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# CHEMICAL PROPERTIES AND BACTERICIDAL ACTIVITY OF *Rosmarinus officinalis* and *Origanum x majoricum*

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**ABSTRACT**

The aim of this study was to identify the chemical properties and bactericidal activity of *Rosmarinus officinalis* and *Origanum x majoricum* in relation to the compounds detected by gas chromatographic analysis. Proceeded to wash samples *Rosmarinus officinalis* and *Origanum x majoricum* and were referred to a mashing process for seven days at room temperature with ethanol, filtering the ethanol extracts. The extracts obtained were analyzed by a gas chromatography system equipped with a mass spectrometer. *Staphylococcus aureus* (ATCC 25923) was used to evaluate the activity antiomicrobial extracts of *Rosmarinus officinalis* and *Origanum x majoricum* by the Kirby-Bauer method modified and quantified with the software Image J. *Rosmarinus officinalis* were detected alcohol, terpene and cetone compounds noted for their abundance and absence of compounds thymol and carvacol. *Origanum x majoricum* were identified for a considerable percentage of alcohol, acids and esters compounds, highlighting the carvacol as one of the most abundant, and linolenic acid and paeonol was detected. Antimicrobial activity of *Rosmarinus officinalis* extracts showed greater antimicrobial activity against *Staphylococcus aureus*, with respect to extract *Origanum x majoricum*.

**Keywords:** *Rosmarinus officinalis*, *Origanum x majoricum*, extract plant, antimicrobial activities.

## INTRODUCTION

In America a very popular plant that would spice the Aztecs called Ahuiyac-Xihuitl and Mayans called it Xaak-il-che, this native spice America is characterized by its aroma and taste very similar to oregano who knew ranks the Europeans (*Origanum vulgare*), why they decided to call it by the name of oregano, although both plants belonging to different families and species. Meanwhile, rosemary Mediterranean origin with deeply rooted in Mexican traditional medicine is first reported in the seventeenth century by its benefits for treating respiratory and digestive ailments. Thus it can be seen that were used with different cultural purposes *Rosmarinus officinalis* (rosemary) and *Origanum x majoricum* (oregano), among other plants, from antiquity being at that time the most important resources that populations had, used in cases ranging from the expulsion of parasites to treat a chronic rheumatism [1].

The herbal medicine is practiced in many countries and Mexico, according to figures from the Ministry of Health at least 90% of the population has used medicinal plants, showing that currently traditional medicine has impact on public health. *Rosmarinus officinalis* grows in all types of soil preferably in arid, dry, permeable, well adapted to poor soils. Attributed tonic properties, stimulating, antipyretic, antispasmodic, antimicrobial, diuretic, including [2-4].

Recent laboratory studies have shown that *Rosmarinus officinalis* slows the growth of some bacteria are *Escherichia coli* and *Staphylococcus aureus* which are related to the decomposition of food, and may be better than some of the conservatives currently marketed food, its activity against *Candida albicans*, *Mycobacterium intracellularae*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* were also documented. Besides its application as an additive to other soaps, cosmetics and perfumes, essential oil is used for the preparation of creams for skincare [4, 5].

*Origanum x majoricum* (oregano) is a hybrid of origin in Spain however, is distributed in arid and semiarid regions from northern to southern Mexico, present in warm, temperate and semi-dry climates, is considered a very promising clone for growth in places with water as places between rivers. Its therapeutic application is in cases of cough, colds, bronchitis and indigestion 5 as an antimicrobial has been evaluated against *E. coli*, *S. aureus* and *B. cereus* [6-8].

In different latitudes is very common to use medicinal plants, as is the case of *Rosmarinus officinalis* and *Origanum x majoricum*, highlighting its use in rural communities due to inherited from generation to generation, besides being a low-cost treatment empirical knowledge. However, frequent consumption of these plants may damage the body. Therefore, the objective of this study was to identify the chemical properties and bactericidal activity of *Rosmarinus officinalis* and *Origanum x majoricum* in relation to the compounds detected by chromatographic analysis.

## MATERIAL AND METHODS

### Collection and processing of samples

Samples of *Rosmarinus officinalis* and *Origanum x majoricum*were obtained in the municipal market Emiliano Zapata of the City of Puebla. Proceeded to wash the samples and subjected to a mashing process for seven days at room temperature with pharmaceutical grade ethanol in amber glass container. After the steeping time the ethanol extracts were filtered, removing the ethanol in a rotary evaporator.

### Chromatographic analysis

The extracts obtained were analyzed by a gas chromatography system Agilent HP 7890 equipped with a mass spectrometer. The GC operating conditions were: FID (Flame Ionization Detector), column 30m x 0.5 x 0.25 um um DI, injection port temperature 180ºC, 270ºC detector temperature, oven temperature (initial 56 ºC, then 65ºC, 65ºC per minute ramp up to 150ºC) with helium as the carrier gas flow of 1.7 ml/min.

### Evaluation of antimicrobial activity of extracts

*Staphylococcus aureus* (ATCC 25923) were used to assess the antimicrobial activity of the extracts by the Kirby-Bauer method modified and quantified with Image J software.

## RESULTS AND DISCUSSIONS

The results obtained from the analysis of gas chromatography coupled to a mass spectrometer helped to confirm that a variety of compounds in *Rosmarinus officinalis* and *Origanum x majoricum* with properties of importance and application in medicine, data corroborate various reports which have evaluated rumen microbial inhibition and has even been reported that the combination of extracts of rosemary and garlic is effective against *Lactobacillus curvatus*, and combining with cranberry oregano extracts showed antimicrobial activity against *Listeria monocytogenes* [9-11].

