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Theme

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# *Development of natural personal care product (soap): physicochemical characterizations and safety assessment*

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**Presented by:**

- Boudraa Nor Djihane
- Khaled Marwa
- Djedadoua Nihed

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**Evaluation jury:**

President: Dr. TOUATI . H — University May 8, 1945, Guelma

Examiner: Dr. AISSANI . F — University May 8, 1945, Guelma

Professional Pole: Dr. ABESS . Z — University May 8, 1945, Guelma

Supervisor: Dr. YAKHLEF. M — University May 8, 1945, Guelma

Academic year: 2024/2025

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*First and foremost, I give thanks to God, for granting me the strength, patience, and perseverance throughout this journey. It is by His will alone that I was able to overcome each step along the way. I dedicate this work:*

***To My Dear Mother Leila,*** *You are the light that has illuminated every step of my path, and your love is my greatest strength. If God created paradise under the feet of mothers, it is not in vain. No matter what you do or say, I can never repay you properly. Your tenderness covers me, and your presence by my side has always been my source of strength to face the various obstacles. With infinite gratitude, I dedicate this work to you, and I am very proud to have finally been able to achieve what you had hoped and expected of me.*

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***Marwa***

## Summary

Soap is a widely used personal care product across all age groups.

This study aimed to develop a mild, effective, and eco-friendly soap enriched with rosemary essential oil. The process began with the extraction of rosemary essential oil through hydrodistillation, followed by its physicochemical analysis. A cold process technique was then used to produce soap from selected vegetable oils (olive oil, coconut oil, palm oil, castor oil), incorporating the rosemary essential oil. The final product underwent various evaluations, including organoleptic assessment, pH measurement, foam capacity, moisture content analysis, and microbiological testing. Results indicated that the rosemary essential oil retained its properties throughout the soap-making process and enhanced the soap's overall quality. The soap exhibited a skin-friendly pH (9.73), good foaming ability (50%), low moisture content (1.57%_4.02%) for improved shelf life, and a pleasant natural aroma.

These outcomes highlight the potential of rosemary essential oil as a natural, functional, and aromatic ingredient in plant-based soaps.

**Keywords**: Natural soap, Rosemary essential oil, Cold process saponification, Physicochemical properties, Antifungal activity, Skin care

## Résumé

Le savon est un produit de soin personnel largement utilisé par toutes les tranches d'âge.

Cette étude visait à développer un savon doux, efficace et respectueux de l'environnement, enrichi en huile essentielle de romarin. Le processus a commencé par l'extraction de l'huile essentielle de romarin par hydrodistillation, suivie d'une analyse physicochimique. Une technique de saponification à froid a ensuite été utilisée pour produire un savon à partir d'huiles végétales sélectionnées (huile d'olive, huile de coco, huile de palme, huile de ricin), avec incorporation de l'huile essentielle.

Le produit final a été soumis à diverses évaluations, notamment une analyse organoleptique, une mesure du pH, une évaluation du pouvoir moussant, une analyse de la teneur en humidité, ainsi qu'un test microbiologique. Les résultats ont indiqué que l'huile essentielle de romarin a conservé ses propriétés tout au long du processus de fabrication et a contribué à améliorer la qualité globale du savon. Le savon obtenu présentait un pH respectueux de la peau (9,73), une bonne capacité moussante (50 %), une faible teneur en humidité (entre 1,57 % et 4,02 %) favorable à une meilleure durée de conservation, ainsi qu'un agréable parfum naturel.

Ces résultats mettent en évidence le potentiel de l'huile essentielle de romarin en tant qu'ingrédient naturel, fonctionnel et aromatique dans la fabrication de savons à base végétale.

**Mots clés**: Savon naturel, Huile essentielle de romarin, Saponification à froid, Propriétés physico-chimiques, Activité antifongique, Soins de la peau

## الملخص

يعُدّ الصابون من منتجات العناية الشخصية واسعة الاستخدام بين جميع الفئات العمرية.

هدفت هذه الدراسة إلى تطوير صابون لطيف وفعّال وصديق للبيئة، مُعزّز بزيت إكليل الجبل الأساسي. بدأ العمل باستخلاص الزيت العطري لإكليل الجبل بواسطة التقطير بالبخار، تلتها تحاليل فيزيائية وكيميائية للزيت. ثم تم تصنيع الصابون باستخدام طريقة التصبين البارد، انطلاقاً من زيوت نباتية مختارة )زيت الزيتون، زيت جوز الهند، زيت النخيل، زيت الخروع( مع إضافة زيت إكليل الجبل.

خضع المنتج النهائي لعدة اختبارات، شملت التقييم الحسي، وقياس درجة الحموضة(pH) ، وقدرة التكوّن الرغوي، وتحليل نسبة الرطوبة، والاختبارات الميكروبيولوجية.

أظهرت النتائج أن زيت إكليل الجبل احتفظ بخصائصه طوال عملية التصنيع، وساهم في تحسين جودة الصابون بشكل عام.

وقد أظهر الصابون درجة حموضة مناسبة للبشرة) 73.9(، وقدرة جيدة على تكوين الرغوة) 50%(، ونسبة رطوبة منخفضة )بين 57.1% و02.4%( مما يعزز مدة صلاحيته، بالإضافة إلى رائحة طبيعية مميزة.

تؤكد هذه النتائج على الإمكانيات الكبيرة لزيت إكليل الجبل كمكون طبيعي وفعّال وعطري في صناعة الصابون النباتي.



**الكلمات المفتاحية :**صابون طبيعي، زيت إكليل الجبل العطري، التصبين البارد، الخصائص الفيزيائية والكيميائية، النشاط المضاد للفطريات، العناية بالبشرة

## List of figures

## List of tables

## List of Abbreviations

**AFNOR: French Standardization Association**

**BDNF: Brain-Derived Neurotrophic Factor**

**CFU: Colony-Forming Unit**

**CMR: Carcinogenic, Mutagenic, Reprotoxic**

**EO: Essential Oil**

**GC-MS: Gas Chromatography–Mass Spectrometry**

**HE: Essential Oil (from French: Huile Essentielle)**

**ISO: International Organization for Standardization**

**MIC: Minimum Inhibitory Concentration**

**MUFA: Monounsaturated Fatty Acids**

**Ph. Eur.: European Pharmacopoeia pH:**

**Potential of Hydrogen**

**PUFA: Polyunsaturated Fatty Acid**

**Rf: Retention Factor**

**ROS: Reactive Oxygen Species**

**SFA: Saturated Fatty Acids**

**TLC: Thin Layer Chromatography**

**UV: Ultraviolet**

## Table of contents

**Chapter 02: Rosmarinus SP Overview**



**Part 02: Practical part**

**Chapter 01: Materials and methods**

**Part 02: Results and discussion**

# *Introduction*

# Introduction

The skin is the protective covering of the human body. Due to its high sensitivity, it is subject to the influence of climate, eating habits, polluting and aggressive care, and insect bites (Bourahla 2023).

Personal care products are an essential part of the daily life. They include a wide range of items such as shampoos, soaps, toothpastes, deodorants, and body creams. Used to maintain hygiene, enhance appearance, or simply feel good, these products meet various needs depending on age, lifestyle, or individual preferences. Today, their importance continues to grow, with increasing attention given to quality, health, and environmental impact. especially soap (Gamage and Mahagamage 2024)..

Natural soap is a personal care product made from plant-based ingredients such as oils and natural butters (olive, coconut, shea), without chemical additives, synthetic dyes, or artificial fragrances (Cavitch 1995). Produced through saponification, it naturally contains glycerin, a moisturizing agent beneficial to the skin. Often enriched with essential oils and botanical powders, it provides soothing, antiseptic, or exfoliating properties depending on the ingredients used (Cavitch 1995). Gentle and biodegradable, natural soap respects the skin's balance and fits within an ecological and sustainable approach, making it suitable for sensitive or reactive skin types (Draelos 2021).

Nature is filled with many ingredients that have potential for skin care. Two examples of very high quality and effective ingredients are vegetable oils and essential oils used in soap making.

Vegetable oils are natural lipid substances extracted from the fatty parts of plants, mainly seeds, nuts, or fruits. They are generally liquid at room temperature, although some, such as coconut oil or palm oil, may be solid or semi-solid (Gunstone 2011)

. Essential oils are concentrated, volatile aromatic compounds extracted from plants, typically through steam distillation or cold pressing. They capture the plant's natural fragrance and beneficial properties. These oils are found in different parts of the plant—such as flowers, leaves, stems, bark, or roots—and are commonly used in aromatherapy, cosmetics, natural medicine, and soapmaking due to their therapeutic, antibacterial, and fragrant qualities (Burt 2004)

The main difference between vegetable oils and essential oils lies in their composition, properties, and uses. Vegetable oils are non-volatile, fatty substances extracted mainly from the seeds, nuts, or fruits of plants through cold pressing or solvent extraction. They are rich in triglycerides (fatty acids), making them nourishing and emollient. Commonly used as cooking oils or in cosmetics and soap-making, vegetable oils have a thick, greasy texture and a mild scent. In contrast, essential oils are volatile aromatic compounds obtained from various parts of plants such as flowers, leaves, bark, or roots, usually by steam distillation. They are not fatty and evaporate quickly. Essential oils are highly concentrated and are primarily used for their scent and therapeutic properties in aromatherapy, perfumery, and natural remedies. Because of their potency, they should be diluted in a carrier oil—often a vegetable oil—before applying to the skin. Therefore, vegetable oils are nourishing, non-aromatic base oils, while essential oils are fragrant, concentrated plant extracts used for therapeutic or aromatic purposes (Gunstone 2011; Hüsnü Can Başer and Buchbauer 2015).

Among the plants used to extract essential oils is Rosemary (*Rosmarinus officinalis)*, a Mediterranean aromatic plant rich in active compounds, is particularly valued for its antiseptic, antibacterial, toning, and antioxidant properties. When incorporated into soap production, rosemary essential oil not only helps ensure better hygiene but also contributes to skin care, while providing a pleasant and natural fragrance (Nieto, Ros, and Castillo 2018).

