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Physical Characterization-Chemistry of Essential Oil of Oregano in 6 Communities of the Municipality of Rodeo, Dgo.

Caracterización Físico-Química de Aceite Esencial de Orégano en 6 Comunidades del Municipio de Rodeo, Dgo.

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Abstract

The municipality of Rodeo is one of the largest oregano producers in the state of Durango, reporting an average of 100 tons per year, which are used as a condiment and there is no use in its entirety. The objective of the present work was Physicochemical Characterization of Essential Oil of Oregano (AEO) in 6 communities of the municipality of Rodeo Durango, the methodology was carried out by dragging with water vapor, where quality and quantity of oil were controlled, using the leaves of The oregano plant, the density, was determined by means of a pycnometer and the index of refraction by means of a refractometer (Master Refractometer). The results obtained for the index of refraction of the oils of the 6 localities circle between 1.47-1.50 which indicates an acceptable purity in the (AEO). The density of oils circle between 0.91-0.92. The chemical components were read by gas chromatography and a Flame Ionization Detector (FID), where a higher percentage of concentration on the carvacrol compound was reported, which circulated between 60-70% while the compound Thymol was between 30-40%. A statistical analysis was performed to determine if there was a significant difference between the concentration of the analytes based on the height of the sample obtaining a significance >5, which indicates a difference between the data.

Oregano, Oil, Pycnometer, Extraction and distillation

Resumen

El municipio de Rodeo es uno de los mayores productores de orégano del Estado de Durango, reportando un promedio de 100 toneladas anuales las cuales son empleadas como condimento y no se genera un aprovechamiento en su totalidad. El objetivo del presente trabajo fue Caracterización fisicoquímica de Aceite Esencial de Orégano (AEO) en 6 comunidades del municipio de Rodeo Durango, se utilizó la metodología extracción por arrastre con vapor de agua, donde se controlaron calidad y cantidad de aceite, mediante las hojas de la planta de orégano, la densidad, se determinó por medio de un picnómetro y el índice de refracción por medio de un refractómetro (Master Refractometer). Los resultados obtenidos para el índice de refracción de los aceites de las 6 localidades circulo entre 1.47-1.50 lo cual indica una pureza aceptable en los (AEO). La densidad de los aceites circulo entre 0.91-0.92. Se realizó la lectura de los componentes químicos por medio de cromatografía de gases y un detector de Ionización de Flama (FID), donde se reportaron un mayor porcentaje de concentración sobre el compuesto carvacrol el cual circulo entre los 60-70% mientras que el compuesto timol estuvo entre los 30-40%. Se realizó un análisis estadístico para determinar si existía diferencia significativa entre la concentración de los analitos en base a la altura de la muestra obteniendo una significancia >5, lo cual indica una diferencia entre los datos.

Orégano, Aceite, Picnómetro, Extracción y arrastre de vapor

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Introduction

Oregano is the common name of a condiment, applied to more than 60 species and subspecies belonging to the Lamiaceae and Verbenaceae families, of which the most important are those of the Mediterranean or European oregano (Origanum vulgare subsp. Hirtum, O. vulgare subsp .gracite) and Mexican oregano (Lippia graveolens and L. palmeri) (Ocampo-Velázquez, 2019).

This research was the extraction and characterization of oregano essential oil in 6 communities in the municipality of Rodeo, Dgo. In order to detect the level of concentration in its main components of Timol and Carvacrol in the leaf, the collections of vegetative material were in the towns of Rodeo, Dgo; Abasolo, Borcelanas, Chonteco, Cuesta, Michoacano and Yerbabuena part in the Water Technology laboratory of the Technological University of Rodeo.

Theoretical foundation

Oregano

The name "Oregano" comes from the Greek: golds (Mountain) and grains (Ornament). The beauty of the mountains. A Greek legend says that Aphrodite, goddess of love, was the first person to cultivate oregano and gave this plant the fragrance it currently possesses (Jorge, 2012).

