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THE ENVIRONMENTAL IMPACT OF HYDROLATES PRODUCED FROM THE ESSENTIAL OIL INDUSTRY IN ALBANIA

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SYNOPSIS

Waters produced from the essential oil industries in Albania were analyzed for their organic contents. In this study hydrolates, which distilled with essential oils, were saturated with salt, extracted with ether petrol and analyzed with GC-MS. Waters were collected from the industrial steam distillation of three regional plants: *Saturea montana, Salvia officinalis and Juniperus communis*. The use of these waters in shampoo industry was suggested to the industries.

INTRODUCTION

Albania is very rich in aromatic and medicinal plants. The export of aromatic plants and their essential oils is the second biggest export of the country. Each year thousands of tones of aromatic and medicinal plants are steam distilled in Albania. All these water residues, produced from these distillations, are discharged in nature.

The composition of essential oils produced in Albania is studied in depth for each of them (Aslani, 2004). In some cases dependence of essential oil composition on plants collected in different regions of Albania, and in different period of the year, has also been studied. But, no one has ever studied and analyzed the chemical composition of hydrolates and/or the chemical composition of waste waters from the distillation vessel.

In the literature there are several studies on the composition of hydrolates of specific plants. These studies have showed that in these hydrolates one could find polar compounds such as alcoholic terpenes and phenols (Di Leo Lira et al., 2009). Often these waters have been used for their antioxidant activity in marinades as an effective means of retarding lipid oxidation in raw and cooked meat (Mielnik et al., 2008).

The hydrolates, coming through distillation of aromatic plants, have very pure water and they have a very pleasant smell. For this reason they have been used in sprays as deodorant and in aromatherapy.

MATERIAL AND METHODS

This work has been done in collaboration with Xherdo Company in Albania. The hydrolates for this study were taken from the steam distillation of *Saturea montana, Salvia officinalis and Juniperus communis*. The origin of these plants is not specifically known but they are all local Albanian plants. The steam distillation has been done in industrial plants of a capacity of 2000 liters. For each batch, samples of 25 liters of hydrolates were collected and analyzed in the lab.

For each hydrolate a sample of 2L was taken and extracted with 200ml of ether petrol. The remaining water phase was later saturated with salt and then extracted again with ether petrol in order to see if there were still organics in it. After separation and evaporation of ether petrol, the sample was analyzed with TLC and GS-MS.

The TLC's were done in silica gel plates with a mixture of hexane/ethyl acetate 10/1 as eluent. GC's were done in a Varian instrument equipped with a ZB-5 column, 30m long. The oven conditions were: the temperature was kept at 80^0C for 1 min, then a gradient of 5^0C/min up to 280^0C.

RESULTS AND DISCUSSIONS

In the case of *Juniperus communis*, from 2L of hydrolates were taken after extraction and evaporation of the solvent 1.157g organics with a yield of 0.05785%. The remaining waters were then saturated with salt and extracted again with 200ml of ether petrol to give an extra yield of 0.001%. The combined organics, after being diluted at the right volume, were analyzed with TLC. For TLC silica gel plates on glass were used and as detector vanillin solution was used. The development was done in a cell filled with a mixture of hexane/ethyl acetate in a ratio 5/1. The Fig.1 shows the TLC chromatogram.

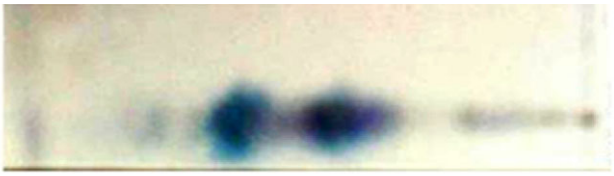
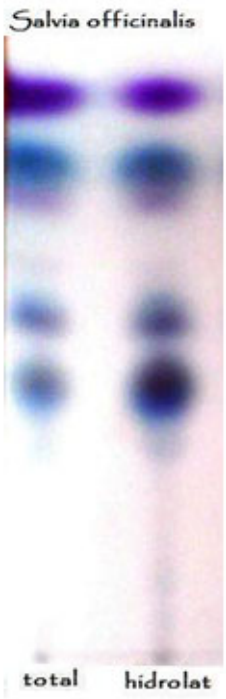


Figure 1: TLC of *Juniperus communis*.

The hydrolates taken from *Salvia officinalis* gave after extraction 3.646g of organics with a yield of 0.183%. The remaining waters were saturated with salt and extracted again to give an extra yield of 0.031%. The combined organics, after being diluted at the right volume, were analyzed with TLC. The Fig. 2 shows the TLC chromatogram.



The comparison between hydrolate TLC and total essential oil TLC shows that in the hydrolate one could find almost all the organic components as in essential oil, but in higher percentage were the polar compounds with a RF of around 0.5.

The GC-MS analysis proves the result of TLC and shows that we could find almost all of the organics of essential oil in these hydrolates, but in higher percentage are substances like camphor, borneol, α-thujone, and cineole.

Figure 2: TLC of *Salvia officinalis*.

