Investigation of lavender oil obtained in experimental cohobation installation

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Abstract - **Primary distillation waters are processed in experimental cohobation installation. The quantity of the obtained secondary essentail oils is defined, and their composition and physico – chemical parameters are investigated. It is established that the basic components of the lavender oils are linalool (31,4 - 45,3 %), α –terpineol (13,8 -18,7 %), geraniol (5,5 – 8,6 %) and lavendulol (1,9 – 2,6 %). The content of essential oil in processed medium at different hights of the column is defined.**

Keywords **– lavender, essential oils, cohobation, distillation waters**

I Introduction

Lavender (Lavandula angustifolia Mill, from family Lamaceae) is perennial essential plant, which is growed and processed in Bulgaria. Primary essential oil with basic component linalilacetate is obtained by steam disttilation of the racemes. The oil is used in perfumery, medicine, technics and faience industris. Distillation waters, called primary are obtained as waste product from the process of steam distillation of lavender racemes. According to the literature data these primary disttilation waters contain about 0,01 – 0,06 per cent dissolved and emultionized oil, which could be extracted by continuons cohobation (redistillation). The secondary oil obtained in this way doesn't mix with the primary oil, because of the differce in their composition [4,5].

The purpose of this paper is to be studed the secondary lavender oils, obtained by processing of primary distillation waters in experimental cohobation installation with horizontal sheet packing, as well as to be determined the essential oil content in processed medium at different column heights.

II Materials and methods

Primary distillation waters, obtained by steam distillation of lavender racemes harvest 2003 year in village Pesnopoy, region Plovdiv are manufactured.

Two batch consigument (A and B) of the primary disttilation waters are processed. Essential oil content in the primary distillation waters and experimental tests are determined by water distillation in glass laboratory apparatus of British farmacopoeia, modified from Balinova –Diakov [1].

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The experimental cohobation installation for extraction of secondary lavender oil is presented on fig.1 and it consists from: cohobation column 3, heat exchange apparatus 2, coil condenser 5, florentine flasks 8, reservoirs for distillation and working waters 1 and 7 respectively and tank for secondary distillation waters 9. The cohobation column is filled with horizontal sheet packing. The experimental cohobation installation is provided with devices for taking of tests from the processed medium. The tests could be taken from the distillation still, florentine flasks and from different heights of the column. Detailed description of the horizontal sheet packing and the installation work is presented in [2,3,8].

Some physical and chemical properties – Consistency, Specific Gravity d_{20}^{20}, Refractive Index n_D^{20}, Acid and Ester Numbers of the obtained secondary essential oils are investigated for comparison of its quality with known literature data [6].

The composition of obtained secondary oils is defined by GC/MS analyses. Gas chromathograph is a Hewlett Packard with a mass-spectrometer detector. The GC was filled with a 30 m x 0,25 mm; 0,25 μm film thickness capillary column HP - 5 MS, which was temperature programmed from 50 °C – 280 °C at 4 °C/min, 280 °C (10 min isothermal), injector temperature 250 °C, carried gas nitrogen, sample 0,2 μm, split ratio 1 : 150.

The statistic processing of the experimental results is carried out according to the standard methods for directly measured quantities. Two to three parallel tests are analysed at calculating the value of the controled parameters and their average value is accepted for real value.

III Experimental Results and Data Analysis

The processed primary disttilation waters before cohobation contain 0,06 (for consigument A) and 0,073 (for consigument B) per cent essential oil (Table II) which doesn't differ from the pointed in the literature data [4,5].

It is established that about 0,05 per cent essential oil is extracted from the primary distillation waters of consigument A in result of cohobation (which is about 83 per cent from the total quantity essential oil) and about 0,001 per cent essential oil remains dissolved in cohobation residue. And about 0,09 per cent desolved essential oil remains in the secondary disttilation waters and it will be very difficult to extract this oil.

The experimental results obtained for the amount of the essential oils extracted from the distillation waters of consigument B don't differ essentially from these for consigument A and they are present in table II. Content of the secondary essential oil in the processed medium (distillation

waters) from different column height is presented in table I. The physicochemical properties and chemical composition of the oil, represented in table I isn't analysed. The location of points I to VI is shown on fig. 1.