The main objective of this work is to extract essential oil from rosemary, evaluate its physicochemical properties, and then use it in the production of a natural scented soap. This soap aims to take advantage of the antiseptic and antifungal properties of rosemary essential oil in order to offer a hygienic, natural, and skin-beneficial product.

This thesis has three parts. The first part represents a literature review containing two chapters: chapter 1. An overview about soap and chapter 2 deals with rosemary (Rosmarinus officinalis), extraction methods, and biological and pharmacological properties. The second section is the practical part, it consists of two chapters one of which includes the materials and methods, describing the overall context of this study and the different objectives to be achieved. Then comes the results and discussion chapter exhibiting the obtained results during the experimentation. Finally, the third part: represented by Annex 1275.

# *Part 01: Bibliographic review*

# *Chapter 01: Overview of soap*

## 1 Definition of soap

Soap is a common skin care product created through a chemical process called saponification. This process involves reacting oils and fatty acids with either sodium hydroxide or potassium hydroxide (lye), resulting in the formation of an organic carboxylic acid salt. This salt possesses detergent properties, making it effective for cleaning (Draelos 2018).

Soap molecules have a unique structure: a hydrophilic head that attracts water and a hydrophobic tail that repels water. When soap is added to water, the tails cluster together, forming a spherical structure called a micelle. The hydrophilic heads face outwards towards the water, while the hydrophobic tails bind to grease and oil. This interaction allows the micelle to encapsulate the grease and oil, pulling them away from the surface and into the water, enabling the removal of dirt and grime (Soni, Kaur, and Verma 2024) .

## 2 The saponification reaction

Saponification is a chemical reaction involving the hydrolysis of a fatty acid ester in a basic medium, typically with a strong base such as sodium hydroxide (NaOH) or potassium hydroxide (KOH) (Ibouchoukene and Belaid 2024).

During this reaction, the ester bond is broken as the alkali attacks the carbonyl group of the ester, resulting in the formation of a carboxylate ion (fatty acid salt), which makes up the soap, and an alcohol (Figure 1). The esters found in fats are primarily triglycerides (Mukhtar *et al*. 2015).

Unlike ester hydrolysis, the saponification reaction is not limited it proceeds to completion, even if it occurs slowly. However, heat speeds up the process. This reaction also accounts for the caustic nature of bases on the skin. The presence of hydroxide ions ($OH^-$) on the skin triggers the saponification of lipids in cell membranes, which contain ester groups.
(Charpentier *et al.* 2008).

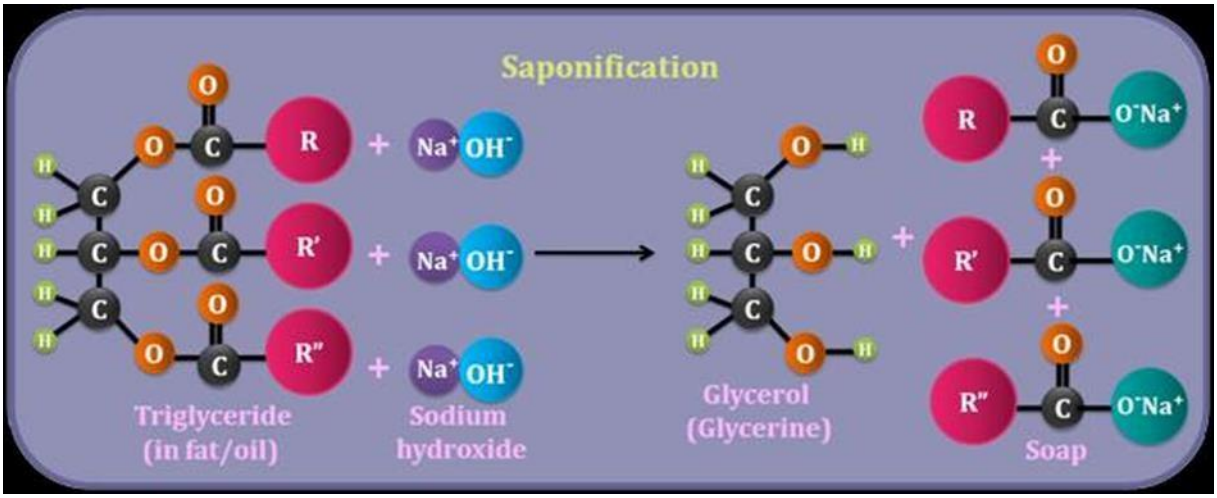



**Figure 1. saponification reaction [1]**

## 3 The raw materials used for soap making

### 3.1 Oils and fats

Oils and fats are essential raw materials in soap making, comprising roughly two-thirds of the factory's volume (Kanyua 2016). Each fat possesses unique physical characteristics, determined by its fatty acid composition. Vegetable-derived fats, including oils, fats, and vegetable butters, are classified into various families (Morin and Pagès-Xatart-Parès 2012) Such as: the monounsaturated fatty acid (MUFA) family (olive oil, peanut oil, hazelnut oil) (Tian *et al,* 2023) Saturated Fatty Acid-Rich Fats Family (SFA) (palm oil, palm kernel oil, and coconut oil) (Petersen *et al,* 2024).

#### 3.1.1 Vegetable Oils and Butters

- **Vegetable Oils**

Vegetable oils are defined as emulsions of hydrophobic triglycerides with high molecular weight, typically liquid or semi-liquid at room temperature, and soluble in non-polar or slightly polar organic solvents (Petrović 2008).

These oils represent a diverse group of plant-derived lipids, characterized by varying compositions of fatty acids, vitamins, and minerals. Their physicochemical properties and production methods give rise to distinct organoleptic qualities, which in turn influence their culinary and industrial uses (Hassid *et al,* 2025).

Chemically, vegetable oils are primarily composed of triglycerides (95–99%), along with small amounts of diacylglycerols, monoacylglycerols (less than 5%), and phytosterols (Vergallo 2020).

- **Vegetable Butters**

They are primarily composed of triglycerides (about 99%) and a small fraction of unsaponifiable matter (around 1%) (Gunstone 2011).

Triglycerides are esters formed from glycerol and fatty acids, while the unsaponifiable fraction includes beneficial compounds such as phytosterols, phenolic compounds, squalene, carotenoids, and vitamin E (Bockisch 2015; Gunstone 2011; Ramadan and Mörsel 2002).

High-quality butters are typically obtained through cold pressing or $CO_2$ extraction methods, without undergoing further refining processes (Poljšak and Kočevar Glavač, 2022).

Among the most commonly used vegetable butters are palm (Elaeis guineensis), coconut (Cocos nucifera), shea (Butyrospermum parkii), mango (Mangifera indica), cocoa (Theobroma cacao), cupuaçu (Theobroma grandiflorum), shorea (Shorea robusta), sumac (Rhus verniciflua), and wild mango (Irvingia gabonensis), all of which originate from tropical regions (Enoua et al. 2022; Honfo *et al,* 2014; Lima *et al,* 2015; Poljšak and Kočevar Glavač 2022).

### 3.1.2 Animal Fats:

Animal fats used in soap making primarily consist of triglycerides esters formed from glycerol (or glycerin) and fatty acids. The composition of these fatty acids varies depending on the animal source and typically includes saturated fatty acids such as palmitic acid, stearic acid, and myristic acid, as well as unsaturated fatty acids like oleic acid and linoleic acid (Achaw and Danso-Boateng 2021).

The specific fatty acid profile of each animal fat influences the characteristics of the resulting soap. Fats with a higher content of saturated fatty acids tend to produce soaps that are harder and more stable, whereas those with a higher proportion of unsaturated fatty acids yield softer, more moisturizing soaps (Achaw and Danso-Boateng 2021).

Commonly used animal fats in soap production include:

- **Lard:** Rendered pork fat, rich in fatty acids, and well-suited for soap making.

- **Tallow:** Derived from beef or sheep fat, this is a traditional and widely used fat in soap production.
- **Fish Oil:** Historically incorporated into soap formulations for its emollient and skinsoftening properties.

### 3.2 Lye

Lye is the second most crucial raw material in soap production. The two key products are sodium hydroxide, also known as caustic soda ($NaOH$), and potassium hydroxide, or caustic potash ($KOH$) (Benmoussa, *et al.,* 2020).

Caustic soda is primarily used in the production of solid and hard soaps, while caustic potash is typically employed in making liquid soaps, shampoos, and mild soaps (Gunstone 2011).

### 3.3 Water

Water is a vital component in the soap-making process, playing a key role in the solubilization of ingredients, activation of chemical reactions, and control of viscosity. It also contributes to the consistency and hydration of the final product (Achaw and Danso-Boateng 2021).

### 3.4 Additives

Various additives are used to alter the properties of soap or to facilitate the reaction (Ibouchoukene and Belaid 2024).

Depending on the desired effect, different additives are incorporated, such as preservatives, dyes, fragrances, superfatting agents (vegetable oils, essential oils), and salt at the end of the reaction to produce hard soap (Ibouchoukene and Belaid 2024).

Additionally, alcohol accelerates the reaction and results in transparent soap (especially vodka), while the addition of lactic acid produces "acid soaps," which are gentler on the skin (Ibouchoukene and Belaid 2024).

#### 3.4.1 Clays and Minerals

Clays typically contain a variety of elements, including silicon, aluminum, iron, zinc, magnesium, calcium, potassium, and titanium. The significance of these minerals in cosmetics lies in the distinct roles they play on the skin. For example, iron acts as an antiseptic and a catalyst for cell renewal, while silicon supports tissue regeneration, hydration, and provides a soothing effect. Zinc and magnesium offer invigorating properties, while calcium and potassium help improve circulation and tissue tone. (da Silva Favero *et al,* 2016).

### 3.4.2 Natural Colorants

Color is a crucial property of a product that influences its appeal to consumers and, consequently, its commercial success (Guerra, Llompart, and Garcia-Jares 2018).

