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Specialty of Toxicology

Theme

Characteristics and biological activities of some plants and their effectiveness in treating flatulence and dyspeptic disorders

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Abstract

Our work is based mainly on studying the properties of the essential oils of three plants (mint, caraway, and *asafoetida*) and determining their effectiveness in treating indigestion and bloating problems, as extracting the aromatic part from them opens new horizons in aromatherapy. First, we used the hydrodistillation technique by the Clevenger device, the samples gave an acceptable yield, such that mint = 0,892% / caraway = 1,6531% / *asafoetida* = 5,12461%. This yield may be cost-effective on a commercial scale. After that, we study the physical properties of these oils, such as (PH, density, refractive index), it was found that they conform to AFNOR quality standards. After that, the antioxidant capacity was studied using the DPPH method and compared with ascorbic acid (IC50 = 0,28) the results showed the presence of antioxidant activity for mint essential oil with IC50 = 0,42 mg/ml, caraway oil with IC50 = 0,57 mg/ml, and *asafoetida* oil with IC50 = 0,59 mg/ml. and the antibacterial activity of the oils was evaluated against four strains (*Escherichia coli* / *Pseudomonas aeruginosa* / *Staphylococcus aureus* / *Bacillus subtilis*), where the results showed the effectiveness of the studied oils against different types of these strains with installation diameters ranging from 7 to 21 mm, and this indicates their ability to Resisting bacteria that cause indigestion and bloating problems. Finally, we decided to evaluate the effectiveness of the extracted essential oils by testing them on 15 patients with indigestion and monitoring their response to treatment for 10 days. The results of this study were good and highly satisfactory for most of the patients.

Keywords: essential oils / Aromatic plants / Indigestion

Résumé

Nos travaux reposent principalement sur l'étude des propriétés des huiles essentielles de trois plantes (menthe, carvi et *asafoetida*) et sur la détermination de leur efficacité dans le traitement des problèmes d'indigestion et de ballonnements, car en extraire la partie aromatique ouvre de nouveaux horizons en aromathérapie. Premièrement, en utilisant la technique d'hydrodistillation par l'appareil de Clevenger, les échantillons ont donné un rendement acceptable, atteignant menthe = 0,892% / cumin = 1,6531% / *asafoetida* = 5,12461%. Ce rendement peut être rentable à l'échelle commerciale. Après avoir étudié les propriétés physiques de ces huiles, telles que (PH, densité, indice de réfraction), il a été constaté qu'elles sont conformes aux normes de qualité AFNOR. Après cela, l'étude de la capacité antioxydant a été étudiée à l'aide de la méthode DPPH et comparée à l'acide ascorbique (IC50 = 0,28) les résultats montrés la présence d'une activité antioxydant pour l'huile essentielle de *mentha spicata* avec IC50 = 0,47 mg/ml, l'huile de *carum carvi* avec IC50 = 0,57 mg/ml et l'huile d'*assa-foetida* avec IC50 = 0,59 mg/ml. et l'activité antibactérienne des huiles a été évaluée contre quatre souches (*Escherichia coli* / *Pseudomonas aeruginosa* / *Staphylococcus aureus* / *Bacillus subtilis*), où les résultats ont montré l'efficacité des huiles étudiées contre différents types de ces souches avec des diamètres d'inhibition allant de 7 à 21. mm, ce qui indique leur capacité à résister aux bactéries qui provoquent des problèmes d'indigestion et de ballonnements. Finalement, nous avons décidé d'évaluer l'efficacité des huiles essentielles extraites en les testant sur 15 patients souffrant d'indigestion et en suivant leur réponse au traitement pendant 10 jours. Les résultats de cette étude étaient bons et très satisfaisants pour la plupart des patients.

Mots clés : huiles essentielles/ Aromatic plants / Indigestion

الملخص

يعتمد عملنا بشكل أساسي على دراسة خصائص الزيوت العطرية لثلاث نباتات (النعناع، الكراوية، الحلتيت) وتحديد مدى فعاليتها في علاج مشاكل عسر الهضم والانتفاخ، حيث أن استخلاص الجزء العطري منها يفتح آفاقاً جديدة في العلاج بالروائح. اولا استخدمنا تقنية التقطير المائي بجهاز كليفنجر، أعطت العينات مردوداً مقبولاً، حيث بلغ النعناع = 0.892% / الكراوية = 1.6531% / الحلتيت = 5.12461%. قد يكون هذا العائد فعالاً من حيث التكلفة على نطاق تجاري. بعدها قمنا بدراسة الخصائص الفيزيائية لهذه الزيوت مثل (PH، الكثافة، معامل الانكسار)، تبين أنها مطابقة لمعايير الجودة AFNOR.. بعد ذلك، تم دراسة قدرة مضادات الأكسدة بطريقة DPPH و بالمقارنة مع حمض الاسكوربيك (IC50 = 0,28) تبين وجود نشاط مضاد للأكسدة لزيت النعناع الأساسي بنسبة IC50 = 0,42 ملجم/مل، وزيت الكراوية مع IC50 = 0,57 ملجم/مل، وزيت الحلتيت مع IC50 = 0,59 ملجم/مل. كما تم تقييم النشاط المضاد للبكتيريا للزيوت ضد أربع سلالات (*Escherichia coli* / *Pseudomonas aeruginosa* / *Staphylococcus aureus* / *Bacillus subtilis*)، حيث أظهرت النتائج فعالية الزيوت المدروسة ضد أنواع مختلفة من هذه السلالات بأقطار تثبيط تراوحت من 7 إلى 21 ملم ، وهذا يشير الى قدرتها على مقاومة البكتيريا التي تسبب مشاكل عسر الهضم والانتفاخ. وأخيراً، قررنا تقييم فعالية الزيوت العطرية المستخرجة من خلال اختبارها على 15 مريضاً يعانون من عسر الهضم ومراقبة استجابتهم للعلاج لمدة 10 أيام. وكانت نتائج هذه الدراسة جيدة ومرضية للغاية بالنسبة لمعظم المرضى.

الكلمات المفتاحية: الزيوت العطرية / نباتات طبية / عسر الهضم

Dedication

Praise be to God out of love and gratitude. I would not have done this if it were not for God's grace. Praise be to God for the beginning and the end. I dedicate the fruit of my success to: About whom God Almighty said: And your Lord has decreed that you should worship none but Him and be good to parents.

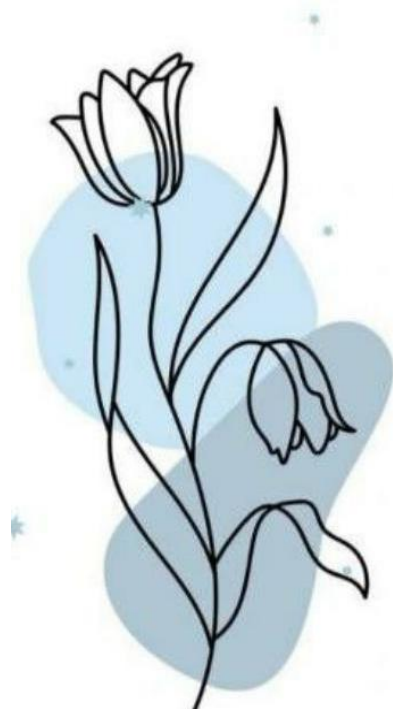
To my role model in life, to the one who raised me and instilled in my soul noble morals, to the one who spent his life for us, my dear father, may God have mercy on him, who passed away before he reaped the fruits of his sowing and effort, without whom, after God, I would not be here. My success is lacking in your pride in me, my father, you are present in my heart despite your absence

To God's paradise on earth, my mother, whose prayers always accompany me, my doctor in life, words are not enough to describe you, my mother.

To my support in life, my brother Fouad, my protective shield when I stumble in life. If it were not for him, I would not have continued my path here, especially after the loss of my father.

To my brothers, each one by name Aldjia Madjeda Lotfi, to all my classmates, to everyone I encountered in life and who supported me with a kind word, to my teachers, may God reward you with the best reward...

The journey was long and full of bumps, but I did it and arrived.



BENAROUS LOUIZA

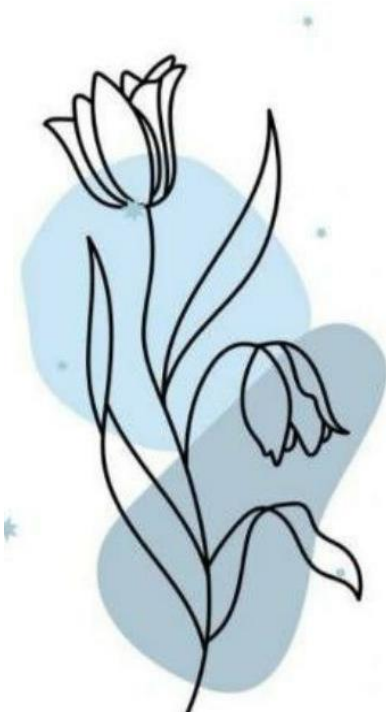
Dedication

To the one whose brow is dripping with sweat, and to the one who taught me that success only comes with patience and perseverance, to the light that illuminated my path, and the lamp whose light never goes out in my heart, my strength and my pride, my dear father Omar Ismailia.

*To the one who placed paradise under her feet and made hardship easy for me with her supplications.
To the great person who always wished to open her eyes to see me on this day, my dear mother,
Berrahmoun Malika*

*To those who have been my support in my life, my brothers, my dear daughters, Nabila, Fahima,
Sarah, Asmaa Safia, and my only brother, Diaa.*

To everyone who was a help and support on this path, to loyal friends and companions for years, to those who poured out their feelings and sincere advice to me, to you, my family and loved ones, I dedicate to you this achievement and the fruit of success that I have always wished for. And here I am today, completing and completing its first fruits, thanks to Him, Glory be to Him. Praise be to God for what He gave me and made me. May God Almighty help me wherever I am. Whoever says: I am hers, then I am hers. If she refuses, against her will, I will bring her. Praise be to God, thanks, greetings and gratitude.



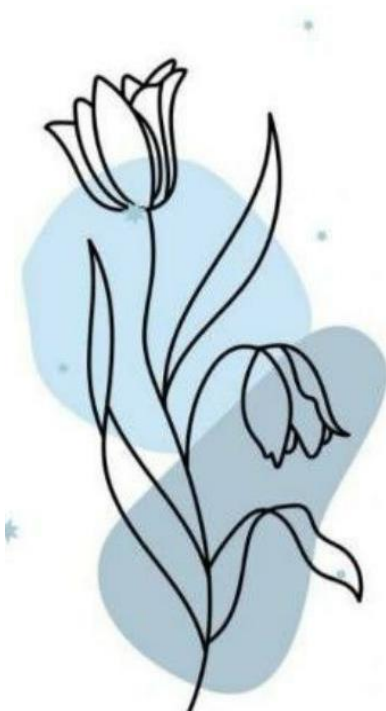
ISMAILIA RIHAB

Thanks and appreciation

Praise be to God, praise be to Him so much that praise reaches its limit, and prayers and peace be upon the most honorable creature whom God has illuminated with His light and chosen.

