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Elaboration of ointments based on vegetable plants "*Calendula arvensis*" and "*Dandelion*".

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Abstract

The synthetic chemical ointments produced by the cosmetic and pharmaceutical industries cause irritations and skin diseases. For this reason, the present work aims to prepare ointments based on two vegetable plants belonging to the same genus but with two different families, Calendula arvencis CA and Dandelion D, according to a protocol of variation of ratios between the beeswax and the infused oil of each flower of the two plants. Physico-chemical analyses are carried out to see the macroscopic and microscopic aspect, the resistance to water and pH as well as the conductivity, and the chemical structure of the ointments.

According to the obtained results, the Ratio R (1/3) of the CA ointment presents a better homogeneity, a better pH, Conductivity and a better physical stability by its water resistance, in addition to a better chemical stability by the increase at the level of all its characteristic bands.

Keywords: *ointment, Calendula arvensis, Dandelion, physico-chemical properties.*

I. Introduction

The pharmacological treatment of disease began long ago with the use of herbs [1]. By definition, 'traditional' use of herbal medicines implies substantial historical use, and this is certainly true for many products that are available as 'traditional herbal medicines'[2].

Our choice fell on *calendula arvensis* (CA) with yellow flowers and *Dandelion* (D) with orange flowers (Figure 1), which are renowned medicinal plants, used for a long time for their anti-inflammatory, soothing and healing properties, especially in dermatology.

Several *Calendula* preparations are available for incorporation in topical formulations directed towards wound healing and for soothing inflamed and damaged skin, like extracts, tinctures, and oils [3]. *Calendula* flower extract is the most frequently used in cosmetic products [4]. This plant contains several bioactive compounds, including terpenoids and terpenes (mainly bisabolol, faradiol, chamazulene, arnidiol and esters), carotenoids (mainly with rubixanthin and lycopene structures), flavonoids, (mainly quercetin, isorhamnetin and kaempferol aglycones) and polyunsaturated fatty acids, (mainly calendic acid) [5].

Dandelion (*Taraxacum officinale*) has been used in folklore medicine and traditional Chinese medicine in the treatment of inflammation and several women's diseases such as breast and uterine cancers [6], and it is also acclaimed as a nontoxic medicinal herb with exceptional values for its choleretic, anti-rheumatic [7], diuretic [8], and anti-inflammatory properties [9]. Several flavonoids including caffeic acid, chlorogenic acid, luteolin, and luteolin 7- glucoside have been isolated from the *Dandelion* [10]. This latter is a rich source of vitamins A, B complex, C, and D, as well as minerals such as iron, potassium, and zinc [11].

Today, many products essentially cosmetic and pharmaceutical [12] contain *calendula arvensis* and even *Dandelion*, like ointments and creams, and avoid chemical synthesis products that cause irritation and skin diseases.

The main objective of this study is to prepare ointments based on two plants of the same genus and different family, *Calendula arvencis* and *Dandelion*. For this purpose, different physico-chemical characterizations were carried out for these preparations.

Figure 1: *Calendula arvensis* (CA) and *Dandelion* (D)

II. Materials and Methods

II.1. Materials

Whole plants of *Calendula arvenisis and Dandelion* were collected from the campus of university of Bejaia-Algeria. Beeswax is one of the natural raw materials used in this study. As well as olive oil obtained by hot extraction.

II.2. Methods

Dry two handfuls of *calendula arvensis* or *Dandelion* flowers in an oven set at a temperature of 45°C for four days (04), and then let them infuse in 250 ml of olive oil for about three weeks (03). Then melt the wax over low heat in a crystallizer to about 60 to 70C° and add the infused oil to it and simmer for about 10 to 15 minutes until you have a homogeneous oily solution. After the cooling of this latter, an ointment will be formed with a consistency that differs from the different ratios R (beeswax/olive oil) prepared (R1/1, R1/2 and R1/3).

III. Characterizations

- **The pH measurements and conductivities.**
- **Morphological aspect and water resistance:** in order to observe the macroscopic surface and its homogeneity microscopically, in addition to the water resistance when we have deposed a droplet of water on thin layer of ointment, the photos were taken of the different samples using an optical microscopy.
- **Chemical analysis**: FTIR spectra of the different samples were recorded using Agilent Technologies Cary 630 FTIR in the range of 4000-400 cm^{-1} with a resolution of 4 cm^{-1}.