Two main categories are established based on their source: those that require certification by the Food and Drug Administration (FDA) and those exempt from it, often referred to as "natural" colorants. Certified colorants are synthetic, primarily derived from petroleum, and sometimes called organic colorants; these undergo strict quality control. Noncertified colorants are sourced from natural materials such as plants, minerals, or animals (Chungkrang, Bhuyan, and Phukan 2021).

### 3.4.3 Essential oils

Essential oils can consist of volatile constituents derived from terpenoid or non-terpenoid sources. These compounds are primarily hydrocarbons and their oxygenated derivatives, and may also include nitrogen or sulfur derivatives. Essential oils can be found in various forms, such as alcohols, acids, aldehydes, ketones, esters, ethers, or phenols (Sharmeen *et al,* 2021).

The composition of essential oils varies significantly depending on the plant species, the part of the plant used, the extraction conditions, and the timing of the harvest. According to the International Organization for Standardization (ISO), essential oils are extracted from their matrix through methods such as boiling in water or steam distillation, cold pressing in the case of citrus peels, or dry distillation. Additionally, odorous substances can be extracted using solvent extraction or fluid gas extraction methods. The materials obtained through these processes are referred to as "concretes" or "oleoresins." (Bakkali *et al,* 2008)**.**

Essential oils are widely used in cosmetics not only for their pleasant aroma but also for their broad range of biological activities, including analgesic, antiseptic, antimicrobial, carminative, diuretic, spasmolytic, and stimulating effects. Cosmetic formulations such as creams, gels, and ointments may not require additional chemical preservatives if they contain an essential oil as an active agent, such as Roman oil or eucalyptus oil (Vargas Jentzsch, Ramos, and Ciobot\ua 2015).

The table 1 below shows some examples of essential oils found in different categories of commercialized cosmetic products.

**Table 1. Essential Oils Used in Cosmetic Products According to Their Function**
(Carvalho, Estevinho, and Santos 2016)

| Type of cosmetic products | Essential oils |
|---|---|
| **Moisturizers** | Chamomile |
| **Anti-ageing** | Vanillin<br>Sandalwood<br>Olive<br>Borage<br>Evening<br>Primrose<br>Chamomile |
| **Reparating (anti-chapping and anti-wrinkling agent)** | Camellia (Camellia japonica)<br>Centella asiatica<br>Hippophae |
| **Repairing (anti-acne agents)** | Rosemary (Rosmarinus officinalis) |

# 4 Manufacturing Methods

## 4.1 Artisanal Manufacturing:

There are three primary artisanal methods used to produce soap : the "melt and pour" (or rebatch) method, the cold process, and the hot process. (Ibouchoukene and Belaid 2024).

### 4.1.1 Rebatching or "Melt and Pour"

The rebatching or "melt and pour" method involves melting a pre-made soap base (often commercially available), then adding colorants and fragrances before pouring the mixture into molds. One of the key advantages of this technique is that it allows for the inclusion of additives that would otherwise be unable to withstand the highly alkaline environment of the saponification process. These additives are introduced after the soap has already been made, during the remelting phase (Ibouchoukene and Belaid 2024).

This method requires care during the remelting process, which should always be done using a water bath and never directly on a hot plate to prevent the temperature from exceeding 100°C. The final soaps produced via this method tend to require an extended drying period due to the additional water incorporated during remelting, which helps create a paste that can be easily poured into molds (Bourahla 2023)

### 4.1.2 The Cold Process

The cold process method is a complete process in which oils are first mixed together, followed by the addition of the necessary lye, and saponified at a temperature close to room temperature. Additives and fragrances are introduced during the saponification process itself, just before the mixture is poured into molds. Soaps produced by this method require a maturation period of at least one month before they can be used (Ibouchoukene and Belaid 2024).

This maturation time is often considered essential to complete the saponification process, although it primarily serves as a drying phase. During this period, the soap loses approximately 10 to 20% of its weight, a process that accompanies the final stages of saponification, which typically concludes within the first week of maturation. The drying process can be extended, as seen with Aleppo soap, which undergoes a drying period of up to eight months before it is marketed (Bourahla 2023).

### 4.1.3 The Hot Process

The hot process method is similar to the cold process, but saponification is carried out at approximately 80°C for three hours before additives are added and the mixture is poured into molds. The soaps produced by this method are immediately usable since saponification is fully completed by the end of the process. However, a drying period is still required (Ibouchoukene and Belaid 2024).

This method is advantageous for incorporating sensitive additives, such as essential oils, which retain more of their beneficial properties when added to the paste at temperatures not exceeding 50°C. While the hot process offers some benefits over the cold process, it also has its drawbacks. The soap produced is often more difficult to mold and typically has a rougher texture compared to the smoother texture of cold-processed soaps (Bourahla 2023).

### 4.2 Industrial Manufacturing

Industrial manufacturing processes have evolved significantly since their inception around 1750. Kettle manufacturing, for example, was once characterized by a series of steps including batching, releasing, spinning, washing, and drying (B and H 2023).

#### 4.2.1 Batching

Batching involves mixing fats with a lye solution. In this process, a strongly alkaline soda solution is heated to boiling, and vegetable or animal fats—such as olive, peanut, cottonseed, palm, coconut, sesame oils, tallow, or fish oil—are gradually added, often as a complex blend depending on the desired soap type. Notably, a fixed amount of old soapy solution, known as the "mother liquor" from a previous saponification, is retained in the lye. To produce soft soaps, oils like rapeseed, poppyseed, or hempseed are used in combination with caustic potash (KOH) instead of soda (Barel, Paye, and Maibach 2014; Cavitch 1995; Jouhar and Poucher 1991).

#### 4.2.2 Salting-Out Process (Relargage)

This method employs concentrated lye, followed by the addition of salted lye, to enhance the separation of alkaline salts of fatty acids. As a result, the soap precipitates out of the solution and rises to the surface in the form of solid lumps (figure 2) (Simmons and Appleton 1908).

The salting out process typically involves several key steps, including, draining washing, drying.

- **Epinage (Draining):** industrial process that refines and homogenizes soap, incorporating fragrances and additives to obtain a smooth, high-quality texture.(Simmons and Appleton 1908).
- **Washing**: a step in the industrial manufacturing process that involves purifying the soap paste by washing it with salt water.(Simmons and Appleton 1908).

- **Drying:** The purpose of this step is to produce dry and solid soap bars. In the 1920s, the washing and drainage steps were occasionally omitted to accelerate the purification process. The soap was poured into shallow basins, known as "mises," while still in a liquid state, where it solidified before being cut into strips. After drying, the soap was stamped and cut into cubes (Simmons and Appleton 1908).

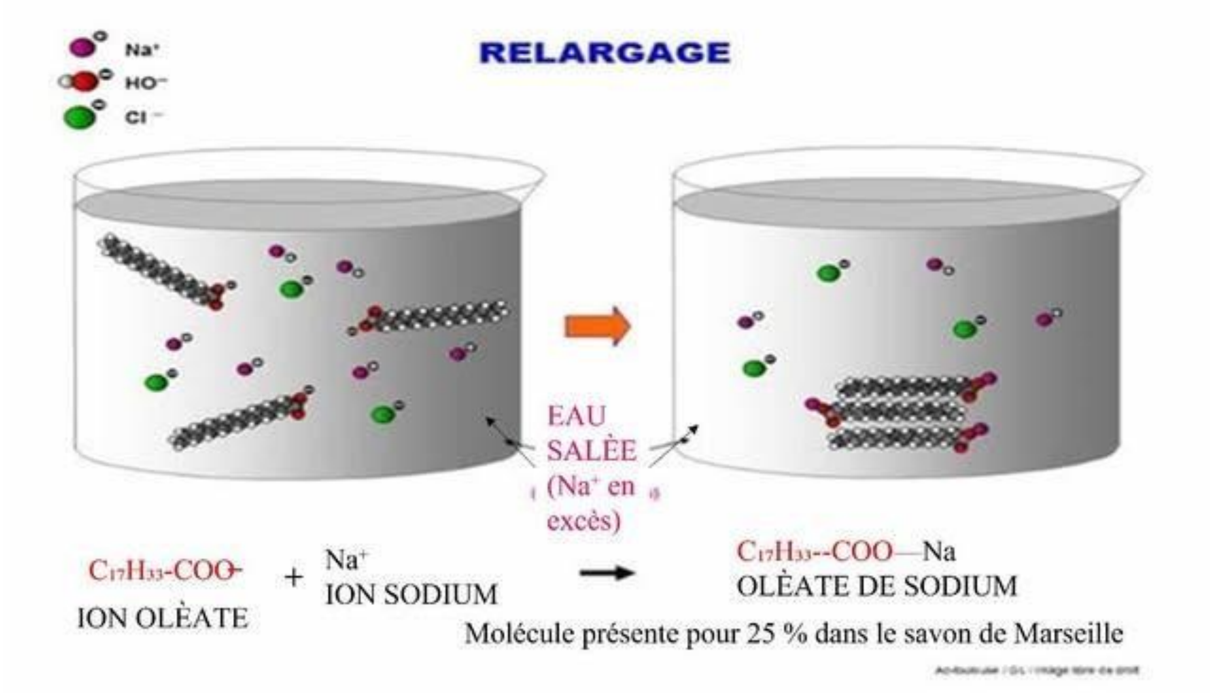



**Figure 2. Salting-Out Process (Relargage) [2]**

## 5 Types of Soaps

Soaps can be classified into various types based on several factors, including their origin (such as Marseille and Aleppo soaps), color, composition, and appearance (whether they are in liquid, solid, or sheet form).

### 5.1 Soap by Origin

Marseille soap (figure 3.A) is produced using vegetable oils and sodium hydroxide (lye). Traditional Marseille soap contains 72% fatty acids by mass and was originally made solely from olive oil. The figure below illustrates Marseille soap (Merklen, 1906).

Aleppo soap is the oldest known soap, originally crafted in the city of Aleppo, Syria. It is a 100% natural soap, made in large cauldrons using olive oil and laurel berry oil, with natural lye derived from sea salt. It contains no preservatives, colorants, additives, or added fragrance, making it a fully plant-based product. The (figure 3 .B) below illustrates Aleppo soap (Cloarec and Lavaud 2013).


