Chemical Composition and Antibacterial Activity of Essential Oils of Lavandula Stoechas

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***Abstract*—The aromatic plants are plants of culinary use. Lavandula stoechas (LS) used in traditional medicine like falling on anticonvulsant and antispasmodic. In this work, we studied the chemical composition of essential oils of Lavandula stoechas of the area of Tetouan in particular the (Halilla and Zinat rural areas). The natural drying of our plant is carried out in free area and in the shade. Essential oils are extracted by the hydrodistillation technics, and the identification of the components is carried out by the gas chromatography coupled with the mass spectrometry (CPG-MS). Essential oils extracted from hydrolats the leaves and flowers of LS are very rich of D-Fenchyl alcohol, (major product) and α-Fenchone. In addition, the antibacterial activity of LS is stronger over Bacillus subtilis bacteria. The other bacterias like Porteus sp, Escherichia coli K12 and Staphylococcus aureus showed a resistance against our species essential oils.**

Keywords—Aromatic plants; Lavandula stoechas; Hydrodistillation; Essential oils; Antibacterial activity.

I. INTRODUCTION

The history of medicinal and aromatic plants [1, 2] "PAM" is associated with the evolution of civilization [3, 4]. In all the areas of the world [5]. The history of the people shows that thesis plants always occupied significant status in medicine and perfumery [6]. Some medicinal herbs are approbation since antiquity. The lavenders [8] are broadleaf shrubs of the family of Lamiaceae [8] (labiate) and Lavandula [9] kind generally with purple flowers purple or ugly out of ears, of All which most species and very odorous. They are largely used in all the branches of perfumery. They push especially on the grounds dry and shone upon limestone's, except for Lavandula stoechas (LS) , which prefers siliceous [10] grounds. One counts between 25 and 30 species of lavenders and more than a hundred varieties. They can push at altitudes of 2000 m. Indeed, LS is a plant which has disinfectants [11], bactericidal [12], disinfecting, calming [13.14], antispasmodic [15] and carminative properties. [16] The extraction by hydrodistillation of this species gave a larger quantity of essential oils [17].

During this article, we studied respectively the composition of essential oils from Lavandula stoechas LS extracted starting with all which is the area of Tetuan and its antibacterial activity.

II. EQUIPMENT AND METHODS

The air portion of the plant was collected in two different sites. It was identified by IBN MANSOUR professor of the applied Organic Chemistry laboratory, Department of Chemistry, Faculty of Science, University Abdelmalek Essaâdi, Morocco.

A. Experimental sites

The lavenders of the stoechas group are earlier, they are collected from March to May in a wild state purpose, they are more rarely exploited. With our box north of Morocco one took two different locations of harvest in the area of Tetouan (Zinat, Hallila). Harvest was made in May 2011, for the period of flowering.

B. Production of essential oil

The assembly of hydrodistillation is completely particular in chemistry. It allows at the same time to realize a decoction of flowers, to channel vapors trained (formed) during the heating then to condense them to get back the essential oil. There is however some distillations of wild lavenders of mountain intended for the aromatherapy, the quantities are very limited.

C. Methods of analysis

The gas chromatography coupled with the mass spectrometry is a technology used to identify the components of essential oils studied. The chromatogram traces used is of type GC ULTRA carrying a VB5 column (5% phenyl 95% methylpolysyloxane) (30m, 0.25mm, 0.25µm) with the following Conditions of injection:

- Volume injected = 1 µL
- Temperature injector = 250 ° C
- Temperature = 300 ° C interfaces
- Mode of Split injection
- The Carrier gas Helium
- Flow = 1 ml / min

The coupling of gas chromatography with the mass spectrometry (GC / MS) makes it possible to carry out simultaneously to the separation and the analysis of the various components of a complex mixture. There exist two modes of ionization: t Ionization by electronic impact (EI) and chemical ionization (CI). In this last case, one distinguishes positive chemical ionization (PCI) and negative chemical ionization (NCI).

D. Experimental method the biological activity of essential oils

The study was pursued on the antibacterial activity. Essential oil (Lavandula stoechas) was tested on four origins (stumps): Escherichia coli, Staphylococcus aureus, Bacillus subtillis and Porteus sp.

