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Research Article

CHARACTERISATION OF VOLATILES AND EVALUATION OF ANTIOXIDANT ACTIVITY OF THE FLOWER ESSENTIAL OILS OF *MYRTUS COMMUNIS* L FROM MOROCCO

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ABSTRACT

In this work, the chemical composition and antioxidant activity of essential oils obtained from *Myrtus communis* L were determined. Myrtle species from the Myrtaceae family are widely distributed in Morocco. In this study, the essential oils of *Myrtus communis* L flower collected from Atlas median in the region of Sekoura (Morocco) were obtained by hydro-distillation and analysed by gas chromatography equipped with flame ionisation detector (GC-FID) and gas chromatography coupled to a mass spectrometry system (GC/MS) for their chemical composition. The antioxidant activity of essential oils against DPPH radical was determined in vitro by treated with different concentrations of essential oil and vitamin C as standard antioxidant compound. The percentages of DPPH inhibition and IC_{50} were recorded. Forty tree compounds were identified in flower oil representing 92.19% of the total oil composition. The yield of essential oil of *Myrtus communis* L was 1.75% and the major compound in the flower was α-pinene (48.54%) followed by 1.2 cineole (14.75%), myrtenal (5.01%), myrtenol (4.01%), myrtenyl acetate (3.45%), myrcene (2.09%), linalool (2.01%) and geraniol (1.67%). The radical scavenging activity (% inhibition) of the essential oil from *Myrtus communis* L was the highest (89.15 ± 2.01%) at the concentration of 200µg/ml. Therefore they could be suitable for using as antioxidative agents in the food industry.

Keywords: *Myrtus communis,* Essential oil, GC/MS, Antioxidant activity, α- pienene.

INTRODUCTION

Myrtus communis L. (Myrtaceae family and subfamily Myrtoideae) is an annual plant that has been used since ancient time's for medicinal, food and spice purposes. The leaves contain tannins, flavonoids such as quercetin, catechin and myricetin derivatives and volatile oils [1, 2]. This aromatic plant, very odorous, is also present in Occidental Asia, South America and Australia and it's widely distributed in the Mediterranean area [3-5]. The fruits of this plant are mostly composed of volatile oils, tannins, sugars, flavonoids and organic acids such as citric and malic acids [6]. The leaf and berry essential oil compositions from various Mediterranean origins have also been investigated: France [7], Italy [8], Portugal [9], Spain [10], Lebanon [11], Iran [12, 13], Greece [14], Albania [9, 15], Turkey [16], Croatia [11] and Tunisia [17].

The essential oil obtained from the leaves *Myrtus communis* L by steam distillation is also important in perfumery [1]. It is traditionally used as an antiseptic, disinfectant drug and hypoglycaemic agent [18]. Different parts of the plant find various uses in the food industry, such as for flavouring meat and sauces, and in the cosmetic industry [11].

Different part essential oils have been employed for their antimicrobial, tonic and balsamic properties [19]. Myrtle berries and leaves are mostly employed for the industrial formulation of sweet liquors with digestive properties [20]. [21] Reported that a crude methanol extract of *M. Communis* leaves had potent antibacterial activity against 10 microorganisms, including 6 gram positive and 4 gram negative bacteria. Myrtle is better known as a medicinal plant for its anti-hyperglycaemic [18], antiseptic, anti-inflammatory activities [22, 23] and anti-diabetic [24]. The essential oils obtained from the leaves is also mainly used for treatment of lung disorders, [25], and has antimicrobial [26, 27], antibacterial [28, 29], antioxidant activities [12, 30, 31], anti hyperglycaemic [18, 32], analgesic [33] and anti genotoxic [34]. The antioxidant activity of myrtle liquor was reported by [35]. The antifungal activity of myrtle oil against *Rhizoctonia solani, Fusarium solani* and *Colletotrichum linelemuthianum* exhibited weak fungicidal activity [26]. Myrtle has a long history of use in folk medicine and infusion of its leaves has been employed as anti-inflammatory antiseptic for treatment of respiratory and genitourinary disorders [36] and assessed anticancer activity of some myrtle compounds [37]. Moreover, many phytochemical researches investigated at the same time the essential oil composition of leaves and fruits as well as the other parts of *M. communis* [38, 39] because of its great interest in various fields such as culinary, cosmetic, pharmaceutical, therapeutical and industrial. Several studies have investigated the chemical composition of myrtle oil [40-43]. The present work therefore, attempts to determine the chemical composition and evaluate antioxidant activity of the essential oil from the flowers of *Myrtus communis* L collected in Atlas mean (Sekoura), a mountainous region from Morocco.