**Figure 3 : Soap by Origin**

### 5.2 Soap by Color

The Grand Larousse dictionary of the 19th century defines white soap as the common Marseille soap or other toilet soaps. Its light color indicates that it is a sodium-based soap, in contrast to the darker "black soaps" (figure 4.B) made with potassium hydroxide. Traditionally produced in Switzerland using sunflower oil, it is commonly known as white soap. The figure below illustrates white soap (Cloarec and Lavaud 2013).

Black soap (figure 4.C) is a soft-textured soap available in two main types:

Black soap for skincare, known for its exfoliating and moisturizing properties.

Black soap for household cleaning, used for polishing floors and tiles. The figure below illustrates black soap (Ibouchoukene and Belaid 2024).

Transparent soap (figure 4.A) is produced by dissolving tallow-based soap in alcohol while heating, followed by slow cooling and molding. When glycerol (glycerin) is used as the alcohol, the soap is commonly referred to as glycerin soap. The figure below illustrates transparent soap (Dunn, 2017).


**figure 4: soap by color [4] [5] [6]**

### 5.3 Soap by Appearance and composition

Liquid soap is made from castor oil and palm kernel oil. It has the lowest equivalent fatty acid content, ranging from 15 to 20% by mass. (Virbel-Alonso 2012).

Soap sheets are created by coating liquid soap onto a sheet. This process helps preserve the soap on the sheet, making it portable and convenient for use wherever you are. Soap sheets are available in various scents, so choosing the right one is simply a matter of selecting the fragrance that suits you. It is also possible to create your own soap sheets. The figure 9 below illustrates soap sheets (Bourahla 2023) .

Dermatological soap is formulated to be gentle on the skin, either as superfatted soap with moisturizing ingredients or as soap-free bars (syndets) made from synthetic detergents. It is less drying than regular soap. Antiseptic soap combines a detergent with an antiseptic agent to clean the skin before applying a separate antiseptic. The detergent removes contaminants that may reduce the antiseptic's effectiveness and must be rinsed off completely before further application. (Virbel-Alonso, 2012).

## 6 Physico-chimical properties of soap

### 6.1 pH of soap

The pH of soap influences both its cleansing effectiveness and its compatibility with the skin's natural pH balance (Ibouchoukene and Belaid 2024)

The average pH of healthy skin ranges from approximately 5.4 to 5.9, making it slightly acidic. Using soap with a pH that is too high can disturb this natural balance, creating an alkaline environment that may weaken the skin's protective barrier (Vivian *et al,* 2014).

An effective soap typically falls within the standard pH range of 9 to 11, ensuring both cleansing power and skin compatibility (Amnudi *et al,* 2015).

### 6.2 The foaming power

Foam is a thermodynamically unstable mixture of gas or air within a liquid matrix. This means that over time, the foam will eventually collapse, releasing the excess surface energy accumulated during the foaming process (Handayani, Aditiya, and Almaidah 2023).

Surfactants like soap lower the surface tension between water and oil, enabling the soap molecules to form a unimolecular film on the water's surface and penetrate tissues. The long non-polar tail of a soap molecule surrounds dirt, while the short polar head, containing the carboxylate ion, faces the water. This structure forms micelles, which encase the particles and emulsify them (Mijaljica, Spada, and Harrison 2022) (Zhang *et al,* 2003).

The foaming power of soap is influenced by both the type of soap and its concentration (Petkova *et al,* 2020).

The foam stability and weight loss during the curing (hardening) process ranged from 5.45 to 6.30 minutes and 13 to 18 grams, respectively (Amnudi *et al,* 2015).

### 6.3 Moisture Content

Measuring the moisture content of soap is essential for assessing product quality, as it directly influences shelf life (Ibouchoukene and Belaid 2024).

Excessive moisture can trigger a reaction between water and unsaponified fats, leading to the formation of free fatty acids and glycerol through a process known as soap hydrolysis during storage (Mahesar, Chohan, and Sherazi 2019).

This parameter is a key indicator of the soap's storage stability, microbiological resistance, and overall commercial quality (Ibouchoukene and Belaid 2024). An ideal moisture content typically falls between 8% and 15% (Mahesar *et al,* 2019).

Moisture content was found between 1.9 - 5.8% (Amnudi *et al,* 2015).

### 6.4 Total Free Alkali Content

Total free alkali content, or free alkalinity, refers to the amount of sodium hydroxide (NaOH) or potassium hydroxide (KOH) that remains unreacted after the saponification process

(Vivian *et al,* 2014). This value is typically expressed as a percentage by mass, depending on whether the soap is sodium- or potassium-based. Alternatively, it can be reported in milliequivalents per gram (Delinska, Perifanova-Nemska, and Dimitrova 2024).

For optimal quality, cold process soaps should have a free alkali content between 0.1% and 0.5%, while hot process soaps should ideally contain none (0%) (Enoua *et al,* 2022).

A high-quality soap is characterized by a low level of total free alkali (Amnudi *et al,* 2015).

### 6.5 Melting Point

The melting point of soaps, even when the fatty acid salt is unique and purified, remains relatively undefined, ranging between 200°C and 250°C when measured using a Koffler bench. The resulting liquid is transparent, not milky. At low temperatures in liquid water, soap dispersion is difficult through agitation, except for sodium laurate, which has a "short" C11 chain (Myers 2020; Rosen and Kunjappu 2012)

As the temperature increases, dispersion becomes easier, producing clear and opalescent soapy water. In a basic medium, with an optimal pH between 10 and 12, partial hydrolysis into free fatty acids and basic ions is observed. Dispersion is very weak in benzene, toluene, and most organic solvents, and the formation of reverse micelles is energetically less favored. The type of base used in saponification significantly affects the melting point of the synthesized soap—approximately 150°C with a mineral base and 200°C with a synthetic base (Goddard and Gruber 1999; Rosen and Kunjappu 2012).

The table 2 below presents the melting points of common soaps based on the type of base used.

**Table 2. Malting point of common soaps (Hamanache, 2023 )**

| **Soap** | **Calcium** | **Aluminium** | **Lithium** | **Sodium** | **Clay** |
|---|---|---|---|---|---|
| **Melting point (°C)** | 95 | 110 | 180 | 190 | infusible |

### 6.6 Wetting Power

Soapy water is more effective than plain water at penetrating small gaps on contact surfaces such as fabric fibers, dishes, tables, or skin (American Chemical Society, 2020).

When water with surfactant (such as soap) is used the surface tension is reduced, decreasing cohesion and allowing the liquid to spread more easily—thereby enhancing wetting efficiency (American Chemical Society, 2020)

### 6.7 The Emulsifying Power of Detergents in Water

As a surfactant, soap infiltrates the interface between oil and the fibers of a material, gradually breaking down greasy substances. It forms micelles—tiny spherical structures that trap and suspend oil droplets in water—enabling their removal. This process is known as the emulsifying power of detergents (Poré 1992) .

### 6.8 The Dispersing Power

The dispersing power of soap is attributed to the carboxylate ions and the structural properties of micelles. These micelles carry like charges, causing them to repel one another and remain evenly distributed in the soapy water, preventing reaggregation of particles (Poré 1992).

# *Chapter 02: Rosmarinus SP Overview*

## 1 Origin and Definition

The genus name *Rosmarinus* comes from the Latin term "Ros marinus," which means "dew of the sea." It is commonly found in the rocky regions of the Mediterranean basin (Segarra-Moragues *et al,* 2016).

Known for its strong fragrance, rosemary is a highly melliferous plant and has been used since ancient times for its aromatic and medicinal properties (Chevallier 1996).

## 2 Systematics.

According to APGIII (2009) (Haston *et al,* 2009), rosemary is classified as follows;

- Kingdom ………………………. Plantae
- Division…………………………Spermaphytes
- Subdivision……………………. Angiosperms
- Class…………………………… Dicotyledons
- Order…………………………... Tubiflorales
- Suborder………………………. Lamiales
- Family…………………………. Lamiaceae
- Genus…………………………. *Rosmarinus*
- Species………………………… *Rosmarinus officinalis L.*

**Common names:** Rosemary, incense, herb of crowns, rose of the seas, sea rose, RoseMarie (Chevallier 1996)**.**

**Vernacular name:** Azir, barkella, haselban, Aklil, iklil ljabal, klile (Algeria, Morocco, Tunisia) (Bellakhdar 2006)

## 3 Botanical description

The underground part of the rosemary plant consists of deep, taprooted roots, which are specialized in absorbing water and mineral salts, as well as anchoring the plant to the soil (Smith & Brown, 2020).

The aerial part of the plant consists of a stem that grows as a shrub or subshrub, with the stem of *Rosmarinus officinalis* reaching a height between 0.5 to 2 meters. It is twisted, angular, and fragile. The bark is linear, and the plant produces cymes that resemble spikes (Figure 5.b) (Anfal 2022).

The leaves of *Rosmarinus officinalis* are linear, wrinkled, leathery, sessile, and arranged oppositely on the stem. These rigid, glossy leaves have rolled edges, with the upper side appearing greenish and the underside being whitish and somewhat rough. The leaves range in size from 18 to 50 mm in length and 1.5 to 3 mm in width (Figure 5.c). When dried, rosemary leaves emit a strong aroma and possess a bitter taste. They contain up to 2% essential oils, including cineole and borneol, as well as alkaloids and organic acids. Due to their rubefacient properties on the skin, rosemary leaves and their essential oil are commonly used in antirheumatic treatments, particularly in alcohol-based rosemary spirit preparations (Madadori 1982).

The flowers of *Rosmarinus officinalis* are typically pentamerous and mostly hermaphroditic. The calyx is bilabiate and persistent, while the corolla is bilabiate and tubular, often featuring 4 to 5 subequal lobes or a single trilobed lower lip, with the upper lip bilobed. The androecium consists of four stamens, with a fifth highly reduced or sometimes absent, leaving just two stamens and two staminodes. The gynoecium consists of two biovulate carpels, each subdivided by a false partition into two univulate ocules (figure 7. D) (Bouhenouna, and others 2023).

