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Original article

Extraction of Essential Oils from Dry Leaves and Seeds of *Moringa Oleifera. L* Using Organic Solvents

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ABSTRACT

Background and aims. *Moringa. oleifera. L a very important healthful plant is one amongst the foremost wide cultivated species of the family Moringaceae. It is extremely valued from past as a result of its large healthful properties. With its high alimentary values, each part of the tree is appropriate for either nutritional or commercial purposes. The composition of essential oil isolated from Moringa oleifera, growing in Libya, was analyzed.* ***Methods.*** *In this study, essential oils from dry leaves and seeds of Moringa oleifera were extracted with petroleum ether or chloroform as solvents using Soxhlet apparatus.* ***Results.*** *Each solvent showed differences in the extraction yields between dry leaves and seeds, which were highest with chloroform compared to petroleum ether. Physical constants of the extracts were shown variation in color, viscosity, density, PH and percentage of production between dry leaves and seeds for each solvent. Mineral contents were identified in both dry leaves and seeds of Moringa oleifera using atomic emission device. Six elements were determined by atomic emission device at levels of mg/100g dry matter: sodium, potassium calcium, magnesium, iron, and copper. Levels of sodium, potassium, magnesium, iron, and copper concentrations were higher in the dry levees of Moringa oleifera than in seeds.* ***Conclusion.*** *Leaves and seeds of Moringa oleifera have a potential to be used as a nurse improver for humans and could contribute enormously toward meeting human nutritious requirements.*

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INTRODUCTION

Moringa, native to Asia and spread in most parts of Africa, is the sole genus in the flowering plant family Moringaceae [1]. It originates from the Himalayan Mountains in North India and Pakistan and is spread widely in tropical and subtropical areas of Africa, the southeastern part of Asia, and South America [2,3]. This species is introduced intentionally into Libya for its nutritional and medicinal value. This is because almost all parts of the tree are utilized as natural medicine for several diseases [4,5]. Almost all parts of this plant have been used for various diseases in the folk medicine of South Asia, including the treatment of inflammation and infectious diseases along with cardiovascular, gastrointestinal, haematological and hepatic and kidney disorders [6-8]. An extensive variety of nutritional and medicinal uses have been attributed to its roots, bark, leaves, flowers, fruits and seeds [9]. Leaves of *Moringa*. *oleifera* are traditionally used as purgatives and in the treatment of headaches, haemorrhoids, fevers, inflammation of noise and throat, bronchitis, eye and ear infections, and to combat vitamin C deficiency. The leaf juice is believed to control glycaemia and is applied for swollen glands. Leaves of *Moringa oleifera* are cooked and eaten like spinach or used to prepare soups and salads. Fresh leaves have been reported to contain vitamin C and vitamin A, more than those reported in carrots and oranges [5,10]. They are also used to contrast hypertension and cholesterol; indeed, anticancer, antitumor, anti-inflammatory, diuretic properties as well as antihepatotoxic, antiurolithiatic and analgesic activities were reported [11]. The seeds, instead, have attracted scientific interest as Moringa. oleifera seed kernels contain a significant amount of oil (up to 40%) with a high-quality fatty acid composition (oleic acid > 70%) and, after refining, a notable resistance to oxidative degradation [12,13]. *Moringa oleifera* is also known for its antioxidant activity, essentially due to the presence of high amounts of polyphenols [14]. The antifungal activity of crude

extracts and essential oil of *Moringa oleifera* against *Trichophyton rubrum, T. mentagrophytes, Epidermophyton xoccosum, and Microsporum canis* has been reported [7,15]. Therefore, the aim of this study was designed to extract the essential oils from dry leaves and seeds of *Moringa oleifera* grown in West of Libya using Soxhlet apparatus with three different organic solvents and to learn the different pieces of the extracted oils.

MATERIALS AND METHODS

Preparation of plant extracts of dry leaves and seeds of Moringa oleifera L

Samples were collected from Ain Zara and Tajoura, Tripoli, Libya (Figure 1). The collected plant leaves or seeds were washed gently with water, drained as much as possible and finally fine spread over a wide filter paper and left in the shade at room temperature for two weeks.