MATERIALS AND METHODS

Chemicals and standards

All solvent were of analytical grade, unless otherwise specified. Hexane solution, anhydrous sodium sulfate, series of alkanes (C_4-C_{28}) standards and 2, 2- diphenyl-1-pic-rylhyrazyl radical (DPPH) were obtained from Faculty of Medicine and pharmacy, Sidi Mohamed Ben Abdellah University, Fez, Morocco.

Vegetal material

The flower of *Myrtus communis* have been collected during March 2010 in the region of Sekoura, 90 km in the south east of Fez city (latitude: 25° 31 '11" longitude: 5° 22' 21"; altitude: 2100 m). The climate is semi-humid with strong continental influence having an annual average temperature of 20°C. The plant was identified by Dr. Elhoussine Derwich from Regional Center of Interface, Sidi Mohamed Ben Abdellah University, Fez, Morocco. The collected flowers were then dried in the open air for fifteen days and the plants were then isolated from the other specimen and conserved for extraction.

The amount of oil obtained from each plant material was calculated as:

Oil (% v/w) = observed volume of oil (ml)/ weight of sample (g) x 100

Extraction of essential oils

The essential oils were extracted by hydro-distillation using an apparatus of Clevenger type [44] in Faculty of Sciences of Fez (Morocco). The extraction took 2.5 hours for mixing 200g of plants in 1400 ml of distilled water. The yellowish oil (0.5 ml) for flower was dissolved in hexane and then dried over anhydrous sodium sulfate. After filtration the solvent was eliminated by pressure distillation reduced in rotary evaporator at 35°C and pure oil stored at 4°C in obscurity till the beginning of analysis.

Gas chromatography analysis (GC-FID and GC/MS)

The essential oils from flower of *Myrtus communis* were analysed by gas chromatography (GCFID) and gas chromatography–mass spectrometry (GC–MS) using a CP-SIL- 5 CB column in Unity of GC/-MS and GC, Regional Center of Interface, Sidi Mohamed Ben Adellah University, Fez, Morocco.

The GC (TRACE GC-ULTRA, S/N 20062969, Thermo-Fischer) analysis equipped with flame ionisation detector (GC-FID), Varian capillary column Test Report CP 7770 (CP-SIL- 5 CB; 50m length, 0.32mm of Inside diameter, 0.45mm Outside diameter and Film thickness 1.20 µm). Column temperature was initially kept at 40 °C for 2 min, then gradually increased to 260 °C at 5 °C/min rate and finally held for 10 min at 260 °C. The temperature of the injector was fixed to 250°C and the one of the detector (FID) to 270°C. The debit of gas vector (nitrogen) was fixed to 1ml/min.The volume of injected specimen was 0.5µl of diluted oil in hexane solution (10%). The percentage of each constituent in the oil was determined by area peaks.

The identification of different chemical compounds was realised by gas phase chromatography (TRACE GC-ULTRA, S/N 20062969, Thermo-Fischer) coupled with mass spectrometry (PolarisQ, S/N 210729, Thermo Fischer) (GC/MS). The utilised column was Varian capillary column Test Report CP 7770 (CP-SIL- 5 CB; 50m length, 0.32mm of Inside diameter, 0.45mm Outside diameter and Film thickness 1.20 µm). The column temperature was programmed from 40 to 260°C for 5°C/min. The temperature of the injector was fixed to 250°C and the one of the detector (PolarisQ) to 200°C. Ionisation of the sample components was performed in electron impact mode (EI, 70 eV). The debit of gas vector (Helium) was fixed to 1ml/min. Transfer line temperature was 300°C. The mass range from 40 to 650 amu was scanned at a rate of 2.9scans/s. The volume of injected specimen was of 1µl of diluted oil in hexane solution (10%). The constituents of essential oils were identified in comparison with their retention indices, calculated in relation to the retention time of a series of lineary alkanes (C_4- C_{28}) with those of reference products and in comparison with their retention indices with those of the chemical components gathered by [45] and in comparison with their spectres of mass with those gathered in a library (NIST-MS Search Version 2.0) and with those reported in the literature [46-48].