*And based on the principle that whoever does not thank people does not thank God, we extend our sincere thanks and appreciation to the supervising professor **Tommi Ikram** for her guidance and directions that she never skimmed on us, We also extend our sincere thanks to the members of the discussion committee, Professor **MEDJOUR Abdelhah** for accepting to head this committee, and our thanks are also extended to Professor **MAHBOUB Nasma**, As well as the members of the Business Incubator Committee in El Oued, for agreeing to participate in discussing, evaluating and enriching this work.*

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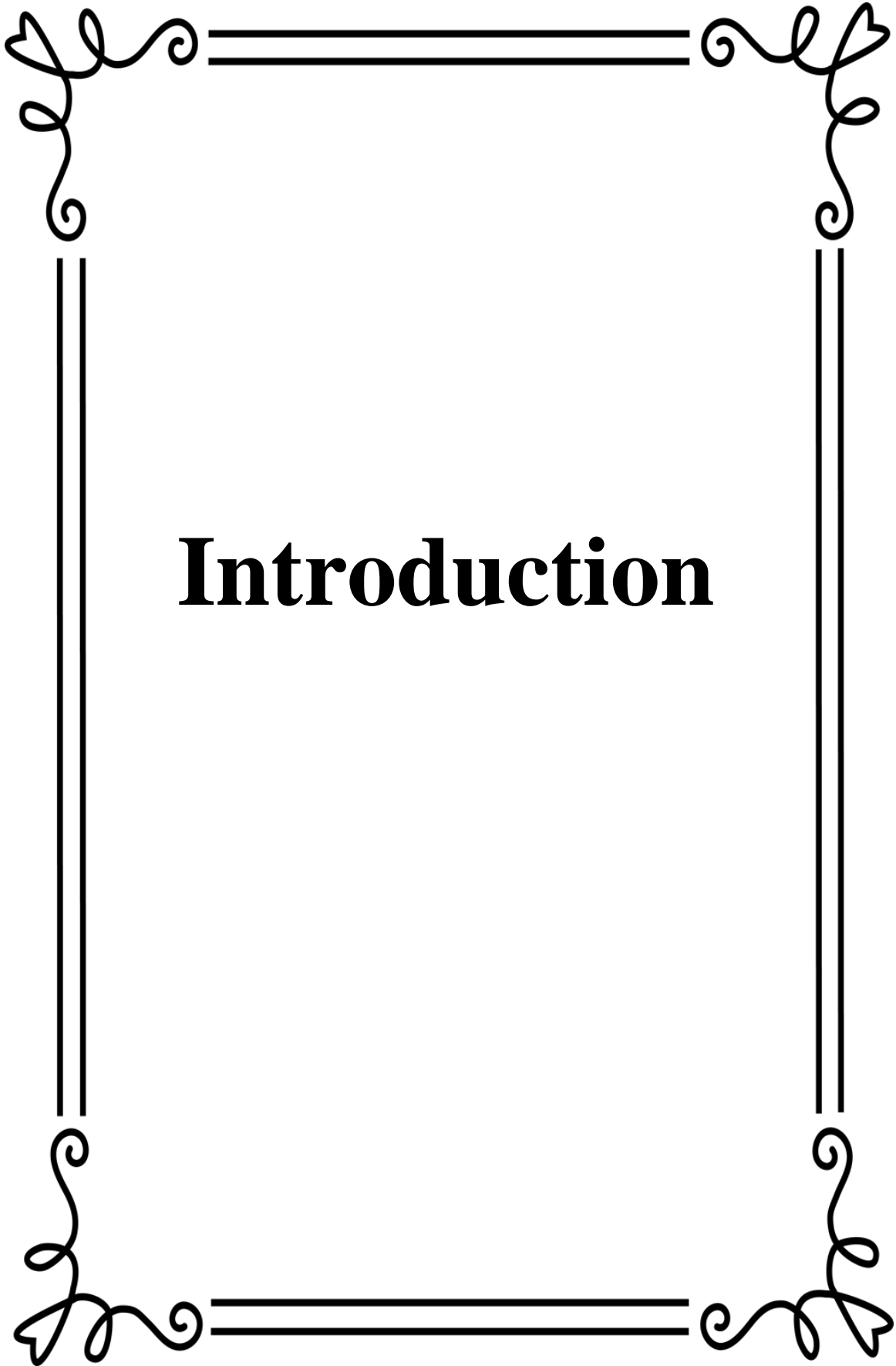
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List of abbreviations

- ❖ CAMs: complementary and alternative medicines
- ❖ EO: Essential Oil
- ❖ DW: Distilled Water
- ❖ DPPH: 2,2-diphenyl-1-picrylhydrazyl (α , α -diphenyl- β -picrylhydrazyl)
- 1. A: Absorption
- ❖ I: Inhibition
- ❖ CEO: Caraway Essential Oil
- ❖ MEO: *Mentha spicata* Essential Oil
- ❖ AEO: *Asafoetida* Essential Oil
- ❖ E.coli: *Escherichia coli*
- ❖ DMSO: Dimethyl sulfoxide
- ❖ IC50: Inhibitory concentration at 50%
- ❖ mg: milligram
- ❖ ml: milliliter
- ❖ mm: millimeter
- ❖ μ l: Microliter
- ❖ AFNOR: Association Française de Normalisatio



Introduction

Introduction

For thousands of years, humanity has used many aromatic plants found in its environment, in order to treat and cure all types of diseases, and these plants represent an enormous reservoir of potential compounds attributed to secondary metabolites that are characterized by being of great diversity in chemical composition and have a very wide range of biological activities.

Evaluating these activities remains a very interesting task and could be of interest for many studies. Aromatic plants currently have a great advantage thanks to the gradual discovery of applications for their essential oils in healthcare.

The popularity of essential oils and aromatic plants has long been linked to their medicinal properties, in this case anti-inflammatory, antimicrobial, antioxidant, antifungal, stimulating, soothing, etc.

Indigestion symptoms have a prevalence rate of 30% of the population, which necessitated searching for other natural solutions without chemicals to reduce or eliminate these symptoms with multiple causes, such as changing the diet, frequent smoking, or obesity.

To introduce the beneficial effects of essential oils in the field of indigestion and expelling gases, caraway, peppermint, and safflower oils were chosen, whose aromatic plants have gained great popularity in this field, as they are among the most effective plants for eliminating abdominal cramps, expelling gases, and being a sedative and tonic.

In the first part, we present a group of aromatic plants, which have gained great fame in the field of indigestion: mint, asafoetida and caraway, and we discuss their benefits in traditional medicine in a group of ancient countries and civilizations and their various uses in addition to generalities about indigestion problems and an overview of essential oils.

In the second part, we extracted the essential oils of plants using the hydrodistillation technique using a Clevenger device and studied their properties, as well as the antioxidant and antimicrobial activity of these oils. Finally, we formed a product with these extracted oils and tested it on a sample of sick people to study the extent of its effectiveness in eliminating indigestion.



**Literature
review**

I. Indigestion (Dyspepsia)

1. Definition

Indigestion (also known as dyspepsia) is a term which describes pain or discomfort in your chest or stomach. These symptoms are among the most common and widespread health complaints in the population. Indigestion usually refers to upper abdominal pain or discomfort, but may also include symptoms of early satiety, post-meal bloating or bloating, nausea, and vomiting. Dyspepsia can be episodic or persistent and is often worsened by eating. Dyspepsia is a general term describing discomfort or pain in the upper abdomen or chest, usually after eating.

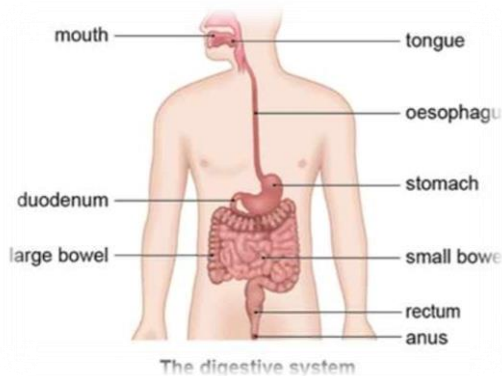


Figure 01 : The digestive system



Figure 02: Indigestion pain

2. Cause of indigestion

Almost all of us are likely to experience indigestion from time to time, often after a heavy, spicy or fatty meal, sometimes when we have rushed our food but quite often when we have simply had too much to eat or drink. Whilst gastric and duodenal ulcers used to be a common cause of indigestion only a few years ago, they occur less frequently nowadays.

This is partly because most ulcers are caused by an infection called *Helicobacter pylori* and this bacterium (stomach bug) is becoming less and less common. Some people are more prone to underlying conditions such as peptic ulcer disease. This may be partly because ulcers tend to run in families, but ulcers are also more common in people who smoke and those who take one of the many anti-inflammatory drugs for joint and muscle pains as these can damage the lining of the stomach. Alongside these, reflux is more common in people who are overweight or those that feel under stress. An increasing number of people suffer from reflux associated with indigestion because the acid produced in their stomach can travel (reflux) back up into their oesophagus (gullet).

Less commonly, indigestion symptoms can be due to more serious conditions such as gallstones, disease of the pancreas, and rarely, cancer of the stomach or oesophagus. Happily, the vast majority of people with indigestion don't have any of these conditions and for most there is no obvious reason why such symptoms occur

3. Symptoms of indigestion

Symptoms vary from person to person and depend on the underlying problem causing indigestion. Most people suffer from indigestion and each person has their own pattern of symptoms, ranging from mild discomfort to very severe pain in the upper abdomen that can radiate to the back. Some people may experience a burning sensation that increases, called heartburn, in the chest. There is a general feeling of fullness and discomfort in the upper abdomen after a meal. Sometimes, the pain is felt more locally just below the breastbone and a combination of all three. Indigestion may occur alone or may be accompanied by other symptoms such as nausea and vomiting. It appears to affect 25-41% of the population at any given time. Around a quarter of people seek advice from their GP.



Figure 03: Indigestion symptoms

4. How do you treat indigestion ?

Treatment options are many which include changing food, drinks, lifestyle, synthetic medicines, etc. But among all this, treatment through complementary and alternative

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medicines (CAMs), especially time-tested traditional herbal remedies, is gaining importance and adoption. Herbal medicinal plants and the medicines derived from them are arguably the oldest forms of healthcare recognized to humankind, and have been used by all cultures throughout history. Plants contain phytochemicals with specific and comprehensive biological functions, which may have an important role in the treatment and prevention of various gastrointestinal disorders. The present review will address the problem of indigestion as a common and universal human inconvenience across the world and also its magical treatment options by comparing the effectiveness of some medicinal plants and herbs.

II. Caraway

Caraway is considered a type of spice that has long been used in herbal medicine and cooking. Many people use its oil, seeds, and even caraway fruit for the health benefits it has. historically, it has been used to treat many diseases, most notably indigestion, bloating, and gas.

1. Botanical description

Caraway is an aromatic medicinal herbaceous plant. This plant grows in the Mediterranean basin, and is widespread in central and northern Europe. It is grown in large quantities in the Netherlands, Sweden, Norway, Russia, North Africa and Egypt.

It has finely divided feathery leaves, growing in the form of stems. The main flower stalk is 40-60 cm long, and the small flowers are white or pink. The carawayfruits, commonly called seeds, are crescent-shaped and have five pale edges. They bloom from June to July, and the seeds ripen from July to August. It is received by bees (self-fertilizing plant).

It grows in semi-shade or no shade, suitable for light (sandy) and heavy (clay) soils and prefers well-drained soil. Suitable pH is acidic, neutral and basic (alkaline) soil.



Figure 04: Caraway plant (stem, flowers, seeds)

2. Scientific name and classification

Table 01 : Scientific name and classification of caraway

Scientific name	<i>Carum carvi</i>	Howlm	Embryonic plants
Above the range	Vitals	Section	Vascular plants
High kingdom	Eukaryotes	Rank	Apiaceae
Kingdom	Plants	Faction	Chemawat

3. Nutritional value

Caraway contains a wide range of essential nutrients, which are lacking in many Western diets. These elements include iron, zinc, calcium and fiber. It provides only one tablespoon (6.7 grams) of caraway:Calories :22 \ Protein : 1.3 grams \ Fat : 0.9 grams \ Carbohydrates : 3.34 grams \ Fiber : 2.6 grams \ Copper : 6.7% of DV \ Iron : 6.1% for women \ Magnesium : 5.4% of the DV \ Manganese : 4.8% for women \ Calcium : 3.6% of DV

What's more, caraway boasts a rich supply of health-promoting antioxidants , including limonene and corvone.

4. Health benefits of caraway

- One of the benefits of caraway is that it contains copper, which is necessary for the process of forming red blood cells, as well as iron, its main component
- Zinc is a cofactor in the formation of many enzymes that regulate growth, digestion, and DNA synthesis
- Potassium helps regulate heartbeat and blood pressure
- One of the benefits of caraway is that it contains manganese, which helps in the action of antioxidants that protect the body
- Caraway seeds are considered a natural storehouse of many important vitamins for the body, most notably vitamins A and C and many vitamin B compounds.
- Caraway seeds are full of dietary fiber and they help a lot in preventing and treating constipation, as they significantly increase bowel movement. It also helps get rid of toxins in the body, in addition to its effective role in getting rid of excess cholesterol in the blood.