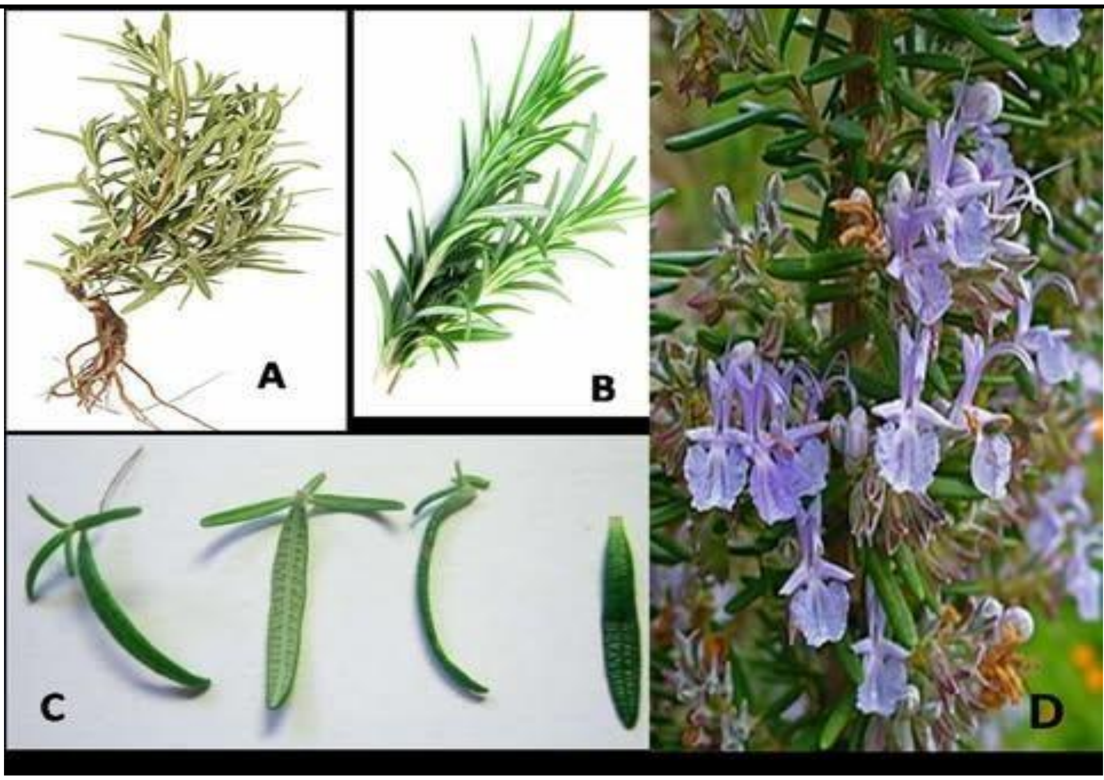



**Figure 5. Botanical description of *Rosmarinus officinalis L* (KÖHLER, 1897).**

## 4 Geographic distribution

Rosemary is native to Mediterranean region and grows in several countries across Europe and Asia, including Spain, Italy, Greece, and southern France, as well as in North Africa, from Morocco to Tunisia. It is also cultivated in regions such as India, the Philippines, the West Indies, Australia, the United States, and Mexico (figure 8) (Pelikan 1986).

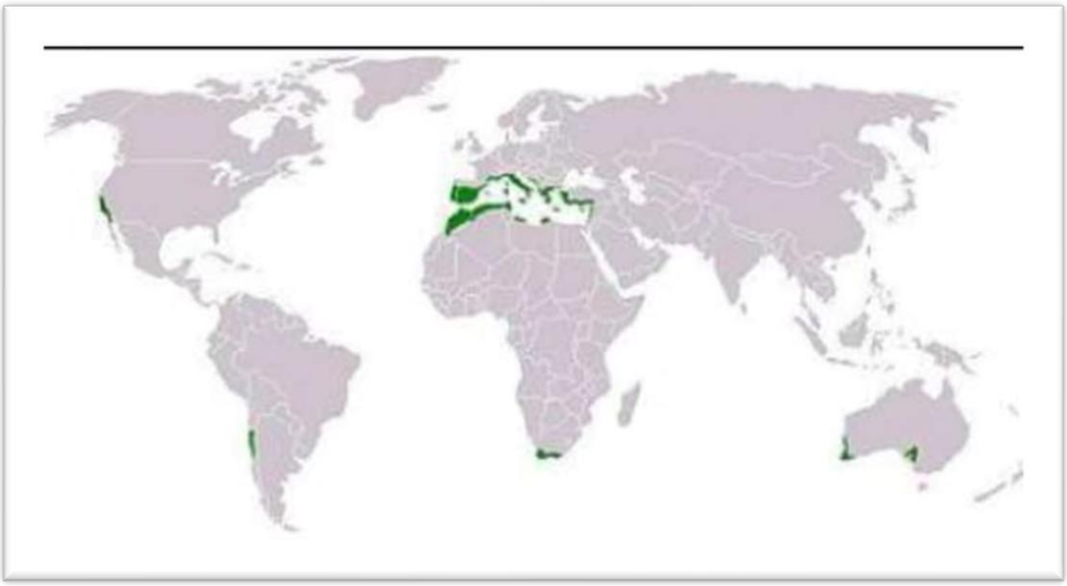


**Figure 6. The geographical distribution of *Rosmarinus officinalis L.* (Mostafai, 2015).**

In Algeria, rosemary covers an area exceeding 100,000 hectares and the main locations are reported in Table 3 (Bensebia *et al,* 2009)

**Table 3. The main locations of the rosmarinus officinalis L.in Algeria** (Bensebia *et al,* 2009)

| Wilaya | Superficie approximative |
|---|---|
| **Khanchla** | **5000 ha** |
| **M'sila** | **4500 ha** |
| **Souk ahras** | **4410 ha** |
| **Mila** | **4000 ha** |
| **Setif** | **3500 ha** |

## 5 Properties of Rosemary

### 5.1 Antibacterial Activity

Rosemary extracts and essential oil are widely recognized for their antimicrobial properties. The main active phenolic acids are carnosic acid and rosmarinic acid, while 1,8cineol, camphor, and α-pinene dominate the essential oil composition. These extracts inhibit various microorganisms, including Escherichia coli, Staphylococcus aureus, Candida albicans, and Saccharomyces cerevisiae (Dai and Liu 2021).

Research by Ekambaram et al. (2016) demonstrated their effectiveness against Staphylococcus aureus and methicillin-resistant strains (MRSA), with minimum inhibitory concentrations of 0.8 mg/mL and 10 mg/mL, respectively. The antibacterial activity of rosmarinic acid may be linked to its effect on virulence-associated surface proteins (Ekambaram *et al,* 2016). (Additionally, Cai Xiaojun *et al*. found that 1,8-cineol exhibited the strongest antibacterial effect against Salmonella, mainly by damaging the bacterial cell structure and causing intracellular leakage (Dai and Liu 2021).

### 5.2 Antifungal Activity

Rosemary essential oil has demonstrated strong antifungal potential. At a concentration of 450 ppm, it completely inhibited the biosynthesis of aflatoxins. These findings suggest that rosemary oil could serve as a natural preservative against Aspergillus parasiticus (Lee *et al.,* 2019).

Using the standard agar diffusion method, the biological activity of 11 essential oils including rosemary oil—was evaluated. The results revealed that these oils exhibited moderate inhibitory effects against five yeast strains: Candida albicans, Rhodotorula glutinis, Saccharomyces cerevisiae, and Yarrowia lipolytica (Benikhlef 2015).

### 5.3 Antiviral Activity

Rosmarinic acid exhibits antiviral properties, effectively inhibiting the growth of various viruses, including HIV, hepatitis B virus, and enterovirus 71 (Dai and Liu 2021).

Rosemary extracts have also demonstrated the ability to inhibit influenza virus replication and provide therapeutic benefits for virus-induced pneumonia injury (Dai and Liu 2021).

### 5.4 Antioxidant Activity

The antioxidant activity of rosemary extracts stems from various components like rosmarinic acid, sagenoic acid, and carnosol (Dai and Liu 2021).

Rosmarinic acid exhibits potent antioxidant properties by blocking lipid peroxidation through competitive binding with lipid peroxides. It also promotes the recovery of mitochondrial membrane (Ke and Zhimin 2019). On the other hand, carnosic acid interacts with other components and produces secondary antioxidants enhancing the overall antioxidant activity (Loussouarn *et al,* 2017).

### 5.5 Anti-inflammatory

Rosemary is also known for its anti-inflammatory properties. It works by inhibiting the production of pro-inflammatory molecules, thereby helping to reduce inflammation within the body (Harach *et al,* 2010).

### 5.6 Neuroprotective effects and Anticancer properties

Research also indicates that rosemary may offer neuroprotective benefits by reducing oxidative stress and inflammation in the brain. These effects suggest potential support for cognitive function and overall neurological health (Ibarra *et al,* 2011).

It has also been explored for its potential role in cancer prevention. It can inhibit the growth of cancer cells and promote apoptosis (programmed cell death) in various cancer types (Guan et al. 2022).

### 5.7 Antidepressant Effect :

Depression is a growing concern in China, and recent research has explored natural treatments. Rosmarinic acid, a compound found in rosemary, has shown antidepressant effects in animal studies. It promotes the growth of hippocampal astrocytes, increases BDNF levels, and activates ERK signaling, all of which help reduce depression-like behaviors (Dai and Liu 2021). Additionally, rosemary extracts exhibit anti-inflammatory properties, reducing levels of IL-1β, TNF-α, and microglial activation (Iba1) in the hippocampus. They also help restore a healthy gut microbiota balance, suggesting that their antidepressant effects may involve both neuroinflammation reduction and gut-brain axis modulation (Guo *et al,* 2018).

## 6 Uses of Rosemary in traditional medicine and cosmetology

Rosemary is widely cultivated for its essential oil, which is highly valued in traditional medicine. The aerial parts of the plant are commonly used orally to alleviate renal colic, ease dysmenorrhea, and act as an antispasmodic. Additionally, rosemary has been recognized for its ecological value, particularly in preventing soil erosion (Benikhlef 2015).