To *Rosmarinus officinalis* alcohol type compounds, and terpene ketone noted for its abundance, among others (Table-1) were detected. In this regard have done extensive research in order to identify components with phytotherapeutic and antimicrobial application, highlighting the work with European plants and very little with Mexican plants. In this paper *Rosmarinus officinalis* shows absence of thymol and carvacrol, attributed to the chemical composition can be affected by factors such as climate, altitude, soil type, rainfall, harvest time, neighbors bushes, growth stage, including [12,13].

The Official Journal of the European Union have reported that *Rosmarinus officinalis* acid as major components, and terpene alcohols, which differs with results obtained in this study, where the major compounds are alcohols with 21.74%, ketones 15.22%, camphor which is the second largest compound in *Rosmarinus officinalis* with an estimated extract 10.15 g/L dry basis, terpenes with 15% concentration where the compound 1, 7, 7-trimethyl - (1R) -Bicyclo [2.2 0.1] heptane-2-one is the most abundant with a concentration of 23.29% g/L and representing only 11.11% of the compounds reported acids. The results show that the chromatogram shows *Rosmarinus officinalis* bornyl acetate, 1, 8-cineole and camphor, constituting the principal components of rosemary, according to other reports [14].

Reported the effects of the compounds identified by GC/MS shows that *Rosmarinus officinalis* has antioxidant activity, camphor compound where the active part. For his part, ferruginol that occurs at low concentration shows antitumor and antibacterial activity.

Also include benzoic acid compounds, 3,4-dimethoxy methyl ester at a concentration of 0.6361 g/L nontoxic, linolenic acid ethyl ester with a concentration of 0.6696 g/L and whose toxicity is not reported and 3,4-dimethylbenzyl alcohol in a concentration of 2.5891 g/L nontoxic. However, presents other compounds as the Vanillic acid methyl ester at a concentration of 1.7074 g/L and whose toxicity is not reported, 2-methoxy-4-vinylphenol is toxic to humans and is present at a concentration of 1.607 g/L and caryophyllene oxide turns out to be non-toxic and is in a concentration of 0.9039 g/L, presenting these compounds anticancer action [2].

In *Origanum x majoricum* identified with a significant proportion of alcohol type compounds, acids and esters (Table-1), carvacrol highlighting one of the most abundant at a concentration of 7.3844 g/L and showing contraceptive, antidepressant and bactericidal activity. Linolenic acid, which presents important activity to prevent chronic diseases and reduce inflammation was also detected, and especially not toxic to humans, plus anti-inflammatory properties are attributed by the palmitic acid. It also presents the paeonol compound is an effective chemotherapeutic agent against colon and ovarian cancer, however it is toxic and irritating [15-20].

**Table-1.** Compounds detected in *Rosmarinus officinalis* and *Lippia graveolens* by chromatographic analysis.

| ***Rosmarinus officinalis*** | ***Lippia graveolens*** |
|---|---|
| Acid (9%) | Acid (18%) |
| Alkane (4%) | Alkane (3%) |
| Alcohol (22%) | Alcohol (42%) |
| Aldehyde (4%) | Aldehyde (2%) |
| Amine (7%) | Alkene (2%) |
| Ketone (15%) | Amine (5%) |
| Sulfur compound (2%) | Ketone (4%) |
| Esther (11%) | Esther (18%) |
| Ether (9%) | Ether (2%) |
| Nitrile (2%) | Sulfide (2%) |
| Terpene (15%) | Terpene (2%) |

The antimicrobial activity of extracts of *Rosmarinus officinalis* and *Origanum x majoricum* was evaluated by determining the inhibition zone diameter, and

the results show that the direct application of *Rosmarinus officinalis* extract significantly inhibits *Staphylococcus aureus* with an average diameter of 24.7 mm, and dilutions of the extract as halos were performed proportionally decreased. The extract of *Origanum x majoricum* also showed bactericidal activity against *Staphylococcus aureus* with an average diameter of 19.9 mm, and as dilution of the extract bacterial activity decreased (Table-2), data collated with those reported in other studies, highlighting applied application today are given plant extracts, such is the case of the association in the synthesis of nanoparticles, therapeutic utilities and applications to prevent deterioration of documents [21-23].

**Table-2.** Average of the inhibition halos induced by extracts of *Rosmarinus officinalis* and *Lippia graveolens* on *Staphylococcus aureus*.

| ***Rosmarinus officinalis*** | ***Lippia graveolens*** |
|---|---|
| Concentrate (24.7 mm) | Concentrate (21.5 mm) |
| Dilution 1 (23.9 mm) | Dilution 1 (19.8 mm) |
| Dilution 2 (23.5 mm) | Dilution 2 (17.5 mm) |
| Dilution 3 (16.7 mm) | Dilution 3 (13.5 mm) |
| Dilution 4(13.1 mm) | Dilution 4(10.6 mm) |

## CONCLUSIONS

This work suggests that *Rosmarinus officinalis* and *Origanum x majoricum* can become toxic and cause chronic diseases in the population consuming due to factors such as frequency of use, number and sensitivity of the individual, due to the presence mainly of compounds as 2,6-dimethoxy found in both extracts. *Rosmarinus officinalis* showed greater inhibitory activity against *Staphylococcus aureus*, respect to *Origanum x majoricum*.

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