5. The therapeutic properties of caraway

- Caraway for colic

Colic is considered the most famous type of disorder that has always been associated with the use of the caraway plant, as the infusion of caraway (Tisane) works to calm the disturbed movement of the intestines, which helps relieve colic and expel the gases that cause bloating, and therefore it is used for adults and children alike. It is also related to Caraway is commonly associated with childbirth, as it is served as a type of dessert after childbirth in

Literature review

some Arab countries, but caraway has many health benefits for the body that are not limited to the mother and her newborn only.

- ✚ **For infants:** Caraway works to increase the baby's intestinal movement and thus treats him from constipation, which often affects him at this stage. It also has the ability to absorb the gases present inside the intestine. As it helps reduce colic and abdominal pain that sometimes affect the infant. It also stimulates the secretory and transport systems in the mother's breast, which increases milk production and increases the efficiency of breastfeeding..
- ✚ **For a breastfeeding mother:** Caraway is one of the herbs that helps increase milk production in a breastfeeding mother, and when the mother eats it, the benefits of caraway are also transmitted to the infant through the milk. It also reduces uterine pain in the period following labor.

- **Improve digestion**

It has been known since ancient times that caraway helps with healthy digestion. It has also been used to treat many stomach and colon diseases, including indigestion and stomach ulcers. Caraway is characterized by its antibacterial properties, and caraway oil helps prevent the growth of harmful colon bacteria while preserving the existing beneficial bacteria. In the colon, maintaining beneficial bacteria helps enhance their function, which includes producing essential nutrients for the colon, reducing inflammation, improving digestion, and supporting the body's immunity. Caraway extracts may also help in treating *Helicobacter pylori* bacteria (*Helicobacter Pylori*), which may cause stomach ulcers and inflammation of the digestive system.

Thus, we see that the caraway plant is one of the most important plants rich in health and medicinal beneficial substances, which we must make good use of in order to benefit from its nutritional value and achieve health and life.

III. Mint

1. History of spearmint

The genus *Mentha* has a very large number of species and successive hybridizations lead to some confusion in their identification. It is therefore impossible to put a botanical name on the species of Mint mentioned in Antiquity.

Mint was celebrated in Greek and Latin mythology through the nymph Mentha ,the daughter of the river god.

The plant was already known to the Egyptians, Plant fragments were found Dried in tombs dating back to the 13th and 17th centuries BC. it was used For the conservation of mummies . Probably due to its strongAroma. mint was used with myrtle and rosemary during funeral ceremonies, In order to mask the smell of corpses.Dioscorides and Pliny affirmed that it constituted a factor of sterility: “mint kills the fetus and opposes reproduction by preventing the coagulation of sperm.

Charlemagne issued an order compiling a certain number of orders or recommendations for the rulers of his domains. This legislative act is famous for Article 70 which contains a list of about a hundred plants that must be cultivated on royal lands, monasteries, farms and where we find the cultivation of mint. Three crops are mentioned for the imperial domains: *Sisymbrium* ,*Menta* ("catnip") and *Mentastrum*. Medieval remedies often used these different species, *Sisymbrium* roughly representing mint. It has been used to treat colds or some digestive disorders. The term mint appeared in 1275 in French literature. In the 16th century, mint was still used for multiple uses which made it truly therapeutic, while afterwards it gradually reached a secondary role.



Figure 05: Essential oil of menth

2. Origin

The origins of mint are still very unclear, the geographical area of departure Being one of the rare facts where the authors find themselves: it would come from a vast region Encompassing North Africa, the Mediterranean basin, Europe and the Middle East. It was introduced to Britain by the Romans. It then spread across the globe, as far as North America, Japan and Australia. It grows naturally in Morocco. It is now found all over the world, in fact it is sometimes considered As invasive. The diversity of soils and the multiplications have given numerous Species, some studies have also shown that *Mentha spicata* is the result of a hybridization between *Mentha longifolia* and *Mentha suaveolens*.

3. Description

Spearmint belongs to the Lamiaceae family, which includes 6,500 species Dispersed over a very large geographical area. It is a very homogeneous family: a Lamiaceae is easy to recognize. They are most often herbaceous plants and Shrubs producing essential oils, the smell of which is released by simple touch. Indeed, the location of essential oils is very external; they form in Gasoline hairs and are located under the cuticle which is raised. The shape of the Flower (a zygomorphic corolla with loss of the upper stamen) and the presence of oils Essential therefore sign belonging to this family. The vegetative apparatus comprising a square-section stem and opposite leaves are also characteristics.

- ✚ **Leaves:** The leaves are opposite, drooping, lanceolate, zigzag, green on both sides, hairless or almost hairless. The leaves are pinnately compound and cross-shaped (angle is 90°).



Figure 06: Leaves of *Mentha spicata*

- ✚ **The inflorescences:** The inflorescence is indefinite in a dense cylindrical spike.
- ✚ **The flowers:** grow in clusters in the leaf axil. They are zygomorphic and hermaphroditic.

The flowers are pink or lilac, in sparse terminal spikes, long, slender, linear-acute, calyx bracts and teeth linear, glabrous or ciliate, pedicels and calyx tube glabrous, corolla glabrous inside, ovoid carpels. The flower has a bract which extends beyond the floral parts.



Figure 07 : Flower of *Mentha spicata*

- ✚ **Stam:** Spearmint stems should rise in a quadrangular (square) shape (orthotropic). It has purple color. The maximum height of spearmint can reach 1.20 meters, but the average height is between 0.30 and 0.60 centimeters. Stems glabrous or glabrous, branched. Spearmint is a plant with creeping rhizomes.
- ✚ **Root:** The roots are taproots and have a lifespan of more than 3 years. Under each foot are rhizomes (underground stems) used to propagate plants.
- ✚ **Habitat:** Spearmint grows primarily in nutrient-rich, deep, cool soil; it does not like calcareous soil. It mainly occurs in low-altitude areas with an altitude of 400 to 1800 meters in temperate regions. It prefers full sun to partially shaded locations.
- ✚ **Phenology:** Spearmint blooms from late spring to early autumn (June to September/October) and is fragrant. Its leaves are evergreen.
- ✚ **Pollination:** Pollination occurs almost not by wind (wind pollination) but by insects (insects).
- ✚ **Assignment type:** Spearmint can be spread in a variety of ways. The asexual route benefits from trailing rhizomes that grow underground and form orthotropic stems at regular intervals. or sexually through the dispersal of seeds. Seeds appear within 30 days. With an average weight of 0.3 grams for 1,500 seeds, these seeds are very light

and can be easily carried short distances by the wind. However, they are primarily Barrow cores, which means they fall due to gravity

4. Uses of *minta spicata* in herbal medicine

Mint (Lamiaceae), commonly known as mint or wild mint, is a perennial herbaceous plant found in 6 species in Iran. *Mentha* genus is used in folk medicine to treat bronchitis, nausea, gas, loss of appetite and liver problems.

Among the various *Mentha species*, spearmint (*Mentha spicata L.*) is a perennial herb grown commercially around the world. Fresh and dried spearmint leaves are used in teas and condiments. Spearmint is used to treat the gastrointestinal tract, respiratory tract, and bad breath, and as a digestive, antispasmodic, diuretic, and sedative. Various types of spearmint preparations (decoctions, tinctures, and tablets) are used to treat gas.

In traditional Iranian medicine, *spicata* leaves are a plant considered to be stomachic and effective against indigestive symptoms such as appetite, bloating, burping, digestion and nausea. The leaves, flowers, and stems of *M. spicata* are currently used as flavorings in beverages, food preparations, candies, and chewing gum. *Spicata* flowers are used in sauces, ice cream, salads, soups, juice drinks, desserts, dressings and vegetable dishes.

In Ayurvedic medicine, *Mentha sp.* Used to relieve digestive problems, skin problems and headaches. Historical records show that it was widely used in ancient Greece. It is added to baths and used to treat sexually transmitted diseases, whiten teeth, and heal mouth ulcers. In traditional Chinese medicine, mint sp. It is believed to have hot, spicy and cooling properties. It is used to clear away wind and heat, clear eyesight, remove rash, and eliminate liver stagnation.

IV. *Asafoetida*

1. Description

Asafoetida, also spelled *asafetida*, gets its name from the Persian *aza*, for mastic or resin, and the Latin *foetidus*, for stinking. It is extracted from the taproot of several plants of the *Ferula* genus (Apiaceae family) which grow in Iran, as well as in central and southern Asia. It is a hard, pale pink to dark red-brown substance that has a strong, pungent odor. This evokes garlic, onion, rotten egg or lighting gas, and earns it its qualification as “fetid”, that is to say “stinking, nauseating”.



Figure 08: Illustration of the stinking kelp plant



Figure 09: Commercial *asafoetida*

2. Scientific name and classification

Table 02 : Scientific Name and classification of *Asafoetida*

Scientific Name	<i>Ferula assa-foetida</i>
Kingdom	Plant
Higher rank	Astral Ways
Rank	Apiaceae
Gender	Al-Kalakh

3. Nutritional value of *asafoetida*

Asafoetida is rich in nutrients that the body needs, as 100 grams of *asafoetida* contains the following: Water : 16 grams / Protein : 4 grams / Fat : 1 gram / Fiber : 4 grams / Carbohydrates : 68 grams / Calcium : 690 milligrams / Phosphorus: 50 milligrams / Iron : 39 milligrams.

Table 03 : Composition of *Asafoetida*

Property	Content
Resin	40–60%
Gum	2.5%
Volatile oil	4–17%
Ash	10–15%

4. Method of gum-resin collection

Ferula plants from which *asafoetida* of commerce is extracted, have massive tap roots and massive carrot-shaped roots, 12–15cm in diameter at the crown when they are 4–5 years old. The rhizomes produce two types of plants, one of which is the male plant, which produces inflorescence and the other, the female plant, which produces the oleo-gum or *asafoetida*. In March-April just prior to flowering, the upper part of the living rhizome/root (about 5–6 cm) is laid bare and the stem is cut off close to the crown. The exposed surface is covered by a dome-shaped structure, 15–20cm high, called the khora, made of twigs and clay and which has an opening to the northern direction. A milky juice exudes from the cut surface. After some days, the exudate is scraped off and a fresh slice of the root is cut, when more latex exudes, sometimes the resin is removed along with the slice. The collection of the resin and the slicing of the root are repeated until exudation ceases (about 3 months after the first cut). The resin is sometimes collected from successive incisions, made of the junction of the stem or rhizome and the tap roots. With 3 incisions, some plants have been reported to yield about 1 kg or more of gum resin.

Table 04: Commercial plants of *asafoetida* grown in the world

Species	Region where grown	Remarks
<i>F. aliacea</i> Boiss	Iran	Gum is used as an intestinal antiseptic and carminative and also to control hysteria and epilepsy
<i>F. communis</i> Linn.	North Africa	Source of a gum known as

Literature review

		“Ammoniac of Morocco” Used medicinally in Europe
<i>F.foetida</i> (Bunge) Reget	Southern Turkey, Iran, Afghanistan	Same use as that of <i>F.asafoetida</i>
<i>F.szowitziana</i>	Central Asia	Source of sagapenresin, has a scent of galbanum
<i>F.tingitana</i> .Linn(Syn.F.sanctaBoiss)	Syria, N.Africa	Source of North African and Moroccan ammoniac

5. Benefits of *asafoetida*

- ✚ **Alleviating stomach pain:** Mixing *asafoetida* in warm water and placing it on abdomen, except for the navel, helps treat stomach pain, as it is rich in anti-inflammatory properties.
- ✚ **Treatment of gases:** If you suffers from gas, all you have to do is add a little *asafetida* with mustard seeds in the water and drink it.
- ✚ **Treating indigestion:** *Asafoetida* helps treat indigestion. This is done by preparing warm water with *asafoetida*. Then massage the abdomen with it, except for the navel.
- ✚ **Stimulates appetite:** Lack of appetite in children can be treated using *asafoetida*. This is done by adding *asafoetida* to warm water and giving it to the child.
- ✚ **Alleviating colic pain:** *Asafoetida* can be a good treatment, as it acts as an immediate pain reliever in the first stage of colic pain. This is done by rubbing it on the stomach.
- ✚ **Strengthens immunity:** *Asafoetida* strengthens immunity. You can give it to children when they reach the age of ten, as it is rich in antibacterial and antiviral agents and protects the child from diseases.
 - In addition to these benefits, *asafoetida* has other benefits, including improving mood and being an antidepressant, as it stimulates the secretion of the happiness hormone. It can also be used as a cosmetic because it eliminates acne and treats hair problems, including dry and frizzy hair.