Determination of antioxidant activity by DPPH radical scavenging method

The DPPH scavenging activity of the extracts from *Myrtus communis* was measured according to the procedure described by [49], with some modifications. Radical scavenging activity of plant essential oils against the stable DPPH radical was determined spectrophotometric ally. The colorimetric changes (from deep-violet to light-yellow), when DPPH is reduced, were measured at 517 nm on a UV/visible light spectrophotometer. The antioxidant activities of essential oils were measured in terms of hydrogen donating or radical scavenging ability, using the stable radical DPPH. Forty microliters of various concentrations (25, 50, 75, 100, 150 and 200µg/ml) of the essential oils in dimethyl sulphoxide (DMSO) as well as vitamin C (as standard antioxidant compound) were put into appropriate tubes and 4 ml of 0.004% methanolic solution of DPPH was added to each tube to give final concentrations (25, 50, 75, 100, 150 and 200µg/ml). Tests were carried out in triplicate. Absorbance measurements commenced immediately. The decrease in absorbance at 517 nm was determined after 1 h for all samples. Methanol was used to zero the spectrophotometer. Absorbance of the DPPH radical without antioxidant, i.e. the control, was measured. Special care was taken to minimize the loss of free radical activity of the DPPH radical stock solution.

Radical scavenging activity was expressed as percentage inhibition of DPPH radical and was calculated by following equation [50]:

% inhibition = (Absorbance of control-Absorbance of sample /Absorbance of control) x 100.

Extract concentration providing 50% inhibition (IC50) was calculated from the graph plotted inhibition percentage against extract concentration

RESULTS AND DISCUSSION

Determination of essential oil components

The retention time and chemical composition of essential oils of *Myrtus communis* are presented in Figure 1 and Table 1.