Rosemary oil has been used for centuries as a key ingredient in beauty products and soaps, as well as for seasoning and preserving various food items (Benikhlef 2015).

Shampoos containing rosemary essential oil are commonly used to regulate excess oil and treat oily scalps (Berbache, Nekaa, 2022).

Extracts from Rosmarinus officinalis leaves have been shown to promote hair growth.(Murata *et al,* 2013)

According to Martini (2011), rosemary is also widely used in perfumery, particularly in men's fragrances and colognes, as well as in the formulation of skin ointments. Thanks to its ability to stimulate cutaneous nerve endings, rosemary serves as a tonic in bubble baths and as a liniment for relieving muscle fatigue when applied at concentrations of 1 to 2%. Its dermopurifying properties also make it a valuable ingredient in the production of deodorants, lotions, and shampoos .(Martini 2011; May 2014).

# Part 2: Practical Part

# Chapter 1: Materials and Methods

**Work objective**

The experimental part was carried out in the biochemistry laboratory and the microbiology laboratory of the Faculty of Natural and Life Sciences at the University of May 8, 1945.

**Specific Objectives**

The main goals of this work are the following:

- ✓ To extract rosemary essential oil and characterize it through physicochemical analyses and assess its quality and composition.
- ✓ To formulate and produce an artisanal soap by incorporating natural vegetable oils flavored with the extracted rosemary essential oil, while adhering to good manufacturing practices.
- ✓ To evaluate the properties of the final soap in order to validate its quality and effectiveness.

## 1 Extraction of rosemary essential oil

### 1.1 Laboratory Equipment:

During the experiment, the following materials were used:

- A hydrodistiller comprising: a heating flask, a 2-liter flask, a ball condenser, a Clevenger-type essential oil separator.
- A reagent: tap water
- A beaker
- A syringe
- An analytical balance

➢ **Plant material**

The plant in this work, comes from the 8 May 1945 University. It was harvested in the green spaces of the University of Guelma in early the morning hours.

The parts of the plant used are the aerial parts consisting of the leaves and stems.

The harvest was carried out during the flowering period, at the beginning of April.

**1.2 Extraction of rosemary essential oil:**

- **Hydrodistillation**

Hydrodistillation is the standard method employed for the extraction of essential oils (Afnor 1992), and it also serves as a reference technique for quality control procedures (Européenne 1996).

Hydrodistillation is a technique used to extract essential oils by boiling plant material in water. As the mixture heats, plant cells break down and release aromatic compounds, which evaporate with water vapor to form an azeotropic mixture. This allows the combined vapor to distill at around 100 °C, lower than the boiling points of most individual components. The vapor is condensed in a Florentine flask, where the essential oil separates from the aqueous phase (hydrosol) due to density differences. The hydrosol can be discarded or recycled through cohobation. In laboratory settings, the Clevenger apparatus is the standard tool for this process and is recognized by the European Pharmacopoeia (figure 7) (Clevenger 1928).

- **Protocol**

The essential oil of rosemary (Rosmarinus officinalis) was extracted by hydrodistillation using a Clevenger apparatus. A quantity of 250 g of fresh rosemary was introduced into a distillation flask containing 1.5 L of distilled water. The setup was completed with a watercooled condenser and an oil collection tube. Boiling chips were added to prevent bumping. The mixture was heated gently to a boil for approximately 3 hours. The steam carrying the volatile compounds was condensed in the condenser, and the essential oil was separated from the water in the graduated arm of the Clevenger apparatus. At the end of the distillation, the essential oil was collected using a pipette and stored in an amber glass bottle, protected from light and heat. This extraction method was used to preserve the aromatic and therapeutic properties of the essential oil (Guenther 1972).

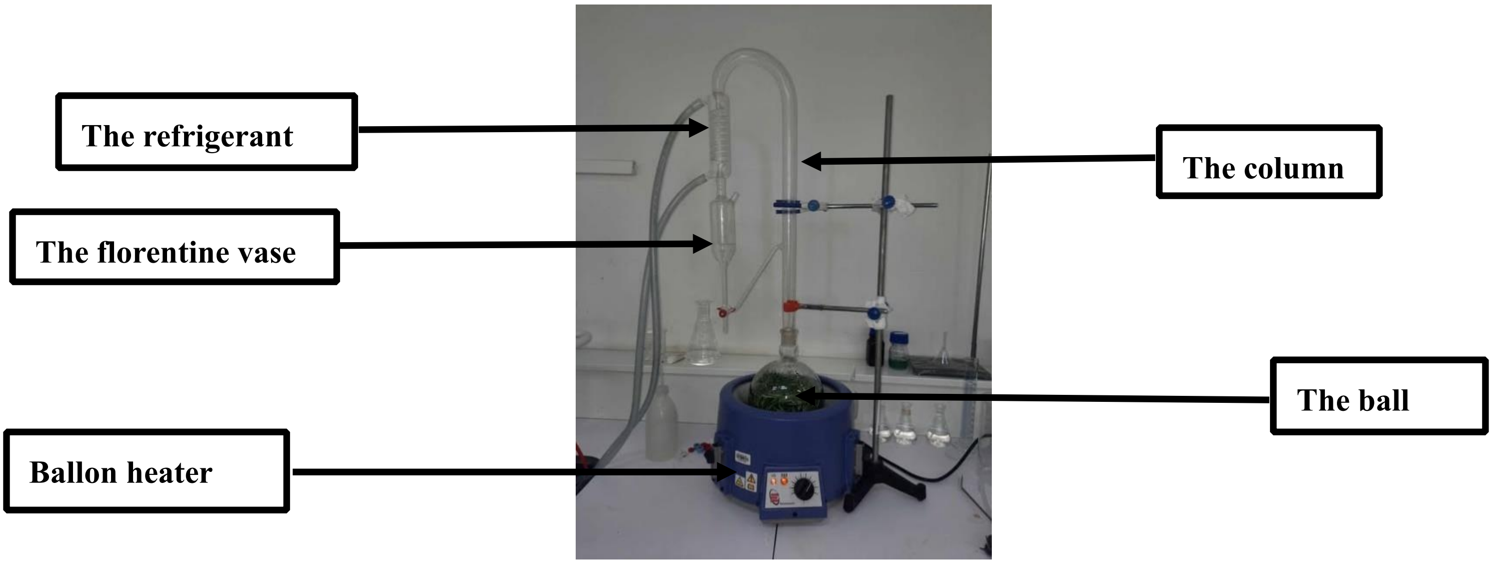



**Figure 7. hydrodistiller assembly (clivenger)**

### 1.3 Cracterisation

#### 1.3.1 Organoleptic Tests:

The sensory properties of rosemary essential oil were assessed, starting with the appearance, color then the odor, in reference to the standards of European Pharmacopoeia 11th ed. (2023), the ISO and AFNOR standards under ISO/TC54. Essential oil was evaluated based on the following specific criteria: Rosemary (ISO 1342:2012)

#### 1.3.2 Physicochemical tests

##### 1.3.2.1 Determining Essential Oil Yield (EOY):

In accordance with (Afnor 1992), the EOY is calculated as the ratio of the mass of essential oil obtained after extraction (MHE) to the mass of plant material used (Mmv), as described by (Mouas 2018). This yield is expressed as a percentage using the formula:

$$\text{EOY (\%)} = \frac{MHE}{Mmv} \times 100$$

Where:

MHE: Mass of the extracted essential oil (in grams)

Mmv: Mass of the plant material used (in grams)

EOY: Essential oil yield

#### 1.3.2.2 Determining pH:

pH measures the acidity or basicity of a solution. It is a coefficient used to determine whether a solution is acidic, basic, or neutral: a solution is acidic if its pH is below 7, neutral if it is equal to 7, and basic if it is above 7.

➢ **Procedure:**

A few drops of essential oil were added to a piece of pH paper. Once the color of the paper changed, it was compared to a range of colors that vary depending on the pH."

#### 1.3.2.3 Refractive Index

The refractive index is a purity criterion for essential oils (Kaloustian and Hadji-Minaglou 2012). According to the 11th edition of Ph. Eur.11e ed (2023) (Slimani and Maghnini 2023), The refractive index was measured using an Abbe refractometer, previously calibrated with distilled water at 20 °C +/- 0.5 °C.

➢ **Procedure**

In the first step, the refractometer's prism was thoroughly cleaned with distilled water and absorbent paper. Then, a few drops of the essential oil were placed in the center of the prism using a micropipette, and the temperature was set to 20°C. Finally, the readings were taken (figure 8) This procedure was carried out in accordance with ISO 280:1998, which specifies the method for determining the refractive index of essential oil..


**Figure 8. Refractometer**

#### 1.3.2.4 Thin-layer chromatography (TLC)

Thin-layer chromatography (TLC) is a planar separation technique that utilizes a thin layer of stationary phase—commonly a silica plate—and a liquid mobile phase. This method was employed to separate and identify the constituents present in our essential oil samples.

Following the standards set by the 11th edition of the European Pharmacopoeia (2023) (Stahl 2011):

- **Sample Preparation**

The rosemary essential oil was diluted in toluene.

- **Mobile Phase Preparation**

5 mL of ethyl acetate were mixed with 95 mL of toluene.

- **TLC Plate Development**

A drop of the diluted sample was applied into the TLC plate.

The plate was placed in a chamber containing the mobile phase.

It was allowed to migrate until the solvent reached the top of the plate (figure 9).

- ✓ **Drying**

The plate was removed and allowed to air dry.

- ✓ **Development**

First, the plate was observed under daylight. Then, the vanillin developer (prepared with 2 mL of sulfuric acid per 100 mL of a 10 g/L vanillin solution in ethanol) was applied.

Gentle heating was applied, if necessary, to make the spots appear.

The obtained result was compared with those described in the 11th edition of the European Pharmacopoeia (2023) (SlimanI and Maghnini 2023).

