,07	trace
limonen	trace	0,22		----	0,51	trace	----
simol	0,67	0,45		2,3	1,54	trace	0,34
tuyon	0,89	trace	0,46	2,0	trace	0,23	0,38
menton	7,76	1,71	2,79	1,70	1,23	1,90	1,30
izomenton	trace	trace	trace	---	trace	trace	0,38
puleqon	trace	trace	trace	2,72	trace	trace	trace
sitral- b	11,2	6,39	11,19	11,7	3,29	10,01	6,25
sitral- a	8,77	0,28	7,15	15,8	0,82	2,50	3,12
linalool	4,04	3,76	2,72	2,5	3,96	4,76	2,60
mentol	0,67	0,34	1,16	trace	0,89	0,71	trace
sitronellol	6,74	20,76	14,23	3,06	17,92	16,20	23,62
geraniol	13,4	28,06	32,63	9,52	24,10	32,89	29,18
linalilasetat	1,68	0,79	1,24	3,2	2,06	1,43	0,69
mentilasetat	0,50	trace	trace	3,7	trace	trace	trace
sitronelilasetat	14,1	31,48	17,26	8,16	39,66	24,67	27,09
epinepetalakton	18,8	0,57	0,62	38,0	izi	0,71	2,60
nepetalakton	trace	trace	trace	trace	trace	trace	trace

It is necessary to note that aldehyde dominated in flower group of essential oil and ether dominated in leaves. Therefore in the same species synthesis of essential oil during vegetation period can be applied in different spheres and the different combination of classes (alcohols, aldehydes, ketones) may increase or decrease in components.

Nepeta L. essential oil species have a smells of acute lemon by aroma mint fragrant component. Essential oil of these plants is transparent, lightweight from water. To clarify the physical and chemical components of these species, their specific weight (D2020), refraction coefficient (n20D), number of acid (n.a), number of essential oil (n.e), there are studied amount of essential oil after acetylation (a.e.a.a.). We have studied the diversity colors and physical-chemical constants of essential oil. It has found its reflection in Table 5. As seen from the table, the number of essential oil is more of number of acids, cause of large number of ethers in essential oil is existence of free alcohol and complex ethers formed from oil acid and aliphatic alcohol in it.

Table 5
Nepeta species essential oil physical-chemical constants

Species	*Specific gravity* D^{20}_{20}	*The angle of refraction* n^{20}_{D}	*The number of acid*	*The number of essential (amount of essential oil).*	*After actylated (amount of essential oil).*	*Color of essential oil*
N.trautvetteri	0,8520	1,4641	7,94	18,40	142,54	light yellow
N.velutina	0,8830	1,1400	6,25	46,75	202,48	yellowish
N.zangazura	0,8954	1,4740	5,82	25,60	236,22	light yellow
N.grossheimii	0, 9256	1,5460	8,12	50,26	194,82	light yellow
N.betonicifolia	0,9404	1,4786	4,85	25,70	186,32	light yellow
N.fissa	0,9610	1,4910	11,05	89,35	195,06	yellow
N.strictifolia	0,8074	1,4656	6,28	70,64	230,75	light yellow
N.cataria	0,9326	1,4820	8,67	25,87	256,34	light green
N.meyeri	0,9412	1,4890	10,34	52,45	176,38	light green
N.sulphurea	0,9522	1,4950	6,45	25,67	236,14	yellow

We have studied some of Nepeta L. species obtained oil after a few years of conservation their quantity and quality content, as well as their physical and chemical constants. (Table6). Researches have shown that the seeds will lost the concentration of oil after conservation of seeds a few years, it will show them in obtain oil from it and there will decrease the ether number and increase acid number in it. We come to conclusion that here the cause of gradual increase

of the number of acidity in Nepeta L. species is existence in content of essential oil decomposition of complex ethers .Therefore it will cause to decrease of ether number.

Table 6

Dynamics of essential oil and comparison of physical-chemical constants of new and after conservation Nepeta L. species (dry form) (analysis implemented in 2008)

Name of species	*Accumulated years*	*The essential oils optain (%)*	*The number of acid*	*The number of essential oils*
N.cataria	2003	0,75	8,67	25,87
	2008	0,31	3,17	48,46
N.meyeri	2003	0,50	10,34	52,45
	2008	0,13	2,95	65,61

Essential oil obtained from Nepeta L. species consists of 8 complex components: monoterpenes, aldehydes, terpene alcohols, phenoles, lactones, complex ethers, aliphatic alcohols, various terpenoids. Some species of the essential oil obtained from (N.trautvetteri, N.velutina, N.zangezura, N.grossheimii, N.amoena, N.pannonica, N.sulphurea, N.parviflora, N.meyeri) were researched microbiologically, they have been tested and obtained positive results over the disease of golden microbial staphilococcus (Staphylococcus aureus), spore carrier anthracoid bacteria-Bacillus anthracis (Bacillus anthracoides), intestinal bacillus (Escherichia coli), bacillus of blood (Serratia marcescens), blue-purulent bacillus (Pseudomonas aeruginosa), yeastlike fungus (Candida albicans). These oils may be used in producing of new medicines.

There have been studied allelopathic effects, development and begin to buds in distilled solution of essential oils in watery extracts of Nepeta meyeri species and there are detected more effects in begin to bud and seedlings growth in grain, barley, wheat, safflor and sunflower seeds. Watery extract obtained from stems and leaves of this species has led to the general phytotoxic effect at all concentrations of barley and sunflower growth (to development). The obtained results can be used in plant protection.

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