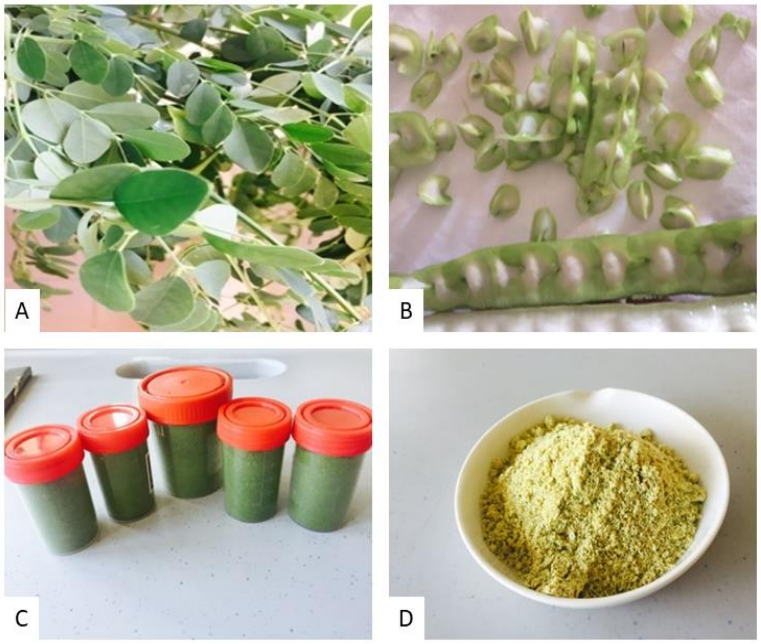

Figure 1. Fresh leaves (A), fresh seeds (B), dry leaves (C) and dry seeds (D) that used in the experiment.

Soxhlet extraction

The extraction experiments were carried out in Libyan Petroleum Institute (Tripoli, Libya) in December 2018. Sixty grams of the dry leaves/seeds of *Moringa oleifera* L were extracted using two different organic solvents (Petroleum ether 99.9% and chloroform 99%: 250 mL from each one at 40-60 o C) in a Soxhlet apparatus for two hours for dry seeds and four hours for dry leaves. The solvents were then evaporated in a rotary evaporator and the extracts were dried until a constant weight using steam distillation

Determination of physical constants of the essential oil samples

The color of the prepared essential oils was described. Density and PH were measured in the laboratories of the faculty of education Janzour (Tripoli/Libya). The percentage (v/w) of the prepared essential oils relative to the dry weight of the plants or production percentages of the essential oil for different samples were calculated by following equation:

*Production percentage = weight of leaves (mg) / volume of essential oil (cm3) *100 [16].*

Determination of chemical properties of the essential oil samples

Chemical properties of the essential oil including pH, saponification value, peroxide number, acid value and iodine value were determined as methods describe by [16].

Measure rate elements in the Moringa oleifera dry seeds and dry leaves using atomic emission device

The mineral contents such as iron, copper, calcium, magnesium, potassium, and sodium from dry leaves and seeds of *Moringa oleifera* were analyzed by atomic emission device (AE, Shimadzu, Japan) equipped with flame and graphite

furnace using the association of analytical chemists standard methods [17]. (An atomic emission device found at private Sadeem laboratory).

Data analysis

Each experimental measurement was done in triplicate. Data obtained from experiments of the mineral analysis were analyzed by two samples T. test using Minitab software version 17. Significance was accepted at 0.05 level of probability ($P < 0.05$). The data were expressed as the mean ± standard deviation of the three replicates.

RESULTS

Physical constants of the extraction yield

The yields of the extracted oils from dry leaves, including physical constants for each sample with different solvents, are described in Table 1 and Figure 2. A modest quantity of solvent was allowed with the extracted oil, which touched on the density and hydrogen number. The leave samples extracted with both solvents were darker in color than the seed samples extracted with the same solvents. The density, pH values of both samples of each solvent are nearly equal, but these values differentiate for dry leaves and dry seeds, as shown in Table 1.

Table 2 illustrated some chemical properties of essential oil yield from dry leaves/seeds, using petroleum ether or chloroform. Acid value, saponification value, peroxide number and iodine value were similar in dry leaves/seeds . Similar results were obtained with both solvents. Table 3 summarizes the mean concentration levels of minerals found in *Moringa oleifera* leaves and seed using an atomic emission device; six elements were determined to be present in the *Moringa oleifera* leaves collected. The elements were determined by an atomic emission device; all the elements/minerals were present at levels of mg/100g dry matter. As shown in Table 3, the sodium, potassium calcium, magnesium, iron, and copper concentrations in the dry leave extract of *Moringa oleifera* from atomic emission device were 161.07 ± 2.36, 1624.45 ± 16.23, 2742.23±11.57,11.66 ± 322.50 , 0.82 ± 0.0802 and 0.32 ± 0.0950 mg/100 g, respectively, and the dry seeds were 110.31 ± 1.105, 781.95 ± 7.32, 564.21 ± 8.26, 202.67 ± 9.59, 0.38 ± 0.085 and 0.13 ± 0.010 mg/100 g, respectively with significant differences between dry leave and seeds.