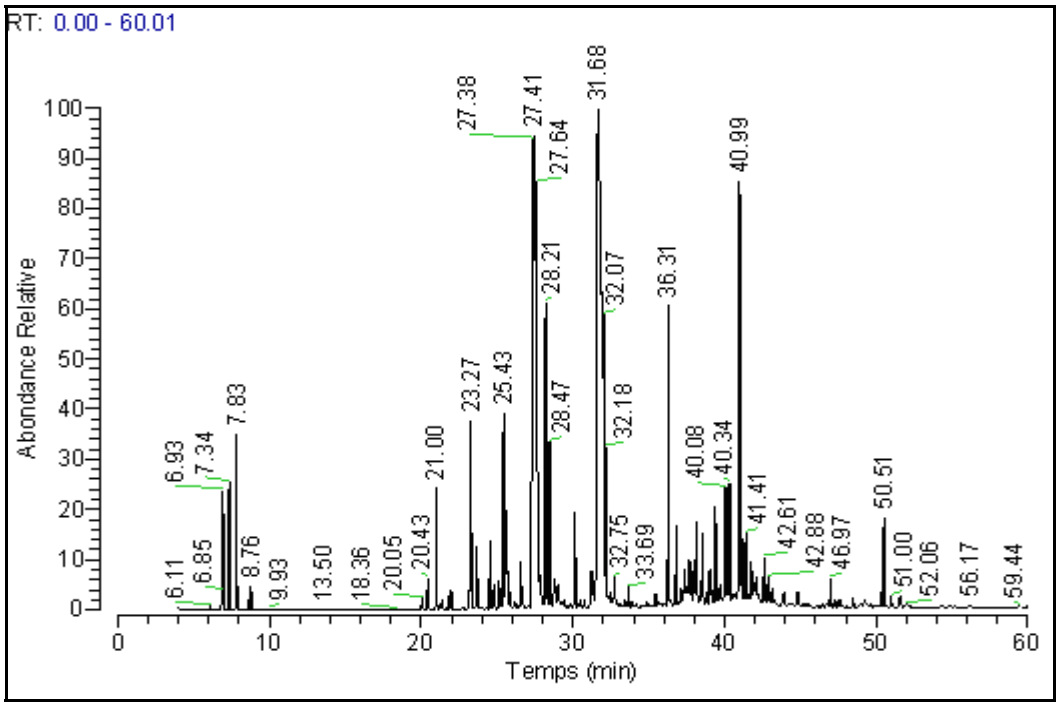

Fig. 1: **Chromatogram of *Myrtus communis* L**

The constituents of *Myrtus communis* L from Morocco are listed in order of their elution on the CP-SIL- 5 CB column, Figure (1). In total, 43 volatile compounds, representing 92.19% of the total composition, were identified in the flowers oils Table (1). The most abundant components found in the flower oil were α-pinene (48.54%) followed by 1.2 cineole (14.75%), myrtenal (5.01%), myrtenol (4.01%), myrtenyl acetate (3.45%), myrcene (2.09%), linalool (2.01%) and geraniol (1.67%). The essential oils yield of *Myrtus communis* L collected in Atlas median region (Sekoura) from Morocco is of 1.75%. It is relatively higher than other plants industrially exploited as a source of essential oils: *Myrtus communis* (0.30%) [51], *Juniperus thurifera* (0.8%) [52], *Myrtus communis* (Portuguese) (0.33% to 0.74% for leaves, 0.02% to 0.19% for branches, and 0.11% to 0.23% for berries) [53], *Artemisia herba-alba* (0.59%), *Artemisia absinthium* (0.57%) and *Artemisia pontica* (0.31%) [54], *Myrtus communis* (Tunisia) (0.003-0.01%) [17] and *Juniperus phoenicea* (1.62%), *Juniperus oxycedrus* (1.66%) [55].The yield of essential oils obtained from leaves of two *Myrtus communis* varieties (*baetica* and *italica*), growing wild in North Tunisia, was observed at the flowering stage with 0.6% (*w*/*w*) for *italica* and 0.4% (*w*/*w*) for *baetica* [56]. Contrary, in this study, the yield was low from yield of *Juniperus occidentalis* study by [57] which is (2.3%) and of *Juniperus oxycedrus* in Pindos from Greece which the yield is (2.21%) [58].

The yields obtained from leaves and berries of *Myrtus communis* collected in different places in Sardinia (Italy) were on average 0.52 ± 0.03% (v/w dried weight) and 0.02 ± 0.00% respectively [59].

Table 1: Chemical composition of the flowers essential oils of *Myrtus communis* L from Morocco