III. RESULTS AND DISCUSSION

A. Outputs obtained

The quantitative results got by the hydrodistillationof the sheets and the flowers of Lavandula stoechas and recovered oils of the medicated water by extraction, of the two areas are gathered in the comparative table 1 according to:

TABLE1. QUANTITY OF ESSENTIAL OILS AND OUTPUTS THE SHEETS AND THE FLOWERS OF LAVANDULA STOECHAS (ZINAT , HALLILA)

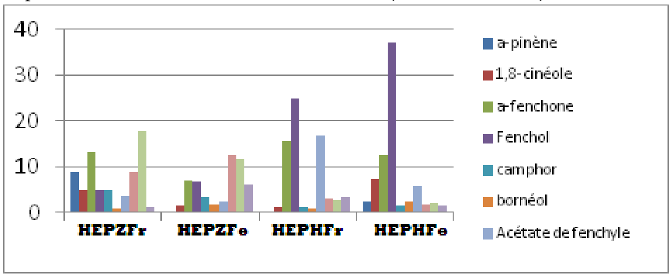
	Zinat				*Hallila*			
	Sheets		*Flowers*		*Sheets*		*Flowers*	
	Pure	Extracted by solvent	Pure	Extracted by solvent	Pure	Extracted by solvent	Pure	Extracted by solvent
Mass of H.E In (g)	0.63	0.66	2.30	0.66	7.56	0.59	0.32	0.58
Output of H.E in (%)	0.12	0.126	0.42	0.12	0.45	0.035	0.03	0.052

According to table 1, we observed that the sheets of Hallila are richer in essential oil than that of Zinat and the opposite for the flowers. However for the essential oils extracted by solvents from the medicated water the percentages from oils for the sheets and the flowers from Zinat are similar. For those of Hallila the percentages are weaker.

B. Chemical composition the essential oilspure and extracted the hydrolat water of the LS from Zinat and Hallila.

It is noted that pure essential oils of the sheets and the flowers Lavandula stoechas of Zinat and Hallila are very rich in monoterpenes oxygenated beside some sesquiterpenes. The percentage of each component varies according to the part of the distilled plant and the area of harvest and in particular α-pinene (0.08-8.76%), 1,8-Cinéole (1.08-7.32%), α-fenchone (6.94-15.71), α-fenchyl alcohol (5.05-37.15), camphor (1.07-5.04%), bornéol (0.89-2.43%), fenchyl acetate (2.53-16.90%), bornylacetate (1.77-12.6%), myrténol (1.49-6.84), acetate of myrtényle (2.1-7.76%) and veridiflorol (1.11 - 6.10%). What in more than in pure essential oils of the flowers and the sheets of the Lavandula S of the area of Hallila, the fenchyl alcohol is the majority compound and one can conclude that one is in the presence of essential oils of chimiotype fenchyl alcohol. For the essential oil the flowers of LS the area of Zinat, it is richer in α-pinene by report other oils and then the acetate of myrtényle is the majority product. However, the essential oil of the sheets of the same plant is richest in of bornyl acetate.

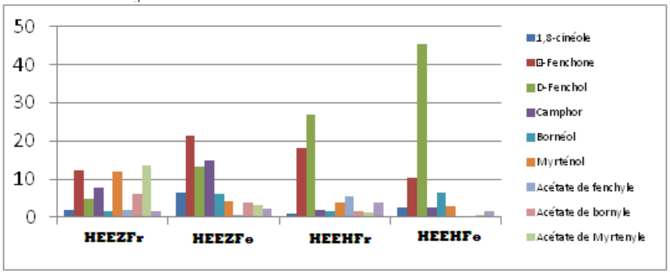
Fig*1*. Variation the percentages of majority monoterpenes of pure essential oils the Lavandula stoechas (Zinat and Hallila).



HEPZFr: Pure essential oil of the flowers of L S Zinat
HEPZFe: Pure essential oil of the sheets of L S Zinat
HEPHFr: Pure essential oil of the flowers of L S Hallila
HEPHFe: Pure essential oil of the sheets of L S Hallila

The analysis of essential oils of the sheets and the flowers the lavandula stoechas recovered showed that they are very rich in oxygenated monoterpenes. The percentage of each component varies according to the part of the distilled plant and the area of harvest. One finds in particular 1,8-Cinéole (0.97-6.40%), α-fenchone (10.27-21.3), α-fenchyl alcohol (4.83-45.33), camphor (1.8-14.8%), bornéol (1.47-6.45%) , myrténol (2.91-11.92), fenchyl acetate (0.41-5.63%), bornyl acetate (0.43-6%), Acetate ofmyrtényle (0.72-13.64%) and veridiflorol (1.48 -3.78%).

Fig2. Variation the percentages of majority monoterpenes the essential oils extracted the hydrolat water of Lavandula stoechas the two sites of harvest.



HEEZFr: Essential oil extracted the hydrola water of the flowers of L S Zinat
HEEZFe: Essential oil extracted the hydrolat water of the sheets of L S Zinat
HEEHFr: Essential oil extracted the hydrolat water of the flowers of L S Hallila
HEEHFe: Essential oil extracted the hydrolat water of the sheets of L S Hallila.