The cohobation column actually is the stripping part of rectification column and increasing essential oil content in processed medium with the upward flow of vapor is owing to that. The abrupt reducing of essential oil content of primary distillation waters with their flow down packing layers of the column is obvious. The essential oil content in the cohobation residue according the literature data is about 1 per cent from the passed for cohobation oil and there is agreemant with the obtained experimental results.

The physical and chemical parameters of the secondary oils, collected from different parts of the cohobation installation are shown in table II. The experimental results point that the analized parameters of the obtained secondary oils don't differ from the published literature data [4,5]. The lack of linalilacetate in the secondary oil can be explained with the hydrolysis of the esters which is occurred in the time of stay of the distillation waters before their processing. And the high per cent of α-terpineol can be explained with the decomposing of the linalool acetate via linalool to α-terpineol, and also terpinen-4-ol to α-terpineol. Higher values are established only for the ester number. The difference in the essential oil content in the two studied consiguments primary distillation waters is due to the fact that they are obtained at two different primary distillations of lavender racemes. There is a little disagreemant in the studied parameters of the secondary essential oils obtained from these two consignments primary distillation waters.

The chemical composition of the obtained secondary oils are present in table 3. The basic oil components are: linalool (31,4 - 45,3 %), α – terpineol (13,8 -18,7 %), geraniol (5,5 – 8,6 %) and lavendulol (1,9 – 2,6 %). The experimental data about the chemical composition of the secondary oils don't differ from the Bulgarian literate data of secondary lavender oils [4, 5]. There are some diviations of chemical composition of the studied oils and the literature data from the Russian references [7]. This diviations is probably due to the difference in the processed lavender racemes sort and in the methods for analyze.

IV Conclusion

1.The composition and quality of the secondary essential oils obtained by processing of primary distillation water in the experimental cohobation installation with horizontally sheet filling don't differ from respective literature data for the secondary lavender oils obtained by constinuously operating cohobator with ceramic filling of Rashing.

2.About 83 per cent essential oils from the total amount oils disolved in the primery disstilation water are extracted by the experimental cohobation installation. Therefor there is a minimum loss of essential oils.

3.The experimental results for the essential oil content in the processed medium of different column height show rapid redusing of the oil content at flowing down of the distillation waters throught the highes packing layers of the column. This means good dividing efficiency of the column packing.

4.The obtained date can be used from the producers of essential oils.

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TableI

Content of oil in the processed medium

Part on the column	Distillation still	Point I	Point II	Point III	Point IV	Point V	Point VI
Content of oil,%	0,001	0,0025	0,0025	0,0075	0,075	0,01	0,02

The oils presented in table 1 aren't analyzed, because there are a little quantaty from these oils.

Table II

Physicochemical properties of lavender oils

Parameters	Oil before cohobation		Oil obtained in the time of cohobation		Oil staied in the water medium[1]	
	A	B	A	B	A	B
Consistency	Liquid					
Color	Light yellow				Orange	
Odor	lavender					
Essential oil content, %	0,06	0,073	0,05	0,06	0,05	0,06
Specific Gravity at 20 ^{O}C d_{20}^{20}	0,908	-*	0,913	0,905	-*	0,903
Refractive Index at 20 ^{O}C n_{D}^{20}	1,472	-*	1,469	1,468	1,470	1,472
Acid Number , mg/KON g	-*	-*	2,29	3,23	2,35	2,80
Ester Number mg/KON g	-*	-*	58,53	66,23	11,73	64,92

-[1]that is oil, which is remained in the water in the florentine flasks about 24 hours, i.e. it's extracted after about a day

-* the oils aren't analyzed

Table III

Chemical composition of lavender oils, %

Components	Oil before cohobation		Oil obtained in the time of cohobation		Oil staied in the water medium	
	A	B	A	B	A	B
Z-linalool oxide	2,1	1,3	2,3	3,3	0,4	0,9
E-linalool oxide	1,5	0,9	1,7	2,4	0,3	0,5
camphor	0,9	0,6	0,8	0,8	0,6	0,6
linalool	35,1	33,6	34,6	31,4	45,3	34,1
terpinen-4-ol	26,2	25,7	24,6	25,0	22,4	23,6
lavandulol	2,5	2,3	2,1	1,9	2,6	2,5
α-terpineol	15,9	17,9	16,3	17,3	13,8	18,7
nerol	1,8	2,4	1,8	1,7	2,4	2,7
geraniol	5,5	7,4	5,7	5,5	6,8	8,6
non indefiziran	8,5	7,9	10,1	10,7	5,4	7,8