*RT (min)	**RI	***Mass range (m/z)	Constituent	Area (%)	Method of identification
6.85	942	(136),93,79,91,77,41,121,67,27,107,39	Camphene	0.01	RI, GC/MS
6.93	943	(136),93,91,69,39,77,92,79,53,41,27	β-Pinene	0.02	RI, GC/MS
7.34	945	(136),93,91,79,77,92,121,80,136,94,105	3-Carene	0.05	RI, GC/MS
7.83	976	(136),93,41,79,39,91,77,92,27,80,53	Cis-ocimene	0.06	RI, GC/MS
8.76	983	(136),93,41,91,77,79,39,27,69,94,43	Sabinene	0.01	RI, GC/MS
8.77	998	(136),93,91,136,121,77,92,79,43,41,105	α-Terpinene	0.15	RI, GC/MS
8.78	1018	(136),68,93,39,67,41,27,53,79,94,92	Limonene	0.08	RI, GC/MS
8.79	1042	(134),119,134,91,120,117,41,77,39,65,115	Cymen-8-ol	0.65	RI, GC/MS
9.93	1062	(152),110,81,95,67,68,41,69,109,55,70	α-Thujone	0.05	RI, GC/MS
13.50	1122	(152),109,41,94,81,39,69,55,97,43,57	Verbenol	0.01	RI, GC/MS
18.36	1137	(154),71,111,93,43,86,41,69,55,68,154	Terpinene-4-ol	0.09	RI, GC/MS
20.05	1221	(204),105,119,93,120,161,41,91,92,107,55	Ylangene	0.02	RI, GC/MS
20.43	1223	(136),93,77,91,136,79,94,41,80,92,39	β-Phellandrene	0.89	RI, GC/MS
21.00	1224	(154),69,41,93,68,39,67,27,29,53,84	Nerol	0.20	RI, GC/MS
21.67	1296	(194),43,93,136,121,41,79,81,91,77,39	Solanone	0.04	RI, GC/MS
23.27	1300	(204),93,133,91,41;79,69,105,107,120,77	β-Caryophyllene	1.45	RI, GC/MS
24.70	1303	(194),91,43,119,92,41,134,79,108,93,39	Myrtenyl acetate	3.45	RI, GC/MS
25.43	1330	(182),69,41,114,83,123,39,82,53,27,70	Methyl geranate	1.56	RI, GC/MS
25.30	1339	(204),94,91,41,105,79,93,204,119,39,77	Isosativene	0.11	RI, GC/MS
26.43	1380	(178),178,163,147,103,91,107,179,151,41,77	Methyl eugenol	0.65	RI, GC/MS
26.90	1350	(196),69,41,43,68,93,80,121,136,67,39	Neryl acetate	0.01	RI, GC/MS
27.01	1344	(204),161,105,119,41,81,91,120,93,55,204	α-Cubebene	0.25	RI, GC/MS
27.41	1359	(154),43,93,81,71,69,84,68,108,41,55	1.8-Cineole	14.75	RI, GC/MS
27.64	1223	(150),79,107,108,106,77,91,41,105,39,27	Myrtenal	5.01	RI, GC/MS
28.05	1360	(196),69,43,41,68,93,136,67,121,80,39	Geranyl acetate	0.03	RI, GC/MS
28.21	1362	(136),41,93,69,39,27,53,79,77,67,91	Myrcene	2.09	RI, GC/MS
28.47	1275	(204),41,91,105,161,93,204,79,121,77,107	Seychellene	1.23	RI, GC/MS
29.04	1403	(204),161,41,105,91,119,93,162,107,189,133	Calarene	0.01	RI, GC/MS
30.56	1450	(204),93,80,41,121,92,43,55,67,91,147	α-Humulene	0.01	RI, GC/MS
31.28	1410	(204),161,119,204,41,105,189,91,121,93,133	α- Elemene	0.02	RI, GC/MS
31.69	1411	(136),93,91,39,121,77,92,79,43,41,105	α-Pinene	48.54	RI, GC/MS
32.07	1400	(153),71,41,43,93,55,69,80,39,121,27	Linalool	2.01	RI, GC/MS
32.18	1348	(164),164,103,77,149,131,91,55,104,137,133	Eugenol	1.14	RI, GC/MS
32.68	1414	(208),95,109,55,41,81,69,83,67,165,124	Amorphane	1.01	RI, GC/MS
32.75	1440	(222),43,41,69,81,109,55,95,67,107,93	Globulol	0.67	RI, GC/MS
36.31	1432	(154),69,41,68,29,93,123,67,70,84,55	Geraniol	1.67	RI, GC/MS
36.75	1494	(204),93,69,41,133,161,79,91,105,81,107	Isocaryophillene	0.12	RI, GC/MS
38.61	1440	(204),161,204,41,121,91,81,107,105,189,93	Patchoulene	0.01	RI, GC/MS
38.71	1515	(204),161,105,91,41,119,79,81,93,77,27	Germacrene-D	0.05	RI, GC/MS
39.01	1536	(220),43,41,205,119,91,93,159,105,162,107	Spathulenol	0.01	RI, GC/MS
40.08	1530	(204),161,189,204,41,105,91,119,133,27,55	Gama-Cadinene	1.02	RI, GC/MS
40.34	1419	(204),161,105,119,41,91,204,133,55,93,81	Isoledene	0.01	RI, GC/MS
40.99	1422	(152),79,91,108,41,93,43,119,77,39,67	Myrtenol	4.01	RI, GC/MS
Total identified compound (%)				92.19	
Yields (%)				1.75	

*RT: Retention time obtained by chromatogram (Fig1).
**RI: Retention indices was determined by GC-FID on a CP-SIL- 5 CB column
***Mass range (m/z) was determined by mass spectrometry (PlarisQ).