It is important to realize that the precise scientific manner in which *asafoetida* helps in medicine is still to be thoroughly investigated, though, many empirical observations, as the ones cited above, have been observed.



Figure 10: Pharmacological activities of *Asafoetida*

V. Aromatic Oils (Essential Oils)

1. Introduction

Essential oils have been known since ancient times for their medicinal properties and are very interesting natural plant products that are still effective today. Essential oils have been used for thousands of years as spices or flavorings for foods and drinks or to heal the body and mind. Its uses appear in Mesopotamia, China, India, Persia, and ancient Egypt in many forms and for a variety of treatments. For example, in ancient Egypt, people extracted oil through injections. Later; The Greeks and Romans used distillation to add additional value to aromatic plants. With the advent of Islamic civilization, extraction technology was further improved. During the Renaissance, Europeans took on this task, and as science developed, the composition and properties of essential oils changed dramatically. Nowadays, peppermint, lavender, geranium, eucalyptus, rose, bergamot, sandalwood and chamomile essential oils are the most frequently traded ones.

2. Definition of essential oils

Essential oils, also called volatile or etheric oils, because they evaporate when exposed to heat, unlike fixed oils, are aromatic and volatile compounds found in only 10% of the plant kingdom and are stored in plants in special fragile secretory structures, such as glands, secretory capillaries, secretory ducts, or cavities. Secretory or resinous ducts. The total essential oil content of plants is generally very low and rarely exceeds 1%. Essential oils are hydrophobic, soluble in alcohol, nonpolar or weakly polar solvents, waxes and oils, but only slightly soluble in water, are liquid and less dense than water and are mostly colorless or pale yellow with the exception of blue chamomile (*Matricaria chamomilla*) essential oil.

3. Extract essential oils

The oils contained in plant cells are extracted by heat and pressure on different parts of the plant material; Such as leaves, flowers, fruits, grass, roots, wood, bark, and gums. And prosper. Essential oils can be extracted from plant materials through a variety of methods, with hydrodistillation, steam distillation, and steam/water distillation being the most common extraction methods. Other methods include solvent extraction, water immersion, cold or hot pressing, drip method, supercritical fluid extraction, and the vegetative process. This subsequent process has been recently developed; It uses fluorocarbons and solvents as coolants at low temperatures (below room temperature), thus extracting good quality oil. Therefore, the chemical composition of the oil varies quantitatively and qualitatively

depending on the extraction technique. For example, hydro-distillation and steam-distillation methods yield oils rich in terpene hydrocarbons. In contrast, the super-critical extracted oils contained a higher percentage of oxygenated compounds .

Essential oils are highly complex mixtures of volatile compounds, with many containing approximately 20 to 60 individual compounds, although some may contain more than 100 different components. The main volatile components are hydrocarbons, alcohols, aldehydes, cyclic aldehydes, ketones, lactones, phenols, phenol ethers, oxides and esters. All these compounds can be divided into two main groups: terpenoids and phenylpropanoids or hydrocarbons and oxygenates. The odor and chemical composition of essential oils may vary depending on geographic climate location and growing conditions, season and harvest time, etc. In addition, there is another important factor that influences the chemical composition of essential oils, namely the genetic composition of the plant. Therefore, all these biotope factors influence the biochemical synthesis of essential oils in a given plant. Thus, the same species of plant can produce a similar essential oil, however with different chemical composition, resulting in different therapeutic activities.

4. Health benefits

Balance hormones

Some oils, such as clary sage, geranium and thyme, help balance out estrogen and progesterone levels, which can improve conditions like infertility and PCOS, as well as PMS and menopause symptoms

Boost immunity and fight infections

Many essential oils have anti-inflammatory, antiviral, antibacterial, antiseptic and antifungal properties that help boost your immune system and fight infections. The chemical substances found in the oils, such as terpenes, esters, phenolics, ethers and ketones, have the potential to fight foreign pathogens that can threaten your health.

Support digestion

Another researched essential oils benefit is their role in aiding and improving digestion. Some oils help relieve upset stomach, indigestion, diarrhea, stomach spasms and even conditions of the gastrointestinal system, such as IBS.

Oils can also aid your digestion by helping to stimulate digestive enzymes that make it easier to break down and absorb the nutrients, fats and protein that you need.

Boost Energy Levels

Some oils have stimulating effects and can actually increase oxygen to your brain. This leaves you feeling refreshed, focused and energized.

Improve brain function

With neuroprotective effects and cognitive performance-boosting abilities, essential oil benefits have helped many people who suffer from neurodegenerative diseases like Alzheimer's and dementia

5. Are essential oils safe ?

Most essential oils are safe and free of adverse side effects when used properly. However, as with any substance you are introducing into your body, it is important to use them intelligently. We recommend that you never eat or drink essential oils. You should pay attention to the following factors.

- Dosage
- Purity
- Application method
- Possible drug interactions



*Material
and methods*

Material and methods

I. Material

1. Laboratory Material

Equipment

- agitator “Vortex”
- Precision balance
- Clevenger’s device
- Spectrophotometer
- Refrigerator
- Autoclave
- Incubator set at 37°C
- Bunsen burner
- Water bath
- VITEK® DENSICHEK®
McFarland
- McFarland Standard No. 0.5
(1.5×10^8 CFU/ml)
- Refract meter
- PH meter

Glassware and other materials

- Flask
- Beaker
- Test tubes
- Aluminum foil
- Stirrer
- Mueller-Hinton culture media
- Petri dishes
- Sterile loop
- Sterile swab
- Micropipette
- Hemolysis tubes
- Cones
- Sterile Pasteur pipettes

Products and Environments

culture used

- Distilled water and EDS
- Sabouraud agar
- Sterile physiological saline solution
(0.9% NaCl)
- Antibiotic Cefazal
- DMSO
- Methanol
- DPPH powder
- Ascorbic acid

Material and methods

2. Biological Materials

Mint plant : The mint plant was collected from an orchard in the Oued Rig area, and then we washed and dried it for 15 days at room temperature.

Caraway plant : We purchased the caraway plant, washed it, and dried it under the same conditions mentioned above

Asafoetida gum : It was purchased from a reliable company online, and due to its hard consistency, we broke it into small pieces.

Bacteria: We used a bacterial strains, including two Gram-negative strains, *Pseudomonas aeruginosa* ATCC 27853 and *Escherichia coli* ATCC 25922, and two Gram-positive strains, *Staphylococcus aureus* ATCC 25923 and *Bacillus subtilis* ATCC 25973.

Volunteers: 15 people were selected who suffer from indigestion, colic, and flatulence problems in order to study the effect of the extracts on their condition.

II. Methods

1. Extracting essential oils

We take 50 grams of the sample (mint, caraway, asafoetida), put it in a flask with a capacity of 1 liter and add 600 milliliters of distilled water to it, then connect it to a Clevenger device and leave it for 3 hours or more, and we repeat the process several times until we obtain the required amount of oil.



Figure 11: Clevenger's device

Material and methods

The yield of essential oil is the ratio between the mass of the extracted essential oil and the mass of the plant before extraction. The yield of the extracted oil is calculated according to the following relationship : $Y = (\text{Mass of extracted essential oil} \div \text{Mass the plant before extraction}) \times 100$



Figure 12: Extracted essential oil

2. Characteristics of essential oils

A. Refractive index

It is the ratio between the sine of the angles of incidence and refraction of a light ray of determined wavelength, passing from the air into the essential oil maintained at a constant temperature.

The refractive index has no unit because it is the ratio of two speeds. The more light is slowed down, the higher the refractive index the material has. The refractive index of essential oils is generally high. This shows their richness in components which deflect polarized light.

The device used to measure the refractive index is the refract meter ,which is an optical instrument used to determine the refractive index of a substance, that is to say the extent to which light is deflected when passing through the substance. First, we clean the refract meter with acetone solution, then we put a drop of oil, set the temperature at 20 C, adjust the device, and read the recorded value.



Figure 13: Refractometer device

B. PH Measurement

PH: the abbreviation for hydrogen potential, measures the chemical activity of hydrogens (H^+) (also commonly called protons) in solution. More commonly, pH measures the acidity or basicity of a solution.

This is a coefficient allowing us to know whether a solution is acidic, basic or neutral; it is acidic if its pH is less than 7, neutral if it is equal to 7, basic if it is greater than 7. This Measurement was carried out using a pH meter Or by PH paper.



Figure 14: PH meter device

Material and methods

C. Density

Density is a physical quantity which characterizes the mass of a material per unit volume.

Measuring method: $D_{20} = (m_1 - m_0) / (m - m_0)$

m1: Mass in g of the syringe containing 1 ml of essential oil.

m0: Mass in g of the empty syringe.

m: Mass in g of the syringe containing 1 ml of water.

3. Antioxidant activity

Preparing a DPPH solution

We dissolve 4 mg of DPPH powder in 100 ml of methanol, obtaining a violet-colored solution. We place it in an opaque flask and leave it on the electric mixer for 30 minutes, then we store it in the refrigerator until use.

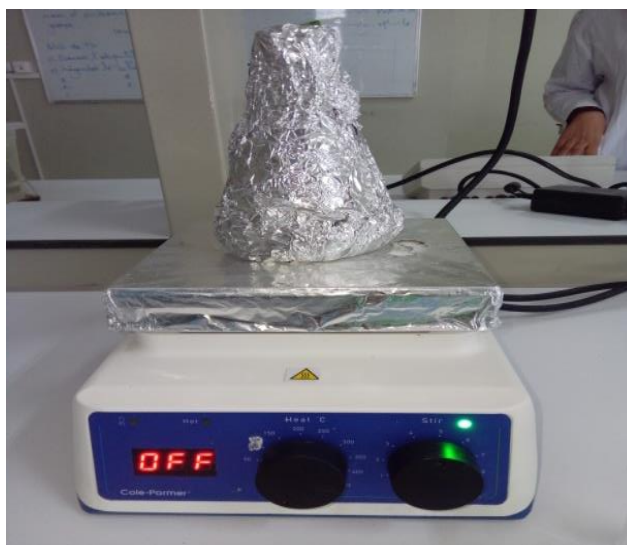


Figure 15: DPPH Solution

Preparing the Mother solution : Mix 0.1 ml of oil with 0.9 ml of methanol.

After; we take test tubes covered with aluminum foil and put different concentrations of the mother solution in each tube (1/0.8/0.6/0.4/0.2) ml, then we add a volume of methanol to each tube so that the total volume in the tube is 1 ml (0/0.2/0.4/0.6/0.8) respectively

Material and methods

Then we take 150 microliters from each tube, add 3 ml of DPPH solution to it, and leave it for 30 mins in the dark, And we use ascorbic acid as a positive control.