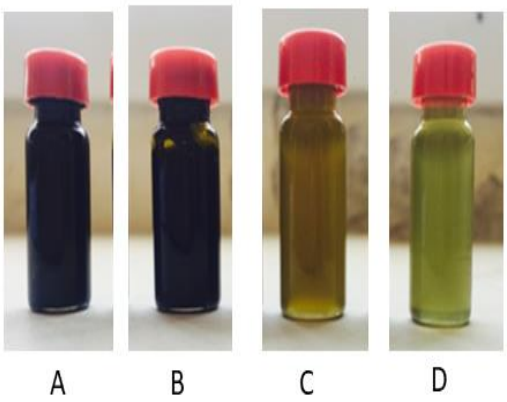

Figure 2. Picture shown sessional oil from dry leaves and seeds using Soxhlet extracts (A: dry leaves with Petroleum ether, B: Dry leaves with chloroform, C: Dry seeds with Petroleum ether and D: dry seeds with chloroform)

Table 1. Some physical constants of essential oil yield from Dry leaves/seeds, using petroleum ether or chloroform

	Petroleum ether		Chloroform	
Variable	**Dry leaves**	**Dry seeds**	**Dry leaves**	**Dry seeds**
Color	Dark green	Brownish	Green	Greenish
Viscosity	Heavy	Heavy	Light	Light
Percentage	7.3%	24%	3.24%	32%
pH value	5.4	5.8	5.2	5.4
Density	0.92315 g/cm^3	0.89996 g/cm^3	0.92412 g/cm^3	0.89987 g/cm^3

Table 2. Some chemical properties of essential oil yield from Dry leaves/seeds, using petroleum ether or chloroform

	Petroleum ether		Chloroform	
Variable	Dry leaves	Dry seeds	Dry leaves	Dry seeds
Acid value	0.5831	0.5611	0.5750	0.6020
Saponification value	235.030	230.051	233.902	231.130
Peroxide number	5.682	6.600	5.931	6.804
Iodine value	1.200	1.130	1.031	1.213

Table 3. Elements contacts from dry leaves and seeds using atomic emission device

Elements	Dry leaves	Dry seeds
Sodium (Na)	161.07 ± 2.36 [a]	110.31 ± 1.105 [b]
Potassium (K)	1624.45 ± 16.23 [a]	781.95 ± 7.32 [b]
Calcium (Ca)	2742.23 ± 11.57 [b]	564.21 ± 8.26 [a]
Magnesium (Mg)	322.50 ± 11.66 [a]	202.67 ± 9.59 [b]
Iron (Fe)	0.82 ± 0.0802 [a]	0.38 ± 0.085 [b]
Copper (Co)	0.32 ± 0.0950 [a]	0.13 ± 0.010 [b]

Values are expressed as means ± SD; for each element. Mean values within a row not sharing a common superscript letters (a, b) were significantly different, $p<0.05$.

DISCUSSION

In the current study, the oil content of *Moringa oleifera* dry leaves and seeds was extracted with petroleum ether and chloroform (bp 40–60C) using a Soxhlet apparatus that spent two hours with dry seeds and four hours with dry leaves. The difference in time may refer to the amount of minerals between leaves and seeds, as shown in Table 3, or this differences may refer to presence amount of fatty acid in seeds more than in leaves.

The oil extraction with chloroform had a higher yield than petroleum ether extraction, and in dry seeds higher yield than dry leaves. Previous study reported similar observations, and it may be because of the increased ability of the polar solvent to overcome forces that bind lipids within the sample matrix [18].

Various physical and chemical characteristics of the solvent-extracted *Moringa oleifera*, of essential oils are presented in Table 1. The density and viscosity depend on the method of extraction and were found to be highest for the chloroform-extracted variant of *Moringa oleifera* oil from dry leaves and seeds. Solvents used for extraction may not have any significant impact on the following properties: color index, values of density, that are comparable with those reported for other *Moringa oleifera* species [19-22].

The current study shows that the sodium, potassium, magnesium, iron, and copper concentrations in the dry levees extract of *Moringa oleifera* were higher than in seeds extract. These results are comparable with those reported for other Moringa species [23, 24]. Therefore, the plant is safe for food, and it has high nutritional value.

CONCLUSION

The result of the present study from atomic emission device contained a significant amount of micronutrients such as magnesium, sodium, zinc, iron, and copper. Both leaves and seeds are nutritional important due to the presence of essential nutrients essential for human health development. Therefore, this plant could be recommended for human diet with health benefits to consumers, combating variety of human ailments and diseases.

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Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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