The chemical compositions revealed that this flowers had compositions similar to those of other *Myrtus communis* L essential oils analyzed in Tunisia by [59], which the major component was α-pinene, limonene and 1,8-cineole. The major compounds in the essential oils of *Myrtus communis* (Italy) were α-pinene (30.0 and 28.5%), 1, 8-cineole (28.8 and 15.3%), and limonene (17.5 and 24.1%) in leaves and berries, respectively [59]. One of the main constituents of myrtle essential oil is 1, 8-cineole [7]. The oil in leaves of *M. communis* growing in Turkey contains 1, 8-cineole, linalool, myrtenyl acetate and myrtenol as major components [16]. Eucalyptol was the predominant component (50.13%),

linalool (12.65%), terpineol (7.57%) and limonene (4.26%) [60]. The oil obtained from leaves and berries of *Myrtus communis* in Italy (Sardinian) were characterised by high contents of α-pinene (19.1–65.6% and 18.9–59.5%), limonene (5.7–43.4% and 6.2–44.2%), 1, 8-cineole (5.9–26.6% and 8.7–30.4%) and by the lack of myrtenyl acetate origin [39]. α-Pinene (29.4%), Limonene (21.2%), 1,8-Cineole (18%), Linalool (10.6%), Linalyl acetate (4.6%) and α-Terpineole (3.1%), were reported to be the major components of the previously analyses materials (myrtle leaves) [61]. The oil in leaves of *M. communis* growing in Italy contains *α*-pinene (11%), 1,8-cineole (16%), linalool (12%), *α*-terpineol (7%) and limonene (5%) [62]. [40] reported the presence of 1, 8-cineole (36.1%), α-pinene (22.5%), linalool (8.4%), bornyl acetate (5.2%), α-terpineol (4.4%), linalyl acetate (4.2%) and limonene (3.8%) as majort components of leaves of *Myrtus communis*. In other study, the major compounds reported were α-pinene (19.20%), 1, 8-cineole (15.96%), linalool (7.66%), α-terpineol (7.51%) and limonene (5.75%) [63]. The essential oil composition of myrtle leaf and flower was characterized by high proportions of α-pinene (58.05% and 17.53%) [64]. However, myrtenyl acetate was the major component of essential oils obtained from different myrtle parts of Portuguese [65] and Croatia [38]. Intensive research has been conducted on this species [66-69].

In this study the composition of essential oils of *Myrtus communis* L is relatively similar than other plants study in Lebanon by [70], Espagne [71], Egypt [72] and in Europe by [73] which the major component was α-pinene. [74], studied the Cryptic speciation between *Juniperus deltoids* and *Juniperus oxycedrus* in the Mediterranean collected from the Morocco, Portugal, Spain, France, Italy , Southern Greece, Northern Greece and Turkey, they reported that the major compounds were α-pinene (45.3%, 47.3%, 40.9%, 53.2%, 19.3%, 19.7%, 27.4% and 32.7%) respectively. In this study the yield and total oil composition of essential oils of *Myrtus communis* L collected in Atlas median region from Morocco where 1.75% and 92.19%. The yield of essential oils of flowers of *Myrtus communis* L is relatively higher than other plants study in Italy (Sardinia) (0.04- 2.54%) [75], Algeria (0.1%) [76], Tunisia (0.6%) [56] and in Holomontas from Greece (0.97%) [77].

The environmental factors such as geography, temperature, day length, nutrients, etc, were considered to play a key role in the chemical composition of myrtle oil. These factors influence the plant's biosynthetic pathways and consequently the relative proportion of the main characteristic compounds. At the same time, results indicated that the oil of *Myrtus communis* L flowers of Morocco belonged to α-pinene rich type.

Antioxidant activity

The free- radical scavenging activity of *Myrtus communis* L essential oils evaluated using the DPPH method is presented in Table (2). The model of scavenging stable DPPH free radicals can be used to evaluate the antioxidative activities in a relatively short time. The absorbance decreases as a result of a color change from purple to yellow as the radical is scavenged by antioxidants through donation of hydrogen to form the stable DPPH-H molecule [78]. The effect of antioxidants on DPPH radical scavenging was thought to be due to their hydrogen-donating ability. Antioxidant activities of essential oils from aromatic plants are mainly attributed to the active compounds present in them. This can be due to the high percentage of main constituents, but also to the presence of other constituents in small quantities or to synergy among them. In this study, the antioxidant activities of essential oils of *Myrtus communis* L compared with vitamin C as a reference antioxidant compound were determined by the method of DPPH radical scavenging assay and the results are summarized in table (2).