Plant as medicinal use

Oregano leaves are mainly used, which are oval, petiolated and covered with hairs. We can use the oregano internally by preparing it in infusion and tincture and externally by applying the infusion locally, the essential oil of oregano diluted in a base oil for massages or in water to make fumes and the oil infused with oregano (Martínez, 2011).

Essential oils

AE have an antibacterial, antiviral, antifungal and antiparasitic capacity in different grades. AE are eubiotics, that is, enhancers of our immune system, while acting on pathogens through more than 25 active ingredients they contain (Pallash, 2018).

Cosmetic industry

Essential oils, due to their magnificent properties, confer great value for natural cosmetics providing enormous benefits in the treatment of acne, wrinkles, cellulite, sensitive or atopic skin (Hörmann, 2016).

Chemical composition of essential oils

As we know an essential oil is composed of hundreds of different substances. Generally, although there are exceptions, the major components are terpenic hydrocarbons (No aroma or with little distribution of global aroma) and minority (but not less important), are responsible for the characteristic aroma of the essential oil and are encompassed in different families chemical (Montes, 2010).

Physical characteristics of essential oils

They are fat soluble and very little soluble in water, but are draggable by water vapor (Farma, 2017).

Timol

One of the main characteristics and properties of thymol as a phenolic compound is its bactericidal, pesticidal and fungicidal potential. Part also that once extracted, does not have an unpleasant color or taste, so it is currently part of mouthwashes, mouthwashes and toothpaste. It has a refreshing and bactericidal action (Copyright, 2019).

Carvacrol

Several concentrations of oregano oil reported the elimination of Listeria bio-films on stainless steel and plastic surfaces, confirming its usefulness as a cleaning agent even in non-organic environments. (Group, 2016).

Methodology to be developed

Description of the study area

The present work was developed in the facilities of the Technological University of Rodeo in the municipality of Rodeo, Dgo, (Figure 1). It is located in the center of the state of Durango.

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It borders to the north with the municipality of San Pedro del Gallo; to the northeast with San Luis del Cordero; to the east with Nazas; by the south San Juan del Río.

Its municipal seat is located at coordinates 25º11 'north latitude and 104º34' west longitude, at a height of 1,340 meters above sea level.

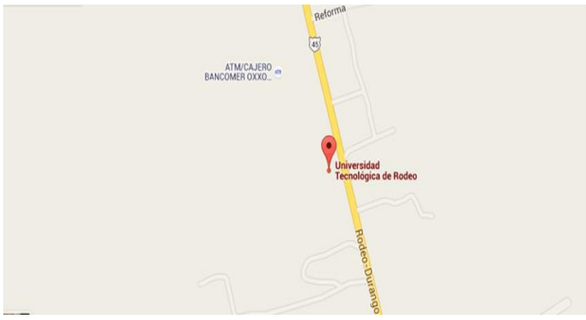

Figure 1 Location of study area Source: Silva, 2019

Density determination of oregano essential oil

To perform the density technique, the following methodology was developed. A 10 mL pycnometer was placed at a constant weight for 8 hrs. Subsequently, the empty pycnometer was weighed, 10 mL of oregano oil was added, the pycnometer was weighed with oregano essential oil, then the formula Ω=m/v was applied where (d) = density (m) = mass of the pycnometer with oil and (v) = volume of oil.

Oregano essential oil refractive index

The index of refraction of oregano essential oil, a volume of 20 micro-liters was taken in a micro pipette, then the 20 micro liters were poured into the prism of the refractometer and the index of refraction of the oil was observed through the eyepiece of the refractometer.

Data collection

Characteristics of the gas chromatograph analysis

Hydrogen with a flow of 1 mL / min was used as mobile phase, with the Detector: FID at a temperature of 250 ° C; air 400 mL / min; H2 35 ml / min; makeup 20 mL / min 3. The initial temperature was obtained with a temperature of 40 ° C; 10 ° C ramp from 40 ° C to 190 ° C. Automatic stop: 16.00 min. For Interval 1: Bipolar, 2500 mV, samples per sec.

Results

Oregano essential oil refractive index

Figure 2 shows the results obtained from the refractive oil index of the 6 communities selected to perform the physical characterization.

