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Extraction and characterization of the antioxidant activity of essential oils from *cotula cinerea* in the region of el oued (algeria)

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Abstract

This work is part of the valorization of spontaneous medicinal plants, a large part of which is still virgin and requires in-depth studies, and then our objective will be an extraction of the essential oils of the aerial part and the flowers of *Cotula cineria*, identifying physical parameters, pH measurement, density measurement, and refractive index. In parallel, biological activity (Antioxidant) is studied. Regarding the physical properties, we find the essential oils of the flowers and the aerial part have basic characters with the values of pH 8,39 and 8,60, the density is 0.95 and 0.90 and the index of refraction is 1,33350 and 1,33375 respectively. Both antioxidant activities show that both essential oils have IC50 45.98mg/ml and 79.28mg/ml for the flowers and the aerial part of *Cotula cinerea* respectively. A large ability to trap the DPPH radical is noted with the value of IC50 0.04% for ascorbic acid.

Keywords: spontaneous medicinal, *Cotula cinerea*, essential oils, Antioxidant activity.

Introduction

Essential oils are by definition secondary metabolites produced by plants as a defense against phytophagous pests [1].

The activity of volatile oils resides in the hundreds of chemical molecules that constitute it like terpenedia. These give the plant its smell, others are responsible for the perfume [2].

The field of application of essential oils is diversified despite the arrival on the market of synthetic compounds; it is thus that they find many applications in the chemical industry and the agri-food field (condiments, spices, flavorings,...) and aromatherapy (perfumery, cosmetics, and soap) [3].

Physical properties

Performance

According to [4], the yield of essential oils is defined as the ratio between the mass of essential oil obtained after extraction (M') and the dry mass of the plant material used (M). It is given by the following formula:

RHE % = (M'/ M) * 100

RHE: yield of essential oil from plant material; **M':** a mass of essential oil obtained in grams. **M:** a mass of plant material used in grams.

Determination of pH

The pH indicates the acidity or alkalinity of the medium, it is determined from the number of free hydrogen ions (H) contained in the essential oil [5].

Density

It is the ratio of the mass of a certain volume of oil at 20°C, and the mass of an equal volume of distilled water at the same temperature [6].

$$d_{20}^{20} = \frac{m_2 - m_0}{m_1 - m_0}$$

With, **m_0:** Mass of empty pycnometer; **m_1:** Mass of pycnometer filled with water; **m_2:** Mass of pycnometer filled with essential oil.

Refractive index

The refractive index $n\lambda t$ is defined as the ratio between the sinus of the refractive angle of the refracted radius in the medium in question. This index is measured at 20°C and related to the D-line of sodium (λ =589nm) [6].

Antioxidant activity

This method is based on the reduction of a very stable free radical: 2,2-Diphenyl-1-picrylhydrazyl (DPPH) in the presence of a donor antioxidant. The latter is reduced to the form of hydrazine (not radical) by accepting a hydrogen atom.

The percentage inhibition is calculated according to this relationship:

$$\% \text{ Inhibition} = \frac{\text{Abs Control} - \text{Abs échantillon}}{\text{Abs Control}} \times 100$$

Abs control: White absorbance (containing all reagents except the test compound).

Sample abs: Absorbance of the test compound.

Since there is no absolute measure of the antioxidant capacity of a compound, the results are often compared to a reference antioxidant in our experiment is ascorbic acid.

Statistical Analysis

The data obtained are treated statistically by the Microsoft Office Excel 2007 software, for the calculation of the concentrations from the calibration curves and the presentation of the results.

Results and discussion

The extraction efficiency of essential oils

The average yield of extraction of essential oils from fresh flowers is 2.54% and 1.07 for the aerial part.

[7] and [8] explained that the yield differs from one botanical family to another, between plants of the same species, from one stage of development to another, and from one season to another.

In parallel, [9] finds with the same plant the yield of essential oil is very low (0.0801% 0.0117%). It is relatively higher than those obtained by Kether and her colleagues working on different parts of *Cotula coronopifolia* L. In Tunisia (0.01134% in leaves); 0.03935% for flowers ; 0.00123% in roots and 0.00405% for stems).

Physical properties

Physical properties such as refractive index, density, acid index, and ester index, are a means of checking and controlling the quality of the essential oil. In the absence of quantity, only the first two characteristics of the essential oils analyzed were determined according to the standards of the French Standards Association [10].

The results of the calculation of the physical characteristics of the essential oils of *Cotula cinerea* obtained by hydrodistillation are evaluated and recorded in Table 1.

Table 1: Physical characteristics of the essential oils of *Cotula cinerea*

Characteristics	Flower Species	Aerial Species
Density	0,95	0,90
Ph	8,39	8,60
Refractive index	1,33350	1,33375

The determination of the density of oil tells us about its purity. It depends on the chemical composition of the oils and the temperature [11].

It has been noted that the density from the essential oils of the flowers and air part is 0.95 and 0.90 respectively. These density values are close to those recorded by [12] and [13] and are in the range of [14] between 0.9 and 2.