The analysis of essential oil of sheets (leaves) and flowers the collected Lavandula stoechas showed that they are very rich in oxygenated monoterpenes. The percentage of every constituent varies according to the part (party) of the distilled plant and the region of the harvest. We find in particular 1,8-Cinéole (0.97-6.40%), has α-fenchone (10.27-21.3), has α-fenchol (4.83-45.33), to camphor (1.8-14.8 %), bornéol (1.47-6.45 %), myrténol (2.91-11.92), acetate of fenchyle (0.41-5.63%), acetate of bornyle (0.43-6 %), acetate of myrtényle (0.72-13.64 %) and veridiflorol (1.48-3.78 %).

Fig3. The chromatogram for the major product D-Fenchol alcohol

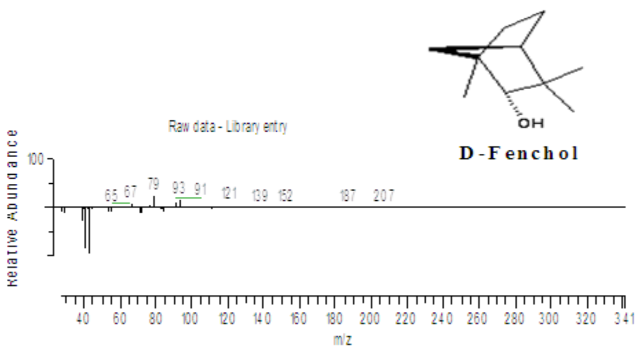
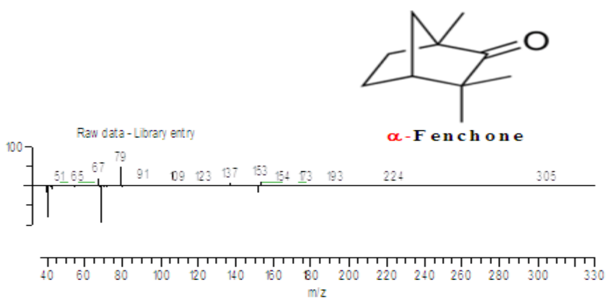


Fig4. The chromatogram for the product α-Fenchone



C. *Antibacterial activity of essential oils the L.S*

In the literature relative to essential oil of Lavandula S, the results (profits) of aromatogrammes are exclusively expressed from the measure of the diameter of the haloes of inhibitions of the boxes of the molded actually that essential oil is the most effective. For other origins (stumps), we note an absence of efficiency in essential oil which presents antibacterial activity.

TABLE2. TRANSCRIPTION THE VALUES OF THE DIAMETERS INHIBITION FOR DISCS IMPREGNATED OF 50 ESSENTIAL OIL ML.

Essential oil	Bacterium used	Test number	Diameter Inhibition
Essential oil of the sheets of Lavandula Stoechas (Hallila)	Bacillus subtillis	1	4 mm
		2	3 mm
		3	2 mm
	Porteus	1	-
		2	-
		3	-
	Escherichia coli K12	1	-
		2	-
		3	-
	Stapylococcus aureus	1	-
		2	-
		3	-
Essential oil of the flowers of Lavandula Stoechas (Zinat)	Bacillus subtillis	1	2mm
		2	3mm
		3	2mm
	Porteus sp	1	-
		2	-
		3	-
	Escherichia coli K12	1	-
		2	-
		3	-
	Staphylococcus aureus	1	-
		2	-
		3	-

According to the values gathered in this table, we on the other hand observe that essential oils of the sheets and the flowers of Lavandula stoechas have a sensitivity of important inhibition for the bacterium Bacillus subtillis, the other bacteria do not have the sensitivity of inhibition.

IV. CONCLUSION

The oils essential treated by distillation with hexane, were recovered with weak outputs. Pure essential oils of the sheets and the flowers of Lavandula stoechas (Zinat, Hallila), are on the other hand very rich in monoterpenes oxygenated beside some sesquiterpenes.

For pure essential oils of the flowers and sheets of Lavandula S for (Hallila), the Fenchyl alcohol is the majority compound.

The essential oils extracted the medicated water of the sheets and flowers of LS of the area of Zinat, it is noticed that the D-fenchyl alcohol is abundant month α-fenchone and that this last is the majority product of the essential oil of the sheets on the other hand for the essential oil of the flowers one finds that the acetate of myrténylе is the majority product which is in abundance with α-fenchone and the myrténol. Finally the components and the percentages of essential oils of the species studied Lavandula stoechas are different from those found in the literature and this can be explained by the factors geographical, climatic, techniques of extractions, the period of harvest and the duration of drying.

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