Table 2: Scavenging effect (%) of *Myrtus communis* L essential oils as well as vitamin C on DPPH at different concentrations

	Concentration (µg/ml)	% Inhibition of DPPH	IC_{50} (µg/ml)
Juniperus oxycedrus	25	18.61± 1.56	72.16
	50	31.90 ± 1.08	
	75	48.67 ± 1.15	
	100	52.09± 2.02	
	150	72.89± 3.25	
	200	89.15 ± 2.01	
Vitamin C	25	52.06 ± 1.12	49.29
	50	72.48 ± 0.89	
	75	80.09 ± 0.12	
	100	89.12 ± 1.78	
	150	91.45 ± 1.45	
	200	94.03 ± 1.01	

Data are given as means ± SD. Viamin C were used as positive controls for antioxidant

All experiments were carried out in triplicate. Data were expressed as means ± SD. It was found that the essential oils of *Myrtus communis* L analyzed showed good antioxidant capacities compared with vitamin C (standard antioxidant compound). The results from table (2) indicate that the radical scavenging activity (% inhibition) of the essential oil from *Myrtus communis* L was the highest (89.15 ± 2.01%) at the concentration of 200µg/ml. It was noticed that the scavenging activities of the essential oils were increased with the increased of the essential oils concentrations. All the tested samples showed lower DPPH radical scavenging activity when compared with the standard. It is clear from the data that the concentration of 200 ppm of *Myrtus communis* L essential oil gave a percentage inhibition of DPPH **(**89.15 ± 2.01%**)** nearly of the same concentration of vitamin C which was 94.03 ± 1.01. The highest EC_{50} was noticed in vitamin C (49.24µg/ml). *Myrtus communis* L essential oils were able to reduce the stable, purple-colored radical DPPH into yellow-colored DPPH reaching 50% of reduction with IC_{50} of 72.16µL/mL. This could due to the chemical composition of the essential oil, as the essential oil contained mainly monoterpene hydrocarbons such as α-pinene. Indeed, these compounds are known to possess a weak antioxidant activity [79-81]. [82] Showed the presence of a significant antioxidant potential of essential oils rich in hydrocarbon monoterpenes (α-pinene). On the other hand the difference in DPPH radical scavenging activity between the essential oils of *Myrtus communis* L and others essential oils of others plant is attributable to the chemical composition of each essential oil.

Also, oils used in the present study had chemical components such as α-pinene (48.54%) followed by 1.2 cineole (14.75%), myrtenal (5.01%), myrtenol (4.01%), myrtenyl acetate (3.45%), myrcene (2.09%), linalool (2.01%) and geraniol (1.67%). which have probably imparted antioxidant properties to the essential oils. *Myrtus communis* L essential oils contained monoterpenes and oxygenated terpenes. Moreover, trying to correlate the observed activity with the chemical composition of the oils, it is noteworthy to cite the work of [83], who studied the antioxidant activity of 98 pure essential oils chemical components and showed that monoterpene hydrocarbons had a significant protective effect, with several variants due to the different functional groups. Furthermore, some researchers show that some essential oils rich in non phenolic compounds also have antioxidant potentials [84]. 1,8-cineole and methyl eugenol compounds were previously reported as potent radical scavengers, especially methyl eugenol, most probably because of its phenylpropanoid moiety [85].

CONCLUSION

This study has been concerned with determining the chemical composition and antioxidant activity of essential oils extracted from

the flowers of *Myrtus communis* L, collected in Atlas median region (Sekoura) from Morocco. The chemical analyses, by GC/MS, GC-FID, have allowed us to identify around 92.19% of the total volatile products for *Myrtus communis* L and 43 volatile compounds were identified. The major constituent was α-pinene (48.54%) and the yield of essential oils was 1.75%. This yield of the plants essential oil that has been studied was important. In addition, the essential oils extracts reveal a very important in vitro antioxidant activity, confirmed by radical scavenging activity (% inhibition) at the concentration of 200µg/ml. It is important to note that the antioxidant activities of the studied essential oils are due essentially to its abundance of the α-pinene and also to the overall chemical constituents contained is this oil. Essential oils of *Myrtus communis* L and their active components, analyzed showed good antioxidant capacities compared with vitamin C (standard antioxidant compound). Nevertheless, additional in vitro and in vivo studies are needed to unequivocally demonstrate this.

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