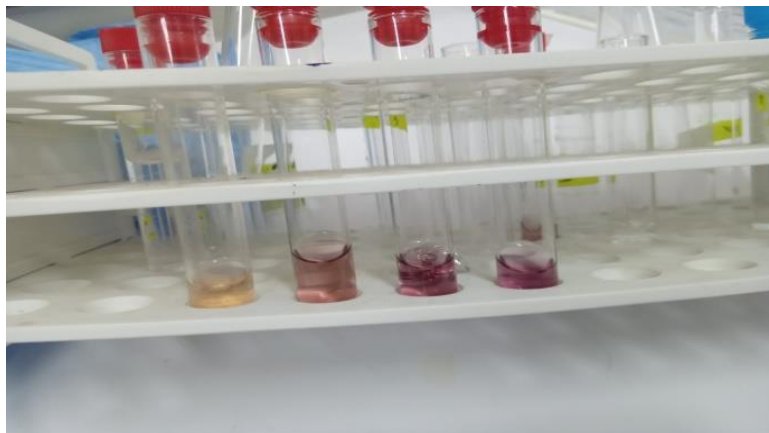


Figure 16: Antioxidant activity test

Finally, we read the absorbance using a spectrophotometer at a wavelength of 517

The inhibition rate is calculated by the following relationship: $I = ((A_{\text{dpph}} - A) \div A_{\text{dpph}}) \times 100$

- ✓ **I:** Inhibition
- ✓ **A_{dpph}:** Absorbency of dpph (0.9)
- ✓ **A:** Absorbency of EO



Figure 17: Spectrophotometer device

4. Antibacterial activity

This is the basic technique used to study the antimicrobial effect of a substance.

Material and methods

Petri dishes containing Mueller-Hinton agar are aseptically inoculated with a suspension of 10^6 cells/mL obtained from a young culture of yeasts or bacteria, respectively. Inoculation is done by swabbing. After the dishes have dried, the agar is perforated at the center using the upper part of a Pasteur pipette.

Additionally, different essential oils were tested at varying percentages of 75%, 50%, and 10%. Each well was filled with approximately 50 μ L of the solution.

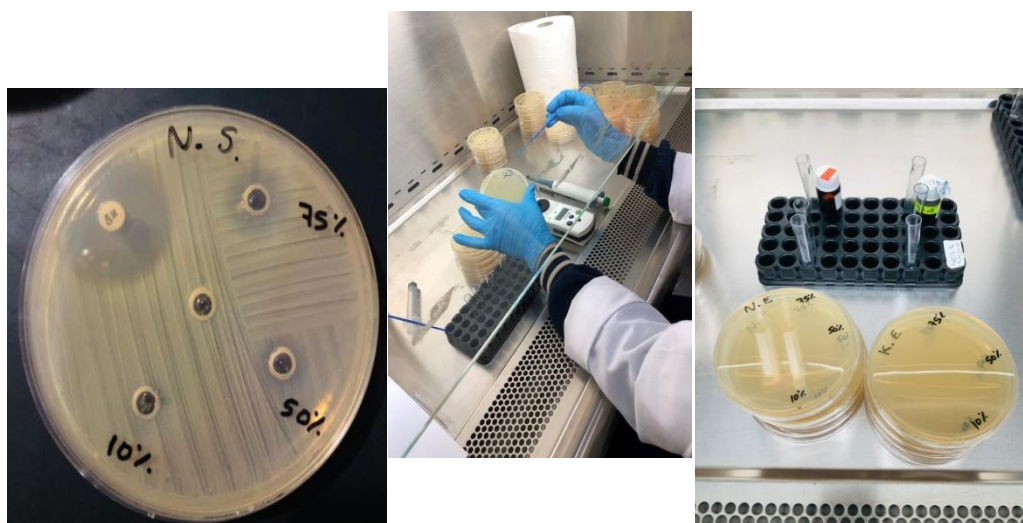


Figure 18: Antibacterial activity test

The dishes are incubated in an incubator at 37°C for 48 hours for yeasts and 24 hours for bacteria. Inhibitory action is indicated by the formation of a zone of inhibition around the wells. The results are read by measuring the diameters of the inhibition zones. A product is considered active if the diameter of the inhibition zone is greater than 6mm

5. Evaluating the Efficacy of Selected Plants for Indigestion and Bloating

To investigate the efficacy of the studied plants in treating indigestion and bloating, we formulated a sugar-free beverage incorporating the essential oils of three medicinal plants: *Mentha spicata*, *Carum carvi*, and *Asafoetida*, along with a selection of additives to achieve the final product. This drink was administered to 15 volunteers experiencing symptoms such as indigestion, intestinal colic, gas, or slow bowel movements over a period of 10 days. We assessed symptoms including acid reflux, stomach pain, heartburn, and flatulence, and also monitored for any adverse effects to determine the safety of the treatment.



**Results and
discussion**

Results and discussion

1. Yield of essential oils

The results obtained are indicated in the table 05

Table 05: Yield of essential oils

Oils	Yield(%)
<i>Carum carvi</i>	1.6531 %
<i>Mentha Spicata</i>	0.892 %
<i>Asafoetida</i>	5.12461 %

The three plants gave an acceptable yield, but the difference in yield is due to the difference in the volatile components in each plant and the type of soil in which the plant was planted, as well as the time of harvest. **Abadllia.M, Chebbour.A,(2014).**

2. Characteristics of essential oils

The results obtained are indicated in the graphics

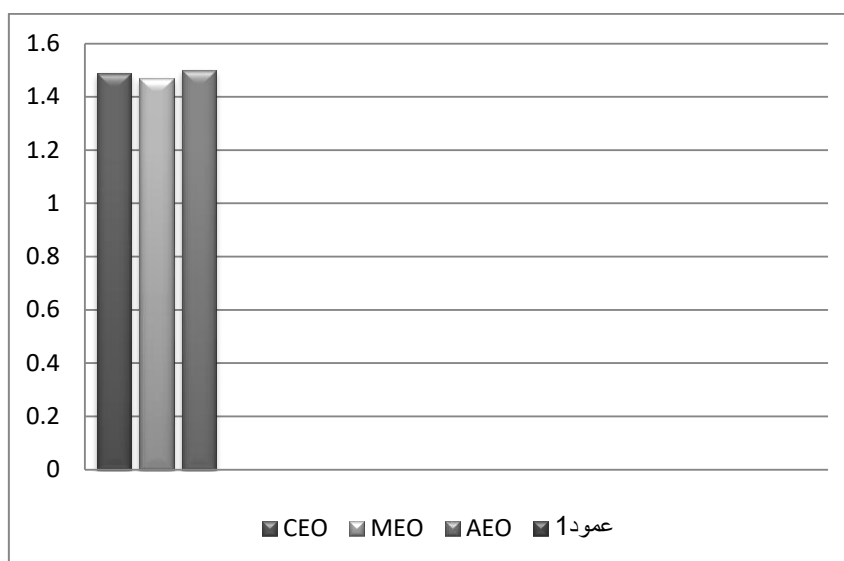


Figure 19: Histogram representing the results of refractive index measurement

The refractive index is inversely proportional to the oil's ability to withstand heat and stability at high temperatures. Whereas the lower the coefficient of refraction, the oil tends to maintain its quality and stability at high temperatures. **Johannes Delgado Ospina and all (2016).** which means that the essential oil can be preserved at high temperatures without fear of affecting its effectiveness or quality.

Results and discussion

In this study, we obtained the following values (minth=1,4700 and caraway=1,4900 and asafetida =1,500) by comparing them with the study conducted by **Ayaidia boutheina (2010)**. and with the standards The quality of essential oils according to **Norme AFNOR,(1926)**.we can say that these results are largely acceptable.

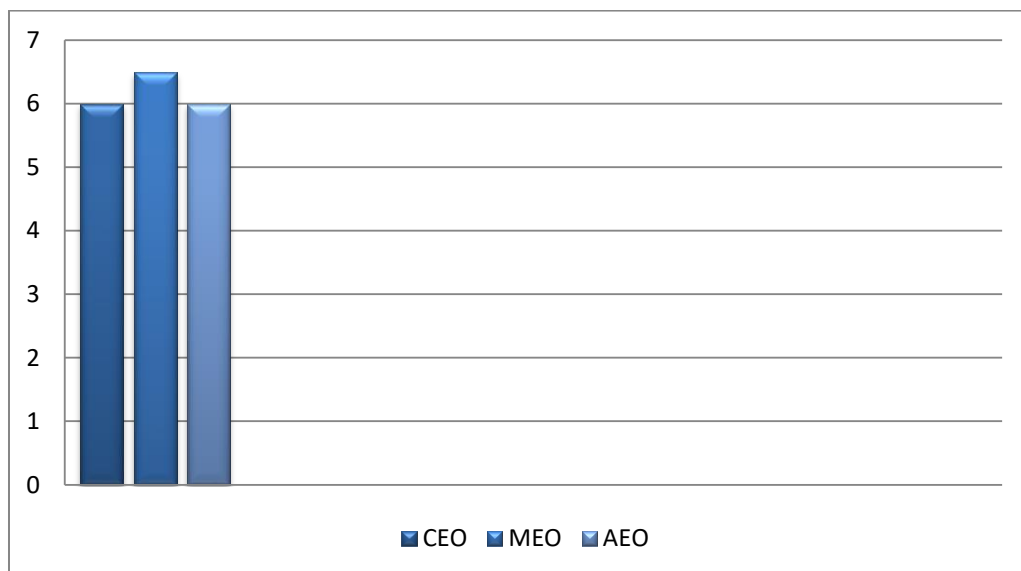


Figure 20: Histogram representing the results of the measured PH values

PH reflects the content of free fatty acids in the oil, and it greatly affects its quality. If the pH is low, this indicates that the oil is less corrosive and more stable, which means a higher quality essential oil **Karray-Bouraoui N., Rabhi M., Neffati M., Baldan B., Ranieri A.,Marzouk B. (2009)**. The PH value we obtained indicates that the oils are acidic due to their chemical composition. Comparing them with other studies shows that they are very close and comply with **AFNOR** standards.

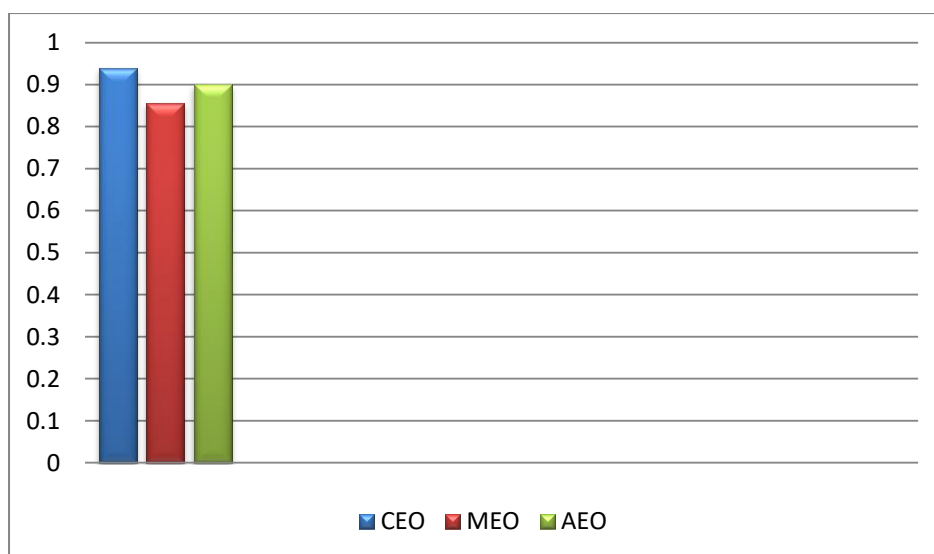


Figure 21: Histogram representing the results of the measured density values

The density of essential oil is an important factor affecting its quality. If the density of the oil is appropriate and compatible with industry specifications, this indicates that the oil has a good composition and a good ability to withstand pressure and heat, which contributes to its general quality **Ben Qassoum A, Laboz F, (2018)**.

By comparing our results with the results reached by several Previous studies were conducted on the same plants we studied **Amalraj, A., & Gopi, S. (2017)**. And based on the **AFNOR** standards shown in Appendix No. 4, it can be said that the oils we obtained are good and conform to those standards that stipulate quality.