- **Preparation of vanillin revelator Solution**

Following standard safety precautions, slowly add 2 ml of sulfuric acid drop by drop to 50 ml of a 0.5 g/L vanillin solution in alcohol (Slimani and Maghnini 2023). .

Store for up to 48 hours.

This procedure was carried out in accordance with the European Pharmacopoeia 11th Edition (2023), which provides standardized methods for the identification of essential oil using TLC.

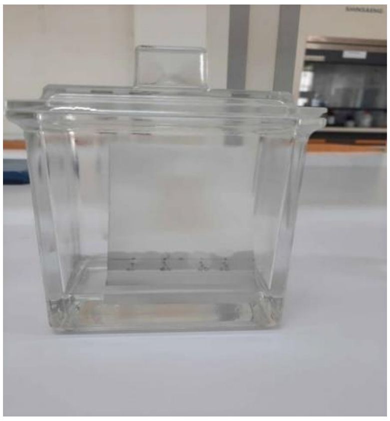


**Figure 9. The migration of the drop of the diluted simple into the TLC plate**

#### 1.3.2.5 Calculation of Density:

The density of an essential oil was defined as the ratio between the mass of the essential oil and its volume. The following formula was used (Hüsnü Can Başer and Buchbauer 2015)**.**

$$D = \frac{MEO}{VEO}$$

Where:

D:Density

MEO: Mass of Essential Oil (g)

VEO: Volume of Essential Oil (ml)

#### 1.3.2.6 Acid Index:

The acid index (AI) is a key parameter for detecting alterations and assessing the quality and purity of essential oils (Kaloustian and Hadji-Minaglou 2012). The acid index represents the amount of potassium hydroxide (in milligrams) required to neutralize the free acids present in 1 g of solution.

➢ **Procedure**

According to the European Pharmacopoeia 11th Edition (2023) (Ph. Eur., 2023) (SLIMANI and MAGHNINI 2023), the acid value of the rosemary essential oil was determined by titrating a 2 g sample diluted in a 1:1 mixture of petroleum ether and ethanol (10 mL total volume). The titration was carried out using 0.1 M potassium hydroxide and phenolphthalein as an indicator. The endpoint was identified by the appearance of a persistent pink coloration (Figure 10). The acid value was then calculated using the standard formula provided in the pharmacopoeia

$$AI = 5{,}611 \times \frac{n}{m}$$

Where:

AI: Acid index

n: Burette reading in ml

m: Mass of diluted essential oil in g

**Figure 10. Acid index**

### 1.3.2.7 Moisture Content:

Moisture content refers to the ratio between the weight of water present in a material and the weight of that same material in its dry state. It can also be defined as the amount of water per unit weight of dry material (Anon 2008).

Oven drying is the most common method for removing water from solids. However, this technique is not suitable for substances that decompose or for those whose water cannot be eliminated at the oven's operating temperature (Skoog and West 2015). Moisture content analysis in food is a key quality control parameter, though obtaining accurate and precise results can be challenging. The method is based on measuring the weight of a test sample before and after oven drying at 40°C for 3 days (Lapointe-Vignola 2002). The calculation is performed using the following formula

$$Moisture\ (\%) = (\ initial\ mass - \frac{final\ mass}{initial\ mass}) \times 100$$

# 2 Soap making

## 2.1 Laboratory equipment

**Safety Equipment:**

- Lab Coat
- Safety Goggles
- Face Mask
- Gloves

**Equipment Used for Preparation**

- Scale
- Heat-Resistant
- Glass Crystallizer
- Thermometer
- Mold silicone
- Beaker
- Silicone Spatula
- Hand Blender
- Magnetic Stirrer

**Raw materials**

- Olive oil came from a rural region called El Mohgan, located in the municipality of El Fedjoudj Guelma).
- Palm oil come from El Captain for oil & herbs extraction (Egypt).
- Castor oil come from El Captain for oil & herbs extraction (Egypt).
- Coconut oil come from Blida Algeria.

**Chemical product**

▪ NAOH

▪ Water.

### 2.2 Experimental protocol

According to (Colleaux 2018) the manufacturing method used is cold saponification. The process is as follows:

#### 2.2.1 Preparation of the lye solution

The mass of lye to be used was calculated using the saponification index of each of the mixed oils. (Table 4).

NaOH (g) = IS × mass of the oil

**Table 4. Mass of sodium hydroxide needed (g) and Saponification index of the oils**

| Oils | Mass (g) | Mass of sodium hydroxide needed (g) | Saponification index |
|---|---|---|---|
| **Palm oil** | 150 | 21.15 | 0,035 |
| **Olive oil** | 225 | 30.15 | 0,035 |
| **Coconut oil** | 100 | 19 | 0,085 |
| **Castor oil** | 25 | 3.225 | 0,038 |

It is very important to be careful when preparing lye (sodium hydroxide solution). It should be done in an open or well-ventilated area. To dissolve it in water, it should be slowly poured into the water, not the other way around.

#### 2.2.2 Soap Preparation

The lye solution was prepared by slowly pouring the lye (23 g) into the water (57 mL) (never the other way around), and the mixture was stirred gently until it was fully dissolved, (figure 11. A)

The temperature of the solution was checked to ensure it was between 38 °C and 49 °C before mixing.

The oils were also heated or cooled to reach the same temperature range.

Once both the lye solution and the oils were at the right temperature (figure 11. B), the lye was slowly poured into the oils and the mixture was stirred thoroughly until what is called “light trace” was reached—a slight thickening of the mixture indicating that saponification had begun.

At this point, about 3 grams of rosemary essential oil were added drop by drop, and the mixture was stirred again (figure 11. C.).

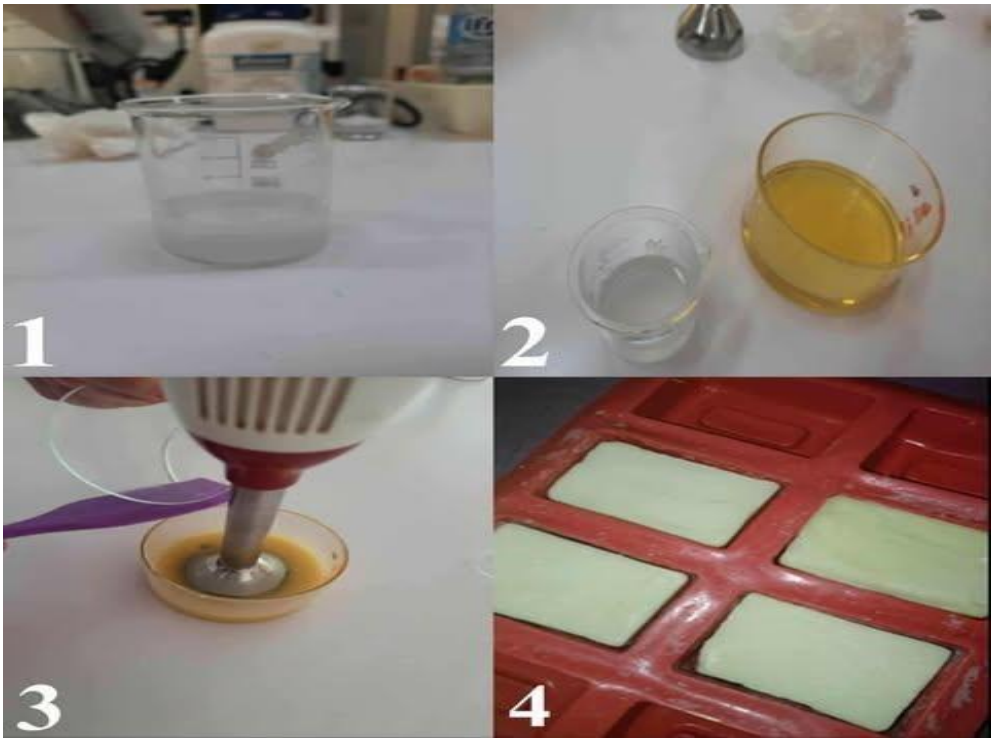



**Figure 11.Soap preparation**

- **Molding**

Before the soap was poured into the mold, the mold was sprayed with alcohol to help prevent air bubbles.

After the soap was poured, the top was lightly sprayed with alcohol again (figure 11.D).

- **Drying:**

Drying was considered essential before the soap could be used after it was made.

The minimum duration of this curing process was set at 4 weeks, and it was carried out in the open air, as shown in figure 12.

This period was allowed for the saponification process to be properly completed and for the pH to be adjusted (making the soap less caustic and therefore milder).

It was also noted that the more a soap was allowed to dry, the harder it became.

**Figure 12. Drying**

### 2.3 Physicochemical tests

#### 2.3.1 Determination of Soap pH:

**Principle**:

The current concern regarding soap is related to its pH, which measures the concentration of $H^+$ ions in an aqueous solution and indicates its level of acidity or alkalinity on a scale of 0 to 14. Human skin has an average pH of 5.5, which is slightly acidic, while most soaps are formulated with a basic pH, greater than 7 (Saadoudi Hadjer 2022).

- **Procedure**

The pH of the soap was measured in accordance with ISO 21130:2019, which outlines standard procedures for determining the pH of cosmetic products. In this method, 0.5 g of soap was dissolved in 150 mL of distilled water, and the solution was stirred using a magnetic stirrer for 2 minutes to ensure homogenization. The pH was then measured using a calibrated pH meter, as shown in Figure 13.

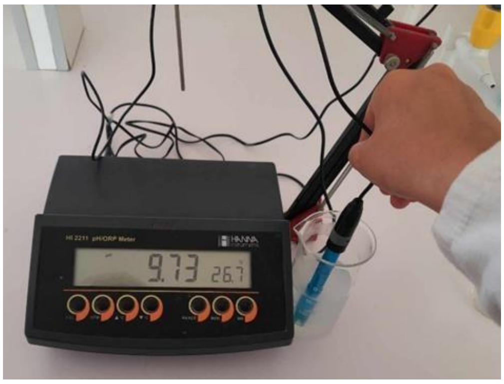



**Figure 13. Soap pH**

### 2.3.2 Foaming Power:

Foam is a thermodynamically unstable suspension of gas or air within the matrix of a liquid. This means that given enough time, the foam will eventually collapse to release the additional surface energy gained during the foaming process (*Handayani et al,* 2023).