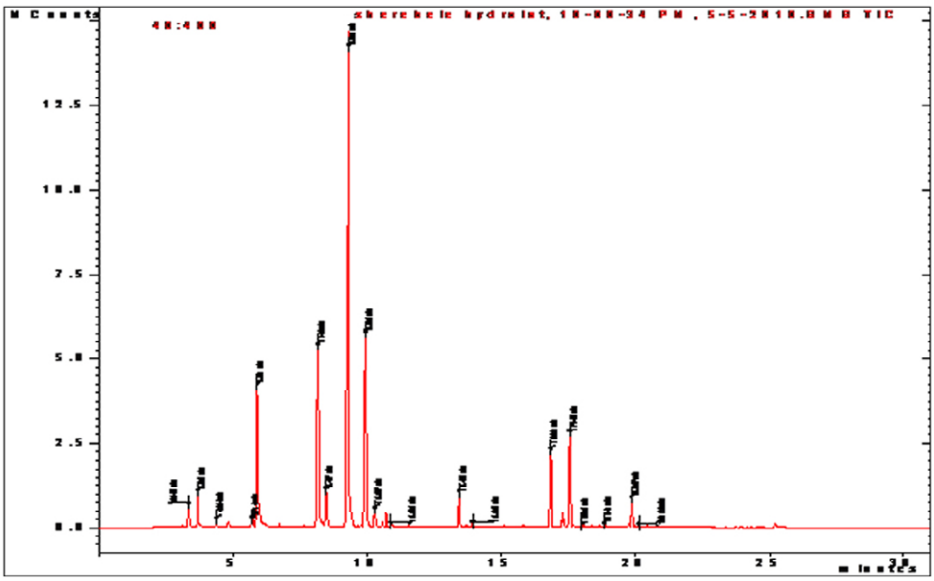


Figure 3: GC-MS of *Salvia officinalis* hydrolates.

In the case of hydrolates taken from *Saturea Montana* after extraction we found 1.184g of organics with a yield of 0.091%. The remaining waters were saturated with salt and extracted again to give an extra yield of 0.0141%. The combined organics, after being diluted at the right volume, were analyzed with TLC.

For TLC silica gel plates on glass were used and as detector vanillin solution was used. The development was done in a cell filled with a mixture of hexane/ethyl acetate in a ratio 5/1. The Fig. 4 shows the TLC chromatogram.

Figure 4: TLC of *Saturea montana*.

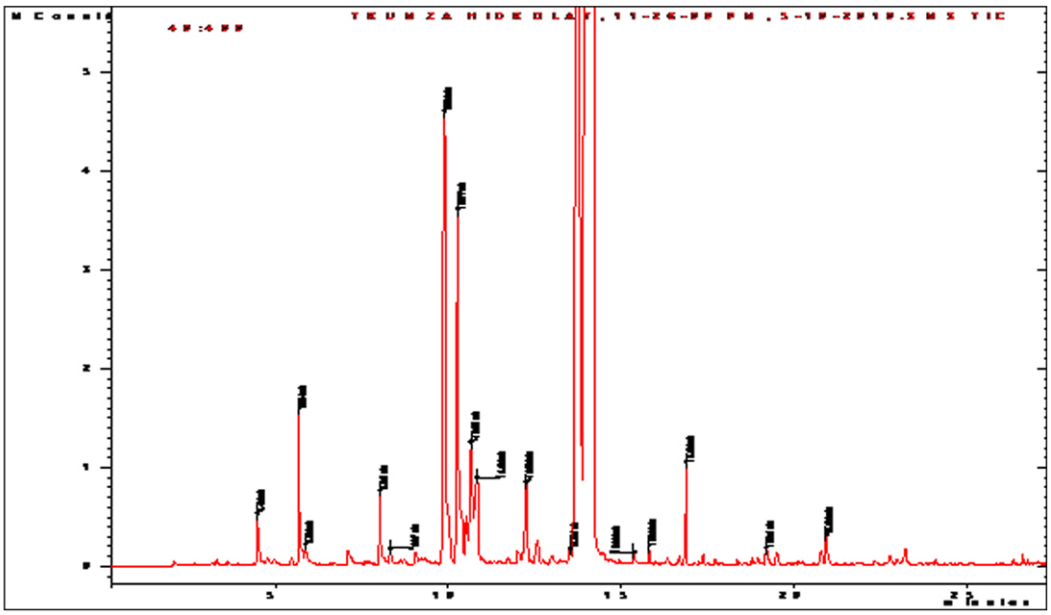


Figure 5: GC-MS of *Saturea montana* hydrolates.

The comparison between hydrolate TLC and total essential oil TLC shows that in the hydrolate as majorities are some spots which give a red color when treated with vanillin.

The GC-MS analysis shows that carvacrol, thymol and borneol have the highest percentage in the organics of hydrolates of *Saturea montana*

From the above study resulted that the hydrolates still contain a considerable amount of organics.

The table below shows the amount and the yield of organics found in the hydrolates of *Saturea montana, Salvia officinalis and Juniperus communis.*

Table 1: Yields of organics contained in hydrolates of *Saturea montana, Salvia officinalis and Juniperus communis.*

Plant	Amount of hydrolate	Organics in gram	Yield in %
Juniperus communis	2L	1.157	0.0578
Saturea montana	2L	1.184	0.0907
Salvia officinalis	2L	3.646	0.183

From the table we could see that the hydrolates of *Salvia Officinalis* have higher amounts of organics than *Saturea montana and Juniperus communis.*

From the GC analysis results that in hydrolates there are mostly compounds with higher polarity, alcohols and phenols, such as carvacrol, borneo, thymol etc..

CONCLUSIONS

We have suggested to the industry to use these waters for shampoo and detergent production because they have already a strong and nice aroma, and they are waters collected from steam distillation, therefore they are very clean waters. Trials for formulation of shampoos are under way in our laboratories.

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