3. Antioxidant activity

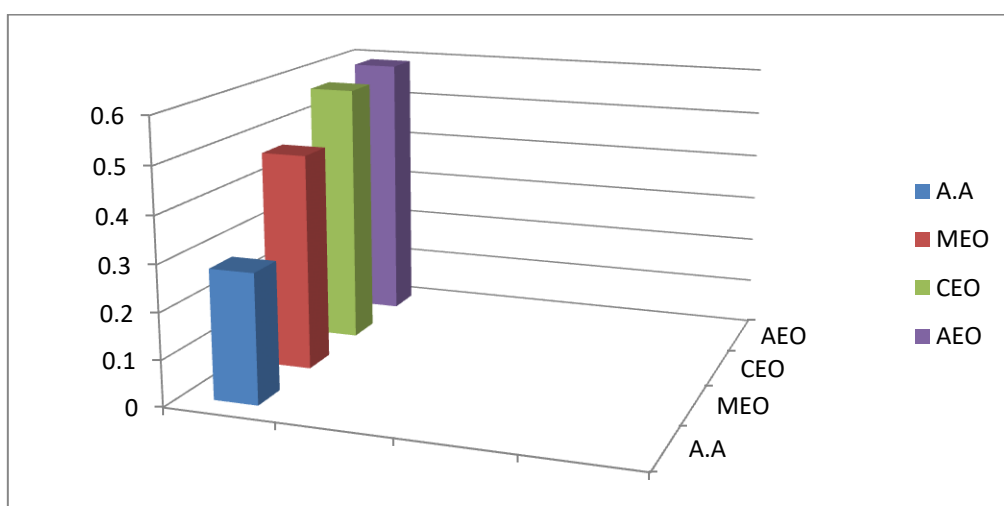


Figure 22: IC50 Of essential oils

In This test the reduced antioxidants decolorize the DPPH radical, transforming it into a yellow compound diphenyl picryl hydrazine. The extent of the reaction will depend on the ability of the antioxidants to donate hydrogen (**ARDESTANI and YAZDANPARAST, 2007**).

The antioxidant activity of our oils is expressed in IC50, this parameter was defined as an effective concentration of the substrate which causes the loss of 50% of DPPH activity (color). These IC50s are determined graphically, the abscissa of which represents the concentration of the extracts and the ordinate the antioxidant activity in percentage.

Results and discussion

For comparative purposes, a standard antioxidant is used, ascorbic acid, it is shown to have powerful anti-radical activity with an IC50 of 0.28 mg/ml (عفاف سبوعي 2019). The lower the IC50 value, the more powerful the oil considered to be an antioxidant.

Among the extracted oils, mint essential oil represents the most active oil, with an IC50 of around 0,47 mg/ml followed by caraway essential oil with an IC50 of 0,57 mg/ml. Next comes asafoetida essential oil with an IC50= 0,59 mg/ml.

The antioxidant activity of any compound can be explained by its ability to fight free radicals that cause oxidative stress and attack cells, causing damage, such as the pancreatic and intestinal cells responsible for secreting digestive enzymes such as lipase and protease, based on the results we obtained regarding the activity of the three plants. Based on previous studies. Akrouf A., Chemli R.C., Chrief., and Hammami M. (2001).

These plants have proven effective in eliminating free radicals to a large extent and thus getting rid of indigestion problems.

4. Antibacterial activity

Table 06: Results of antibacterial tests of CEO

Strains used	Microbial inhibition			
	75%	50%	10%	CN
<i>Escherichia coli</i> ATCC 25922	NI	NI	NI	28
<i>Pseudomonas aeruginosa</i> ATCC 27853	NI	NI	NI	32
<i>Staphylococcus aureus</i> ATCC 25932	NI	8	8	27
<i>Bacillus subtilis</i> ATCC 25973	NI	NI	NI	18

- NI = No Inhibition, CN = Gentamicin (CN) 30ug Discs

Results and discussion

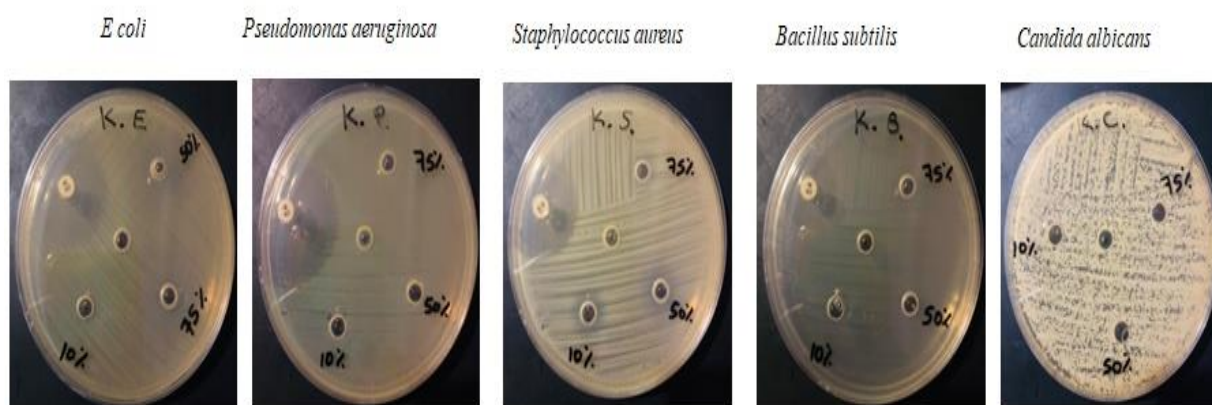


Figure 23: Results of antibacterial tests of CEO

Table 07: Results of antibacterial tests of MEO

Strains used	Microbial inhibition			
	75%	50%	10%	CN
<i>Escherichia coli</i> ATCC 25922	14	12	NI	31
<i>Pseudomonas aeruginosa</i> ATCC 27853	NI	NI	NI	32
<i>Staphylococcus aureus</i> ATCC 25932	14	9	NI	28
<i>Bacillus subtilis</i> ATCC 25973	NI	NI	NI	21
<i>Candida albicans</i> ATCC 10231	23	21	NI	/

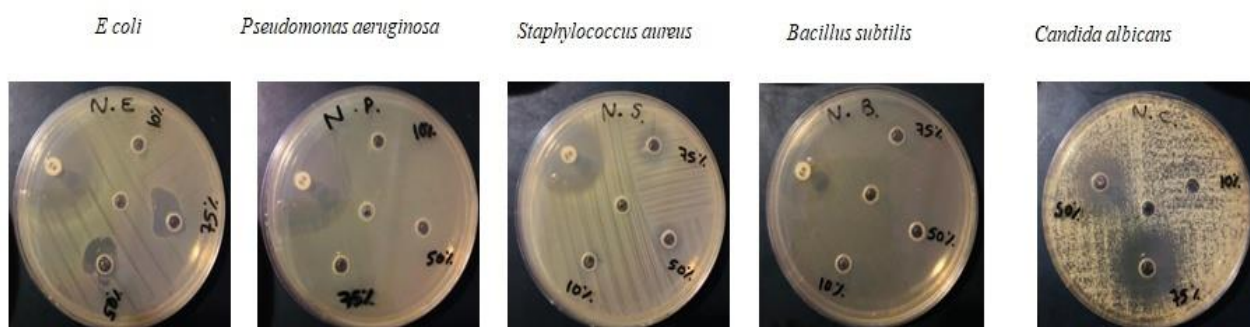
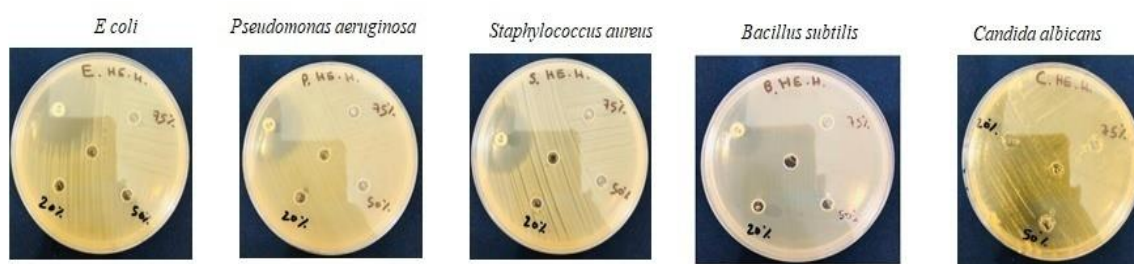


Figure 24: Results of antibacterial tests of MEO

Table 08: Results of antibacterial tests of AEO

Results and discussion

Strains used	Microbial inhibition			
	75%	50%	10%	CN
<i>Escherichia coli</i> ATCC 25922	NI	NI	NI	31
<i>Pseudomonas aeruginosa</i> ATCC 27853	NI	NI	NI	32
<i>Staphylococcus aureus</i> ATCC 25932	NI	NI	NI	28
<i>Bacillus subtilis</i> ATCC 25973	7	7	NI	21
<i>Candida albicans</i> ATCC 10231	NI	NI	NI	/



Picture 25: Results of antibacterial tests of *Asafoetida* Essential oils

Some studies have shown that patients suffering from indigestion disorders and irritable bowel syndrome have changes in the number of bacterial species present in the intestine, or in the abundance of certain bacterial species. **Burt S, (2004).**

As for *E.coli* bacteria, they are Gram-negative bacteria. Some strains of them can live in the digestive system of healthy people normally, but some other strains have acquired genes that enable them to cause gastrointestinal infection or gastroenteritis. They can also produce toxins capable of damaging the colon and is referred to as *enterohemorrhagic*

This is also the case with *Staphylococcus aureus* bacteria, which are naturally present on the mucous membrane of the large intestine, but they are capable of producing toxins that are harmful to human health.

In our study, each essential oil had antibacterial activity against certain strains of bacteria tested.

Results and discussion

Where mint essential oil showed activity against *Escherichia coli* and *Staphylococcus aureus* bacteria, caraway seed oil had activity against *Staphylococcus aureus* bacteria, while asafoetida oil affected the activity of *Bacillus subtilis* bacteria.

These results indicate that the three oils are capable of suppressing the activity of these bacteria, that is preventing them from multiplying or secreting toxins, which are considered a cause of digestive system diseases, as we mentioned previously.

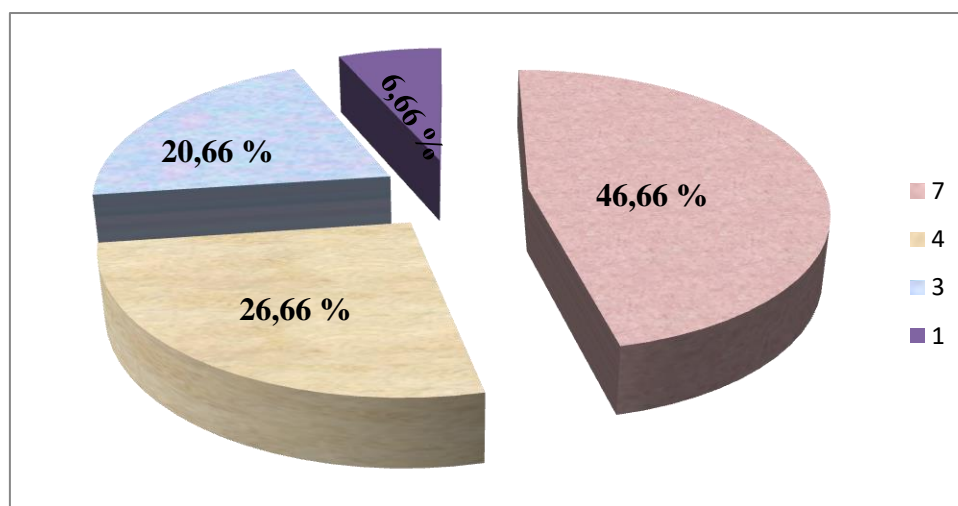
5. Results of evaluating the effectiveness of selected plants for indigestion and bloating