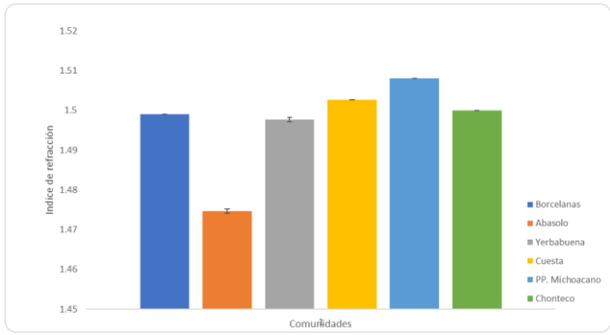

Figure 2 Refractive index Source: Marín, 2019

The following table 2 shows the statistical analysis of the refractive index of the 6 selected communities. Where it was obtained that the value of fashion was 1.4997, which indicates that if the method is repeated the possibility of the result is 1.4997 with a confidence level of 95%.

Half	1.49706667
Typical error	0.00256013
Median	1.4997
fashion	1.499
Standard deviation	0.0108617
Sample Variance	0.00011798
Kurtosis	1.22757885
Asymmetry coefficient	-1.50643399
Rank	0.034
Minimum	1.474
Maximum	1.508
Sum	26.9472
Account	18
Confidence level (95.0%)	0.0054014

Table 2 Descriptive analysis

Obtaining the density of oregano essential oil

The density was obtained through a pycnometer, therefore, in the yerbabuena community it obtained a large amount of density in the essential oil of oregano (Table 3).

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Community	Density
Cost	0.9094
Abasolo	0.9194
Chonteco	0.9153
Michoacano	0.9173
Borcelanas	0.9256
Good herb	0.9292

Table 3 Oregano essential oil density

Calibration curve - Standard Timol

The analysis of the concentration of the thymol standard and its quantified response with the peak area, was determined by means of gas chromatography presenting an R2 = 0.9981400, which indicates a linear response and an acceptable relationship between the data. In Figure 3, it shows the calibration curve of the timol standard, where the quantification of the 6 towns of the municipality of Rodeo was performed**.**

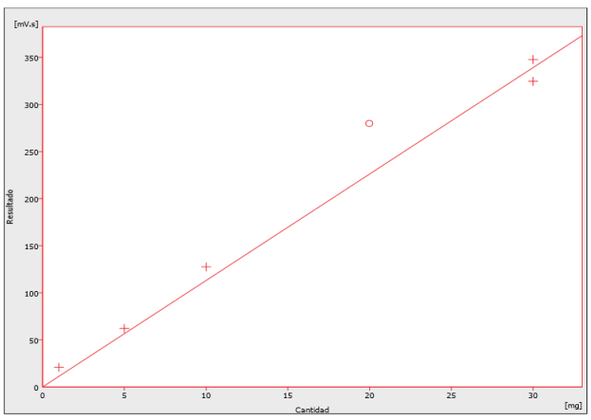

Figure 3 Standard calibration curve for the quantification of Timol in oregano oil Lippia graveolens. Source: Marín, 2019

Carvacrol standard

The analysis of the concentration of the standard of carvacrol and its quantified response with the peak area, was determined by means of gas chromatography presenting an R2 = 0.9974837, which indicates a linear response and an acceptable relationship between the data.

In the following Figure 4, the calibration curve of the carvacrol standard is shown with which the quantification of the 6 localities of the municipality of Rodeo was performed.

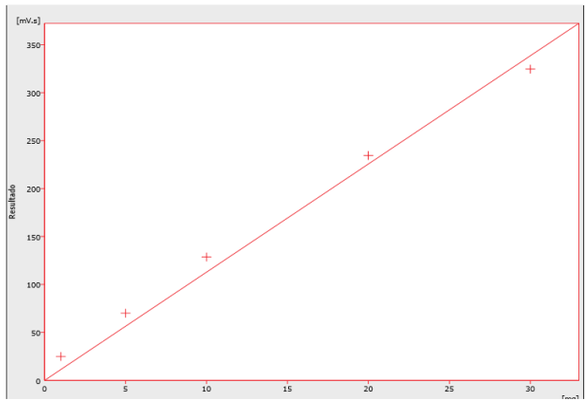

Figure 4 Standard calibration curve for the quantification of carvacrol in oregano oil Lippia graveolens. Source: Marín, 2019

Thymol / Carvacrol concentration

The following table shows the results obtained by gas chromatography of the thymol and carvacrol standard in (mg).