According to [15], this parameter is related to the chemical composition of this oil, which is affected by some factors such as phenotype, time of harvest, type of soil, conservation, process, and extraction conditions.

The essential oils of the flowers and the aerial part have the basic character (pH>7). It should be noted that pH plays a decisive role in chemical and biochemical reactions and can influence the stabilizing properties of essential oil.

Therefore, this result can lead to a good stabilizing character against microorganisms; this will allow these essential oils to play the role of preservatives in food products.

The refractive index calculated at 20°C using a refractometer. The value is greater than the refractive index of water at 1.333. The result obtained is higher than that reported by [16]; The refractive index is inversely related to the degree of unsaturation of the oil. The lower the refractive index, the better the essential oil quality [17].

[18] explained that the refractive index varies essentially with the content of monoterpenes and oxygenated derivatives. A high monoterpene content will give a high index. For some authors, the low refractive index of essential oils indicates its low refraction of light which could favor its use in cosmetic products.

Antioxidant activity

The antiradical activity is carried out by the 2,2-diphenyl-1 picrylhydrazyl (DPPH) radical method which is a frequently used method for its simplicity. This method is based on the reduction of an alcoholic solution of DPPH in the presence of an antioxidant that gives hydrogen or an electron, the non-subject form DPPH-H is formed.

The inhibition of discoloration of the DPPH radical depends on the concentration of the different extracts used [19]. Note that the free radical inhibition percentage for essential oil is lower than vitamin C for all concentrations used (Figure 1).

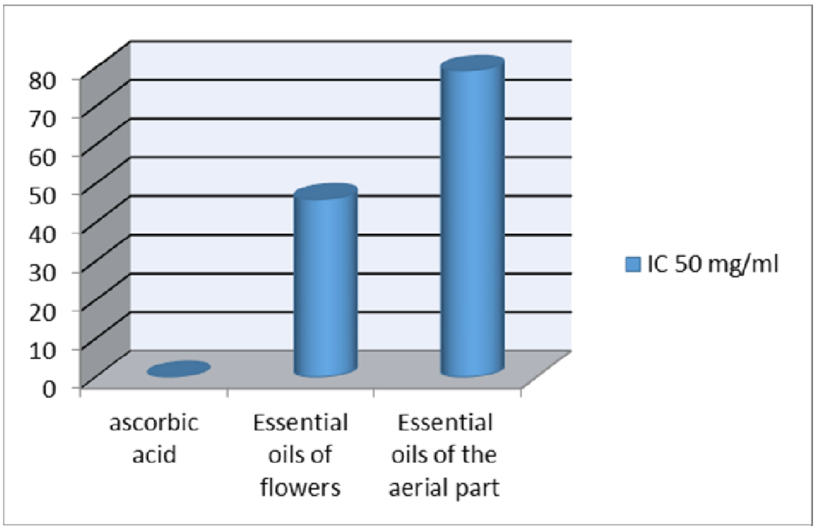

Figure 1: IC_{50} values of ascorbic acid and essential oils of flowers and the aerial part of *Cotula cinerea*.

It was observed that the activity of the essential oils of the flowers of *Cotula cinerea* is greater than that of the aerial part with IC50 respectively of 45.98mg/ ml and 79.28mg/ ml. These results suggest that vitamin C is the most effective antioxidant with an IC50 of 0.04 mg/ml compared to the essential oil studied.

These results generally show that the essential oils of *Cotula cinerea* with lower antioxidant activities.

Other work on the same plate by [20] found that IC 50 of total phenolic compounds determined by analytical HPLC in methanol extracts was 79.23 2.5 mg/g dry matter.

The difference in activity between the sampling of of the essential oils from *Cotula cinerea* is explained by the mobility of the hydrogen atom of the hydroxyl group of the phenolic compounds of the essential oil. In the presence of a free radical DPPH•, the Hydrogen atom is transferred to the latter then transformed into a stable molecule DPPH, this causes a decrease in free radical concentration and also absorbance over the reaction time until the hydrogen donor antioxidant capacity is exhausted [21].

This plant contains many chemical compounds with therapeutic benefits such as flavonoids [22].

Conclusion

Due to the richness of the plant in essential oils, these were extracted using a Clevenger device, The calculation of extraction yield by hydrodistillation showed that the best yield in flowers and the lowest in the aerial part of *Cotula cinerea* were found at rates of 2.54% and 1.07% respectively. This value is lower than the yields obtained in other species belonging to the same genus and higher than in other species.

The determination of the physical characteristics of of the essential oils reveals that they conform to the standards established by the various pharmacopoeia and similar to some previous work.

Furthermore, the results of the antioxidant activity of vegetable essential oils using the DDPH test is performed with ascorbic acid as standard, show that IC 50 of the essential oils of flowers and the aerial part was equal 45,98 mg/ml and 79,28 respectively, while for ascorbic acid was equal 0.04 mg/ml. This confirms that the antioxidant efficacy of the plant is low compared to ascorbic acid.

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