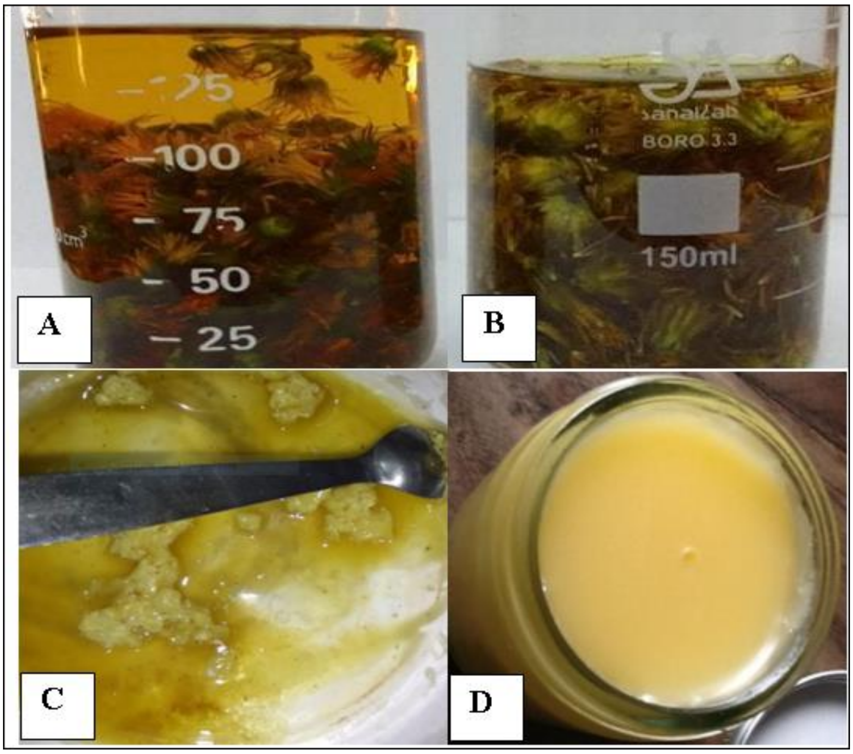


Figure 2: A- infused oil of *calendula arvensis*, B- infused oil of *Dandelion*, C- Beeswax, D-.Ointment prepared

IV. Results and discussion

IV.1. Measurement of pH and conductivity

According to the Table 1 of the pH of the oils, we notice that the pH of the oil infused CA is more acid than that of oil infused D. Concerning the ointments, the pH of the yellow flowers DO one is more acid than the orange flowers CAO. This led to an increase in conductivity, which can be explained by the displacement of ions.

In conclusion, the orange flower ointments CAO have better pH values than 5.25, which explains why our ointments are usable, and therefore we can carry out other characterization analyses.

Table 1: Measurement of pH and conductivity of different ointments

Samples	pH	Conductivity(µs/cm)
Olive oil	6.82	2.80
Infused oil CA	5.44	3.00
Infused oil D	5.23	3.32
R(1/1) CAO	5.25	2.80
R(1/2) CAO	5.46	3.00
R(1/3) CAO	5.80	2.60
R(1/1) CD	5.17	2.20
R(1/2) CD	5.24	3.00
R(1/3) CD	5.33	2.70

IV.2. Macroscopic aspect

All the ointments of different ratios (see Table 2), present a homogeneity before and after the application on the skin as well as they present a yellowish color for DO and an orangeade for CAO.

But a different consistency (fluid for the R (1/1), les consistent for the R (1/2), and more consistent like a vaseline for the R (1/3).

Therefore, the preparation method allowed obtaining a very good homogeneity for all ointments prepared.