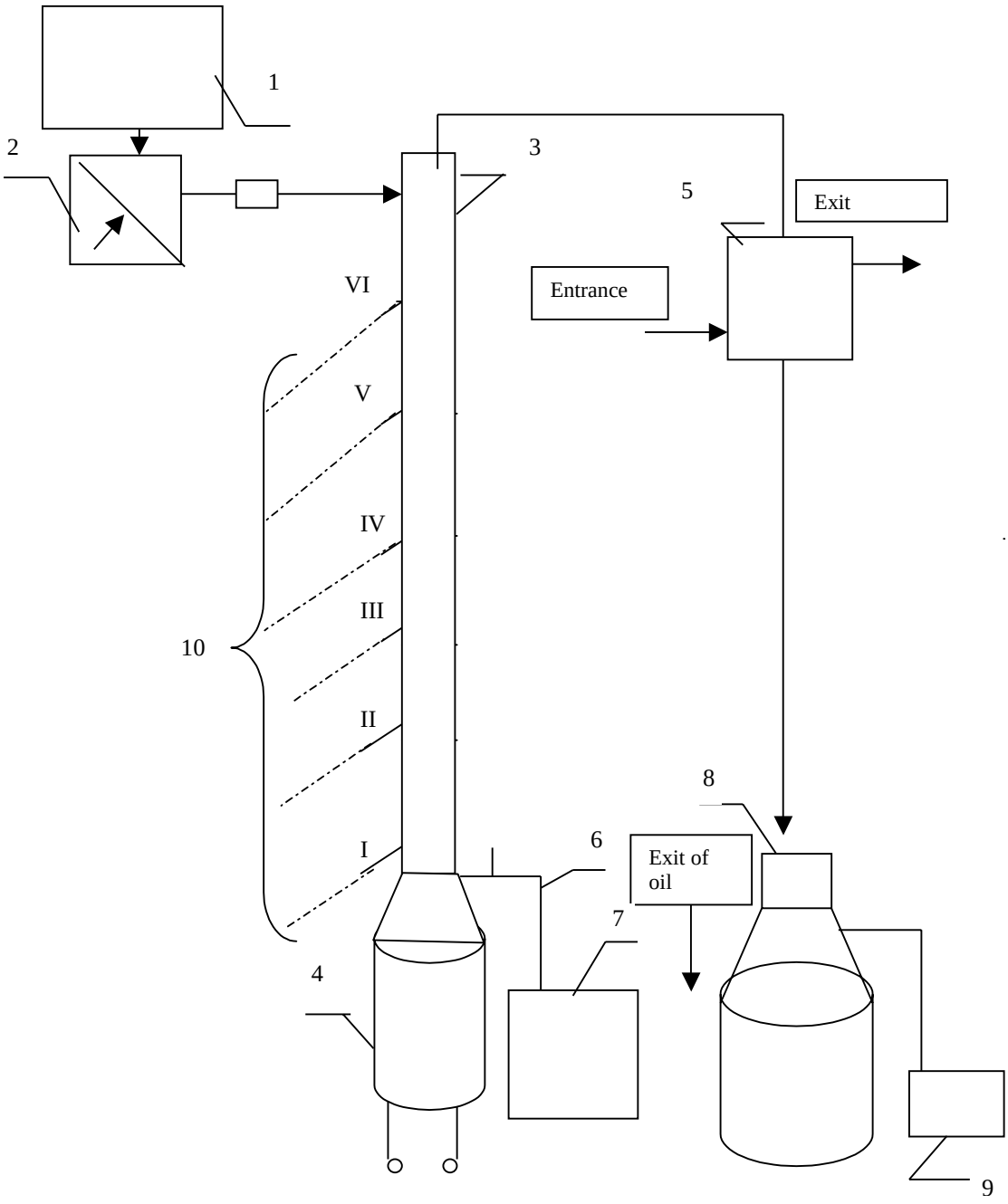

Fig.1 Experimental cohobation installation

1 - reservoir for distillation waters; 2 – heat-exchanger ; 3 – cohobation column; 4 – distillation still;
5 –coil - condenser; 6 – overflow; 7 – reservoir for waste waters; 8 – florentine flasks; 9 – reservoir for secondary distillation waters;
10 – devices for taking of processed medium tests