The results obtained are indicated in the table 09

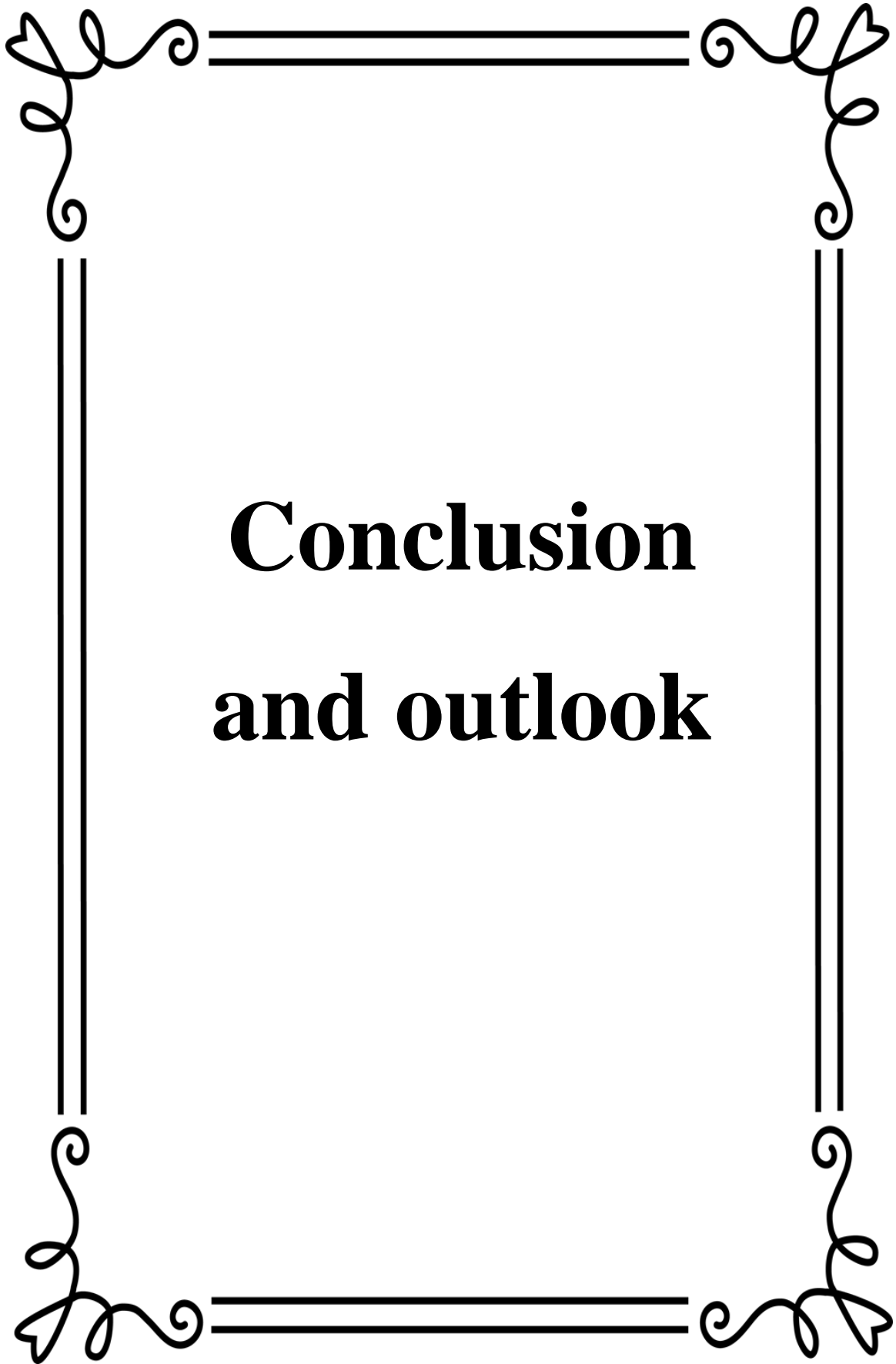
Table 09: Results of patients' response to treatment during the 10 days period of treatment

Treatment period	Number of people who responded to treatment
1 → 3 Day	7 peoples
4 → 6 Day	4 peoples
7 → 10 Day	3peoples

Note: that throughout the treatment period, there was only one person who did not respond to treatment, and this was due to several reasons, including each individual's own metabolic process.



Picture 26: A relative circle representing people's response during the treatment period



**Conclusion
and outlook**

Conclusion

Algeria has a great wealth of plant biodiversity and is considered a fairly large reservoir of molecules with special therapeutic and pharmacological properties that need to be exploited.

As a part of this study, we were interested in extracting the essential oils of some medicinal plants (mint, caraway, and asafoetida) and then studying their properties and some of their biological activities in order to exploit their potential in treating indigestion and gas.

Essential oils were extracted from caraway seeds and mint leaves, in addition to asafoetida gum. Asafoetida oil gave a high yield compared to the other two plants, followed by caraway seeds, then mint leaves. This difference is due to the difference in the volatile compounds in each plant and their percentage.

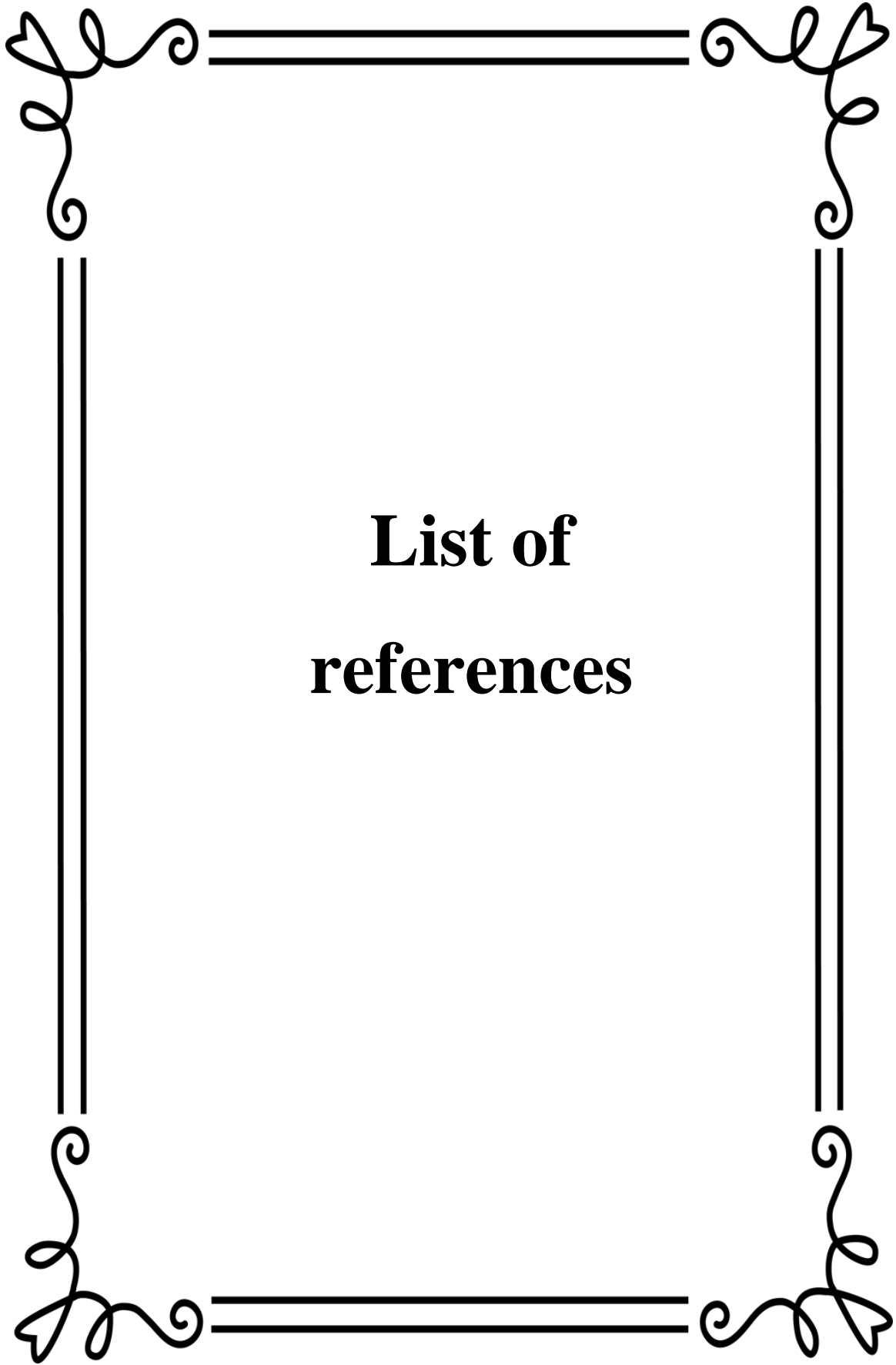
By studying some of the physical properties of the oils of these plants, such as PH, density, and refractive index, it was found that they comply with the quality standards for essential oils set by the AFNOR organization. We also evaluated the antioxidant activity of the essential oils through the DPPH test. According to the results, the essential oil of mint leaves gave the highest percentage of free radical inhibition with an $IC_{50} = 0.47$ mg/ml, followed by the essential oil of caraway seeds with an $IC_{50} = 0.52$ mg/ml, then the asafoetida essential oil with an $IC_{50} = 0.59$ mg/ml. By comparing it with ascorbic acid, these results prove the high ability of oils to eliminate free radicals and thus indirectly eliminate indigestion problems.

In studying the antimicrobial power of these essential oils by spreading them on the agar medium and determining the minimum concentration of the oils that inhibit bacteria. Each oil showed activity against various types of bacterial strains tested, resulting in zones of inhibition ranging from 7 to 21 mm. However, the best results were when using peppermint essential oil, followed by caraway seeds, then asafoetida. This indicates its role in inhibiting the activity of some bacteria, which can cause several problems in the digestive system.

The results of the clinical study to evaluate the effectiveness of these oils in reducing the problems of indigestion and bloating by selecting a sample of patients and treating them with a mixture containing the three previously prepared oils were very satisfactory and the disease symptoms were eliminated in a short period of treatment.

Conclusion and outlook

In the end, all of these results obtained in the laboratory are considered a first step in the search for natural sources of biologically active substances, and additional tests will be needed in future studies, such as determining the components of these oils and evaluate their toxicity.



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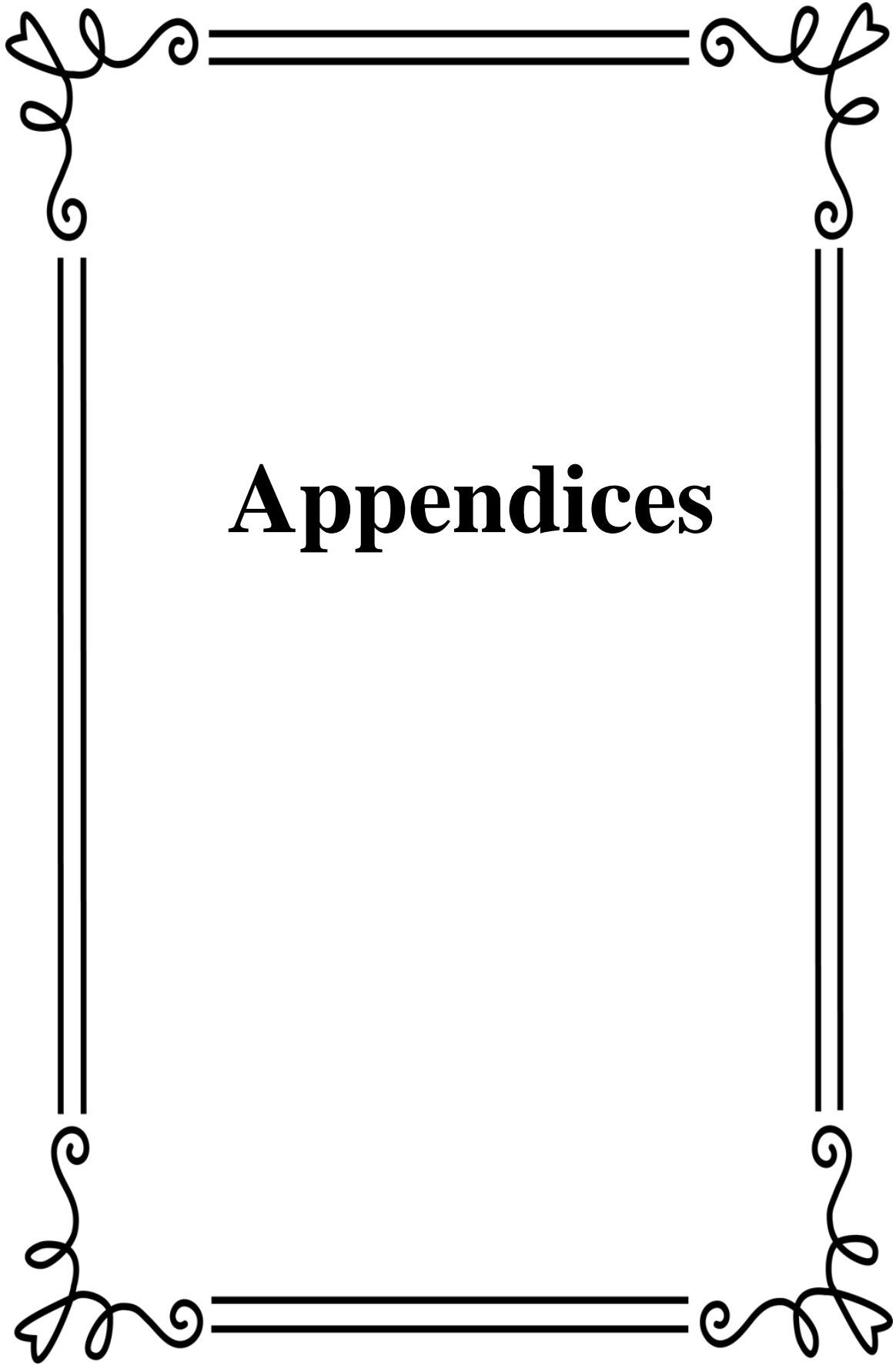
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Appendices

Appendices

Appendix 01: Clevenger's device

The Clevenger : assembly is named after its inventor, Joseph Franklin Clevenger, This device allows the extraction of essential oils from plant samples.