Table 2: Macroscopic aspect of DO and CAO (Before and after application on the skin)

Ratio	DO (Before and after application on the skin)	CAO (Before and after application on the skin)
R 1/1		
R 1/2		
R 1/3		

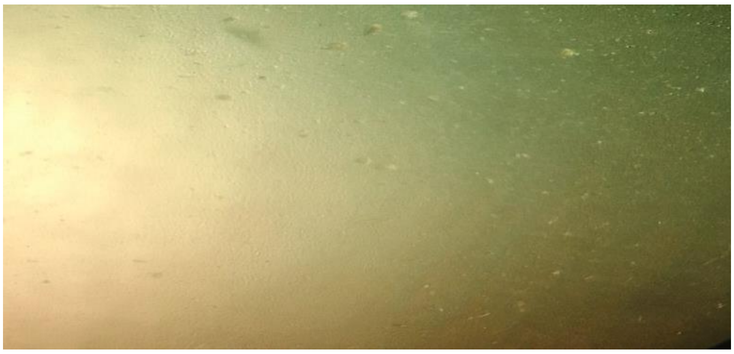


Figure 3: Microscopic aspect of CAO and DO

IV.3. Microscopic aspect

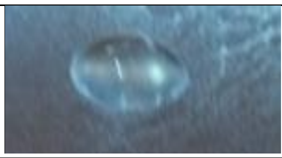
According to the Figure 3 prepared ointments have a better physical stability; the latter is characterized by a homogeneous appearance, which was found for all prepared ointments of CA and D.

IV.4. Water resistance

All the prepared ointments are non-miscible, non-adherent to skin and have an almost spherical shape, especially for the ratio (1/3). As a result, all the ointments are resistant for water, especially for this latter ratio.

Generally speaking, water and wax are an hydrophobic aspect; they form a barrier on the surface of the skin, limit the evaporation of the water contained in the skin and thus increase its hydration. Consequently, these ointments are hydrophobic ointments, which do not dry out and remain on the surface of the skin for a long time and do not wash off with water.

Table 3: Water resistance of CAO and DO

Ratio	CAO	DO
R 1/1		
R 1/2		
R 1/3		

IV.5. Chemical analysis

Figure 4 shows the infrared spectrum of the infused oils and olive oil. From obtained results by chemical analysis, it is noted that all the spectra have the same appearance {virgin before and after infusion}. However, an increase in the intensities of the peaks for the infused oils compared to the virgin oil (which are listed in Table 3 [13]) especially for the orange flowers CA, as well as a finding of an increase in transmittance for the yellow flowers D, which is due to its transparency compared to the orange flowers CA.

This principle can be explained by an addition of the characteristic bands contained in the orange and yellow plants to those already existing in the virgin oil. Concerning the comparison between the spectra of the orange flower ointments CAO (Figure 5), the R (1/3) shows an increase in intensity in all the bands, which corresponds to the best chemical stability, and its results have been confirmed by the visual, microscopic and water resistance analysis.

To this effect, there is a proportional relationship between the amount of oil and the physic-chemical stability.

The same remarks and interpretations for the yellow flower ointments DO (Figure 6) have been drawn.

Table 4: FTIR of olive oil [12]

Bands (cm^{-1})	Fonctionnel groups
3005.64	O-H
2925.71	O-H
2855.17	C-H
1746.39	C=O
1462.38	C=C
1373.98	O-H
1231.97	C-O-
1161.44	C-O-
720.01	$-CH_2-$