Location	Height	Conc. Thymol (mg)	Conc. Carvacrol (mg)
Abasolo	4428	2.024	6.095
Borcelanas	1439	46.746	108.853
Chonteco	4763	49.1012	1118.61
Cost	1570	70.33	153.13
Michoacano	1371	13.229	148.764
Good herb	1666	13.228	156.757

Table 4 Thymol and Carvacrol concentration

Analysis of variance (ANOVA)

The results obtained by means of gas chromatography in the quantification of the compounds Timol and Carvacrol of the 6 localities of the municipality of rodeo were analyzed by means of a statistical analysis (ANOVA), to determine if there is a significant difference between the composition of the compounds depending on the climatic conditions of the region.

For this, an analysis of variance (ANOVA) was performed, where STATISTICA 10 software was used, which yielded the following results for thymol.

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Effect	Univariate Results for Each DV (Spreadsheet 10), Sigma-restricted parameterization Effective hypothesis decomposition				
	Dgr.of freedom	Timol H.H	Timol Ms	Timol F	Timol P
Intercept	1	8596.721	8596.721	1.226351E+10	0.00
Height	6	7162.451	1193.742	1.702912E+09	0.00
Error	5	0.000	0.000		
Total	11	7162.451			

Table 5 Comparison of thymol based on analysis of variance (ANOVA)

Where it indicates based on F = 1.226351E + 10 and P = 0.00 if there is significance in the concentrations of the thymol compound based on the height at which the sample was taken.

For carvacrol the results were as follows, where an F = 6.004800E + 15 and a value of P = 0.00 is demonstrated, which concludes that if there is significance between the concentrations of the carvacrol compound based on the height of the localities.

Effect	Univariate Results for Each DV (Spreadsheet 10), Sigma-restricted parameterization Effective hypothesis decomposition				
	Dgr.of freedom		Dgr.of freedom		Dgr.of freedom
Intercept	1	108362.7	108362.7	1.201443E+17	0.00
Height	6	32495.7	5416.0	6.004800E+15	0.00
Error	5	0.000	0.000		
Total	11	32495.7			

Table 6 Comparison of carvacrol based on analysis of variance (ANOVA)

Discussion

Refractive index

Based on the Study of the Chemical Composition of the Essential Oil of Oregano by Albado et al. (2001), the results obtained for the refractive index of oregano essential oils are within the parameter established by (Poulose and Croteau, 1978), which circulates between 1.47-1.50. as in the research by Dambolena et al. (2010), on the chemical composition of oregano leaf that establishes a refractive index of 1.49. It is also mentioned that the variation in the refractive index may be the reason for a greater or lesser concentration of phenols.

Chromatography

Based on Montes research (2010), on the chemical characterization of oregano vulgarea it was defined that the amount of the analyte compounds (Timol and carvacrol), depend more on the species of oregano than on the geological conditions such as altitude. Based on the analysis of variance (ANOVA), a significant difference in the presence of thymol / carvacrol was demonstrated in the different sampling areas.

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Conclusions

Oil distillation

Based on the results obtained in terms of performance and quality of oil per volume of oregano leaf we can conclude that the pressure cooker distiller showed a better result compared to the process with laboratory glassware showing a yield of 16 mL per 400 g do sheet compared to glassware extraction showing a yield of 5 mL per 400 gm of sheet.

Physicochemical analysis

Based on the physical-chemical analysis performed on the essential oil of oregano from the 6 towns of the municipality of Rodeo, it is concluded that if there is significant deference between the composition of the thymol and carvacrol analytes based on the altitude of the sample.

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