It consists of 2 elements: a balloon and a piece of modified glassware (vertical tube combined with refrigerant + burette with glass tap). A return tube for the aqueous portion of the distillate connects the lower end of the burette to the vertical tube.

Process: The flask contains water which is boiled and the plant to be extracted. The steam rises in the assembly to the condenser, and the condensate falls back into the burette. The oil floats on the water, which is for its part gradually returned to the heated flask through the diagonal conduit.

After a few hours of extraction, it is possible to measure the volume of oil collected directly in the burette.

This piece of glassware is made up of: a 250 ml round-bottom flask with 29/32 run-in, an AllihnL. utile 300 mm condenser + burette cap.10 mL graduation 0.1 mL. 29/32 clip joint not supplied. To be ordered separately.

Appendix 02: Spectrophotometry's device

Spectrophotometry is a branch of electromagnetic spectroscopy concerned with the quantitative measurement of the reflection or transmission properties of a material as a function of wavelength.

Spectrophotometry uses photometers, known as spectrophotometers, that can measure the intensity of a light beam at different wavelengths. Although spectrophotometry is most commonly applied to ultraviolet, visible, and infrared radiation, modern spectrophotometers can interrogate wide swaths of the electromagnetic spectrum, including x-ray, ultraviolet, visible, infrared, and/or microwave wavelength.

Appendix 03: Results of characteristics of essential oils

Characteristics	PH	Refractive index	Density
EO			
CEO	6	1,4900	0,9400

Appendices

MEO	6,5	1,4700	0,8570
AEO	6	1,5000	0.9000

Appendix 04: AFNOR values for some essential oils

Characteristics EO	PH	Refractive index	Density
CEO	4,5_6	0,9100_0,9600	1,4800_1,5000
MEO	6_7	0,8200_0,9900	1,4600_1,5000
AEO	6_7	1.500_1.5200	0,8850_0,9250

Appendix 05: Results of antioxidant activity of *Carum carvi*

	0.2	0.4	0.6	0.8	1
A	0.88	0.8	0.75	0.68	0.6
I	2.22	11.1	16.66	24.4	33.33

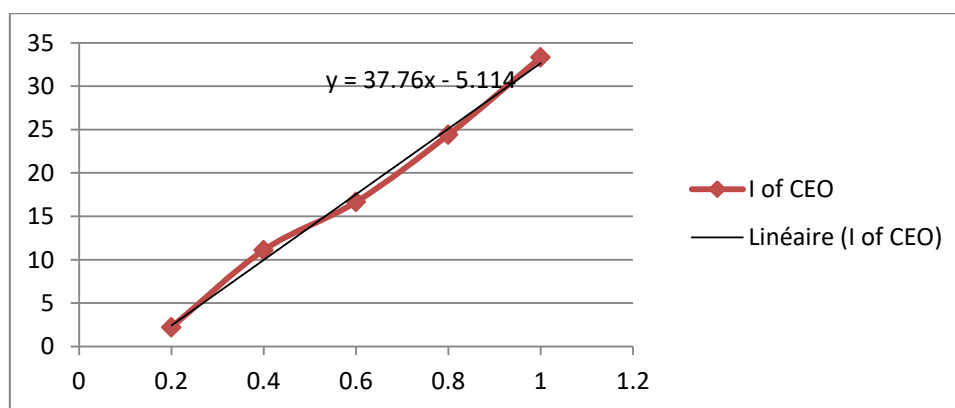


Figure 22: Free radical inhibition curve as a function of concentration(CEO)

Appendix 06: Results of antioxidant activity of *Mentha spicata*

	0.2	0.4	0.6	0.8	1
A	0.82	0.78	0.69	0.61	0.57
I	8.8	13.3	23.3	32.22	36.6

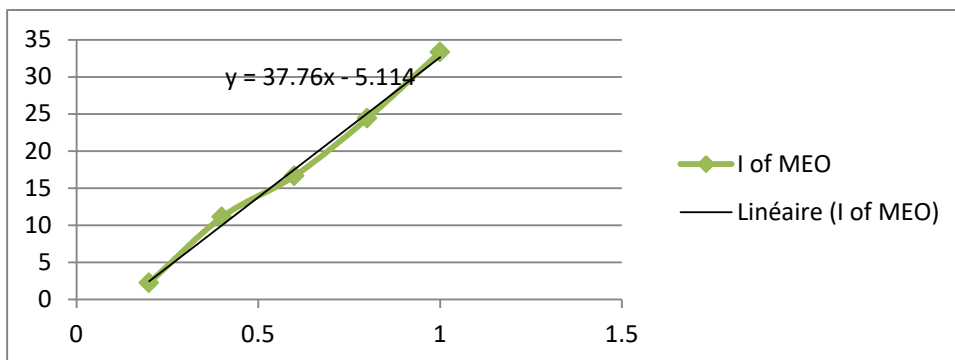


Figure 23 : Free radical inhibition curve as a function of concentration(MEO)

Appendix 07: Results of antioxidant activity of *Asafoetida*

	0.2	0.4	0.6	0.8	1
A	0.89	0.75	0.56	0.39	0.23
I	1.11	16.6	37.7	56.6	74.7

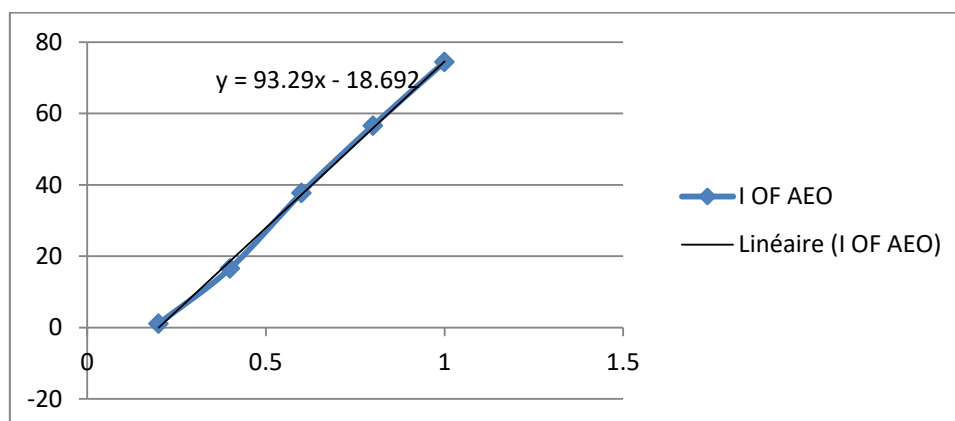


Figure 24: Free radical inhibition curve as a function of concentration(AEO)

Appendix 08: Vegetable oils

1. Definition

Vegetable oils have been known for thousands of years. They were extracted from seeds and oily fruits in various primitive ways. Humans used them for food, soap making, and lighting. They were also used as medicinal substances.

Vegetable oils and fatty substances are among the most important components that enter into the composition of all living organisms, plants and animals, and they play an important role in the lives of humans and animals, as they provide about a third of a person's daily energy needs. These oils also contain many other substances necessary for human safety and health, and there are more than 100 vegetable raw materials used to produce vegetable oils, and the percentage of oil in them ranges between 10 and 70%, but only 22 types are of great economic importance at the present time, and the percentage of oil produced from them exceeds 98% of the total global production.

2. Methods of extracting vegetable oils

Firstc, old-pressed oils: Cold pressing is done using hydraulic presses or driven machines, as the oils produced in this way are first-class oils that are expensive and in great demand due to their high health value, as they are used in many important industries, including therapeutic and cosmetic ones.

Second, Hot-pressed oils: They are oils that are pressed in a chemical way, using presses that are operated either manually or automatically using motors. In this method, the temperature of the seed and the extracted oil rises to high levels, causing them to lose many of their natural properties and health effects from their content. This type of oil is cheap compared to oils. Cold pressing, and therefore it is important in terms of use, not in terms of benefit, and an example of these oils is palm oil.

Third, The method of extraction by heating or boiling with water: This method is done in a limited number of types of seeds, where the processing process is using simple manual tools to crack and break up the seeds, then placing them in large metal pots and submerging them with water, then leaving the mixed ingredients to boil over the fire for very long periods, thus releasing them. The oil is extracted from the seeds and floats on the surface of the water. The liquid mixed with the oil is then cooled, then filtered and cooled, and the water is removed by evaporation, leaving the oil remaining. This method is very low-cost and the percentage of loss in nutritional value is high.

3. Components of vegetable oils

Vegetable oils consist mainly of esters of fatty acids with glycerine. These types of esters are called glycerides. Glycerin consists of a triglyceride whose chemical formula is $\text{CH}_2\text{OH}-\text{CHOH}-\text{CH}_2\text{OH}$. It can combine with three molecules, two molecules, or one molecule of fatty acid. Vegetable oils consist of triglycerides with very small amounts of diglycerides and monoglycerides. Crude vegetable oils also contain small percentages of non-glyceride substances, ranging between 1 and 5%.

1_Fatty acids in vegetable oils

Saturated fatty acids: Their general formula is $\text{C}_n\text{H}_{2n}\text{O}_2$, the most important of which are: lauric, myristic, palmitic, stearic, and arachidic acids.

Fatty acids containing more than one double bond: They are fatty acids that contain two or more double bonds in the fatty acid chain, and are divided into:

A - Linoleic class: Its general formula is $\text{C}_n\text{H}_{2n-4}\text{O}_2$ and it contains two double bonds in the fatty acid chain.

B - Linolenic class: Its general formula is $\text{C}_n\text{H}_{2n-6}\text{O}_2$ and it contains three double bonds in the fatty acid chain.

2_Non-glyceride substances in vegetable oils: they are represented by phosphatides, sterols, hydrocarbons, pigments, antioxidants, vitamins, minerals, and Substances that cause flavors and odors.

4. Uses Of Vegetable Oils:

Vegetable oils have many uses, including:

- **Cooking and Baking:** Vegetable oils are commonly used in cooking and baking to impart distinct flavor and texture to food.
- **Healthy preparations:** Vegetable oils can be used in the preparation of salads, sauces, jams and moisturizers.
- **Skin care:** Vegetable oils are used as a main ingredient in skin and hair care products, as they contribute to moisturizing and nourishing the skin and hair.
- **Pharmaceutical industry:** Vegetable oils are used in the manufacture of pharmaceuticals, medicines and cosmetics.
- **Massage:** Some types of vegetable oils are used in massage sessions for their soothing and nourishing benefits for the skin.

Appendices

These are some common uses for vegetable oils, and there are many other uses depending on the type of oil and the industry in which it is used.