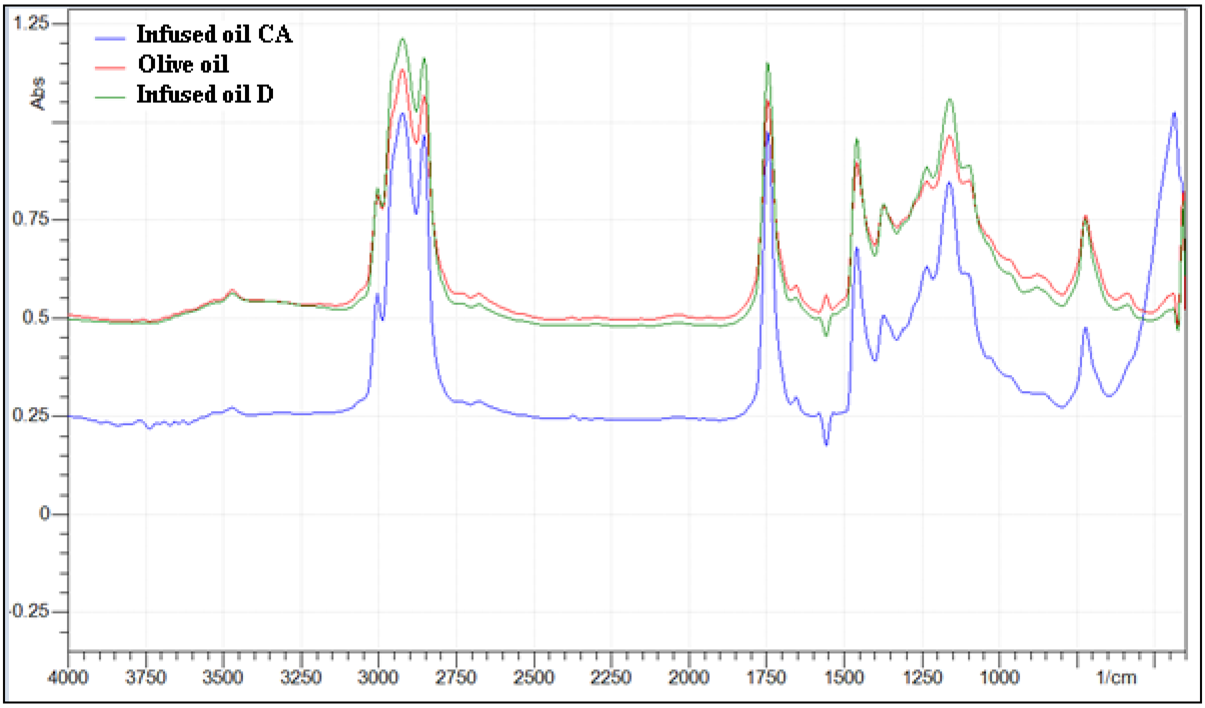


Figure 4: FTIR spectrum of the infused oils (CA and D) and olive oil

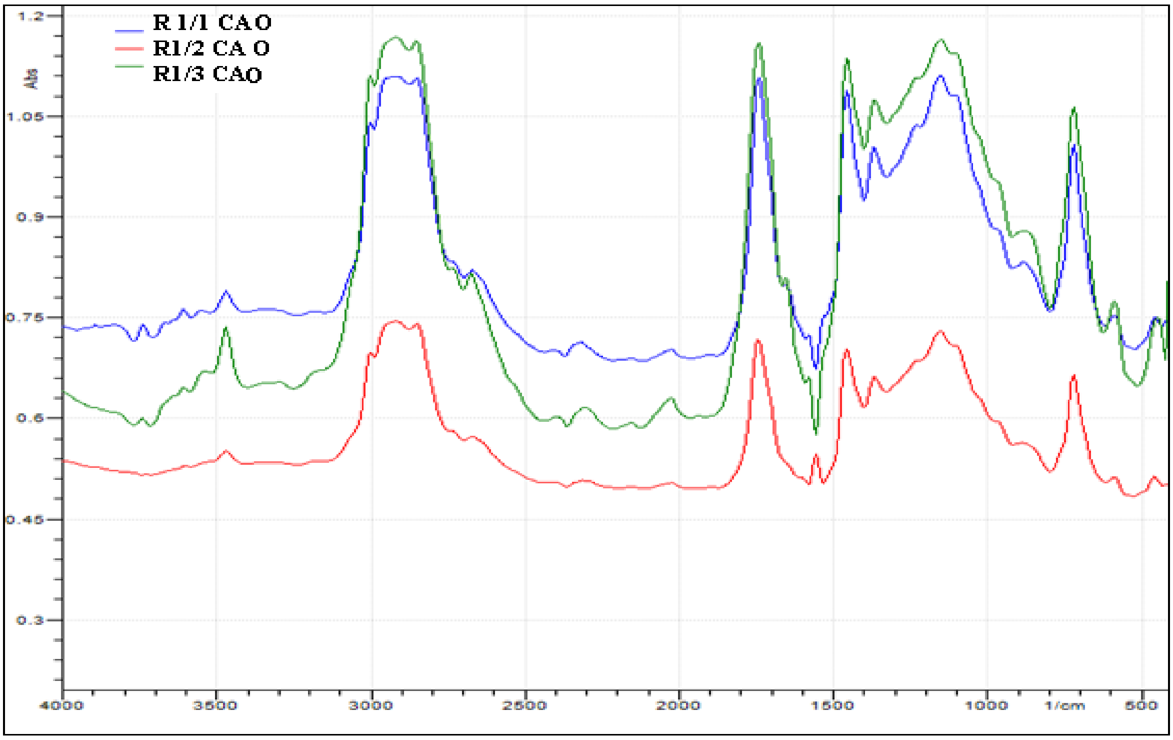


Figure 5: FTIR spectrum of the CAO

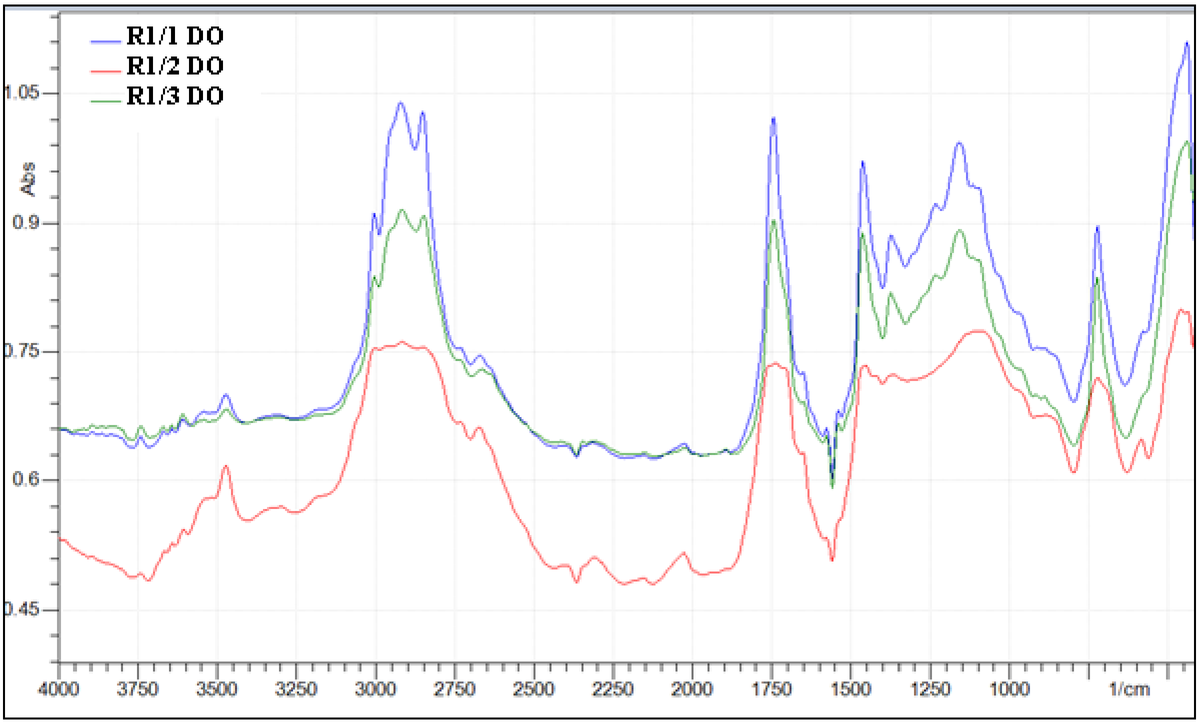


Figure 6: FTIR spectrum of the DO

V. Conclusions

Through this study, we found that in the macroscopic characterization, a semi-solid consistency and homogeneity were attributed to our prepared ointments, the microscopic characterization of our ointments presents a better physical stability, the latter is characterized by a homogeneous appearance, which was found for all the prepared ointments either for the yellow DO or orange CAO flowers. For the test of resistance to water, the ointment of ratio R (1/3) is considered the most resistant to it compared to the other ointments, which is explained by the presence of the spherical shape of the deposited droplet. From the results obtained by chemical analysis, it is noted that the virgin oils spectra before and after infusion show the same appearance, however an increase in the intensities of the peaks for the infused oils compared to the virgin oil.

Concerning the comparison between the spectra of the orange CAO and yellow DO flower ointments, the R test (1/3) shows an increase in intensity in all its bands, which corresponds to the best chemical stability.

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