- **Procedure**

The foaming capacity of the produced soaps was evaluated based on the method described by (Yarovoy and Post 2016). It was assessed by calculating the percentage reduction in foam

Foam stability was assessed by preparing a 1% soap solution in distilled water. 10 mL of this solution was transferred into a 250 mL graduated cylinder, and the mixture was manually shaken for 2 minutes. Immediately after agitation, the foam height was measured using a graduated ruler and recorded as the initial height ($H_0$). After 10 minutes, the foam height was recorded again as the final height (Hf) (Figure 14).

This test is based on commonly accepted methods used in cosmetic formulation studies (Littré *et al.,* 2000) and parallels the ASTM D1173-53(2019) standard, which measures foam generation and stability in detergent solutions. Foaming Power Calculation:

$$Foaming\ Power\ (\%) = \frac{(H_0 - Hf)}{H_0} \times 100$$

Where:

$H_0$ = Initial foam height

Hf = Final foam height

**Figure 14. Foaming power**

### 2.3.3 Determination of Total Free Alkali Content of Soaps (ISO-684-1974, 1974)

- **Principle**

The principle of this method involves dissolving the soap in an ethanolic solution, followed by the neutralization of the free alkali using a sulfuric acid solution, the excess of which is known and measured by back-titration with an ethanolic potassium hydroxide solution.

- **Procedure**

First, the ethanol was neutralized using an approximately 0.1 N ethanolic potassium hydroxide solution in the presence of phenolphthalein.

Then, a 5 g sample of grated soap was introduced into a 250 mL Erlenmeyer flask, and 100 mL of neutralized ethanol was added.

The mixture was stirred and heated until the soap was completely dissolved.

Titration was then carried out by adding 0.1 N sulfuric acid to the mixture until the pink color of the phenolphthalein disappeared.

The volume of sulfuric acid required to reach the equivalence point, noted as V1, was recorded.

As the titration progressed, the pH was observed to decrease slightly, and a first equivalence point was detected around pH 8.3.

The value of the total free alkali content was calculated using the following formula:

$$Alkali\% = \frac{V.N}{10.P}.E$$

Where:

V: Volume of $H_2SO_4$ (ml)

N: Normality of $H_2SO_4$ (0.1 N)

Eq: Gram equivalent of NaOH (40 g)

PE: Test sample weight (g)

### 2.3.4 Determination of Water Content (Moisture) (ISO 672: 1978)

Water in a soap mixture function to dilute the alkali (sodium or potassium hydroxide) and disperse the molecules, allowing them to move and react more easily with fatty acid molecules. Therefore, determining the moisture content is an important parameter in soaps.

- **Procedure:**

An empty crucible was weighed using a precision balance.

A soap sample of approximately 10 g ± 0.01 g (grated for faster drying) was added to the crucible.

The crucible was placed in an oven at 104 °C for 3 hours, then was removed and was placed in a desiccator to cool.

The crucible was weighed again and then was returned to the oven for 1 hour.

If the weight difference between two consecutive weighings exceeded 0.01 g, the operation was repeated until the difference was less than 0.01 g.(ISO 672: 1978)

The moisture content is calculated using the following formula:

$$H\,(\%) = 100 - \frac{PF - P0}{PI - P0} \times 100$$

Where:

H (%): Moisture content percentage

P0: Weight of the empty crucible (g)

PI: Weight of the crucible and sample before heating (g)

PF: Weight of the crucible and sample after heating (g)

### 2.3.5 Evaluation of the Antiseptic Effectiveness of Soaps

The objective of this study was to assess the fungicidal effectiveness of the obtained soap. The experimental protocol was developed based on previous studies aimed at evaluating the effectiveness of different disinfectants (Herruzo-Cabrera, Vizcaino-Alcaide, and FdezAcinero 2000) (Marchetti et al. 2003).

- **Materials**

- Petri dishes
- Swab Microbiologique
- 100 µL micropipette
- Test tube

- **Experimental Protocol**

The experimental protocol was conducted in several stages: fungal samples were taken from the operator's hands before and after washing with the synthesized soap.

**Step 1: Preparation of Solid Medium:**

- A culture medium Saboraud chloramphenicol was prepared.
- The medium is poured into Petri dishes placed next to the Bunsen burners and left to cool until solidified.

**Step 2: Antifungal Sampling Before Washing**

- A first fungal sampling was performed on unwashed hands to determine the initial skin flora of the operator. This sampling served as a baseline to assess the soap's ability to eliminate fungi from the skin.
- The sampling was conducted for each hand by pressing each hand lightly for 5 seconds onto the surface of Petri dishes). All manipulations were performed in a single day.

**Step 3: Fungal Sampling After Washing**

The hand disinfection process was similar to a preoperative surgical disinfection procedure:

The operator vigorously rubbed each area of both hands with the soap. The hands were thoroughly washed under running water for one minute. After rinsing and drying, a second sampling was performed in the same manner as the initial sampling.

**Step 4: Fungal Enumeration**

At the end of the different manipulations, the agar plates containing the samples were incubated for 72 hours at 30°C. After the incubation period, the fungal colonies present in each dish were counted.

# *Chapter 2: Results and Discussion*

# 1 Oil analysis

## 1.1 Organoleptic Characteristics of Rosmarinus officinalis Essential Oils

The organoleptic characteristics (appearance, color, odor, taste) are the only indications for assessing the quality of an essential oil as chows in the table 5:

**Table 5. Organoleptic Characteristics of Rosmarinus officinalis Essential Oils**

| Organoleptic Characteristics | Analyzed sample | Standards AFNOR (2000) |
|---|---|---|
| **Aspect** | liquide , mobile, clear | liquide , mobile, clear |
| **Color** | pale yellow | Colorless to pale yellow |
| **Odor** | Distinctive fresh odor, more or less camphorlike". | Distinctive fresh odor, more or less camphor-like". |

According to (Afnor 1992), essential oils are typically liquid at room temperature and volatile, which distinguishes them from so-called fixed oils (vegetable oils). They are generally more or less colored and have a lower density than water. The organoleptic parameters of our essential oils are consistent with those outlined in the AFNOR standards (Afnor 1992), indicating that the oils extracted from Rosmarinus and Origanum possess good sensory quality.

However, organoleptic characteristics—such as color, odor, and appearance—are only preliminary indicators for assessing the quality of an essential oil. Since these properties offer limited insight into the oil's full composition, more precise analytical techniques are required for accurate characterization. The quality and commercial value of an essential oil are ultimately determined by established standards based on its physicochemical indices (Yaacoube And Tlidjane, 2018).

### 1.2 Physicochemical Analysis

#### 1.2.1 Essential Oil Yield

Essential oil extraction was carried out by hydro-distillation using a Clevenger apparatus (Clevenger, 1928). A total volume of 4 mL of essential oil was collected, corresponding to an extraction yield of 0.29% as chows in the figure 15.

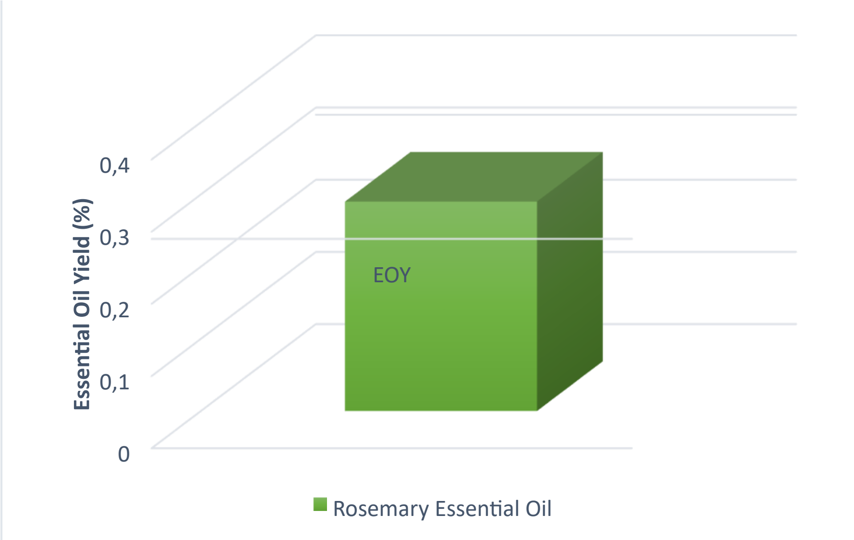



**Figure 15. Rosemary Essential oil yield**

The average yields of essential oils were calculated based on the fresh plant material. Rosmarinus officinalis samples provided a relatively low yield of about 0.29%. This yield is lower compared to those reported by (ABOURA Manel and BELGUENDOUZ Aziza, 2021) (0.36%) and (Makhloufi 2010) (1.52%),who used the same extraction method. The difference in results is likely due to factors such as the species' origin, harvest time, plant organ used, and extraction method, all of which can directly influence essential oil yields.

Additionally,(Williams and Lusunzi 1994) demonstrated that the composition of essential oils extracted by hydro-distillation can be influenced by the amount of water added to the distillation flask, as certain compounds such as terpinene-4-ol, α-terpineol, and cineole are poorly soluble in water.

The low yield obtained could be related to the method and extraction conditions used in the laboratory. Indeed, the oil was extracted using hydro-distillation with a spiral condenser, whereas hydro-distillation typically employs a simple condenser. Moreover, we observed essential oil residues in the condenser, indicating losses during the process (Goddard and Gruber 1999)(Azwanida 2015).

### 1.2.2 Hydrogen Potential

The pH of Rosmarinus officinalis essential oil was between 5 and 6, as shown in Figure 16, which was considered acidic. It was important to highlight that pH played a crucial role in chemical and biochemical reactions and could influence the stabilizing properties of an essential oil. Consequently, this pH value might have contributed to a favorable stabilizing effect against microorganisms, allowing the essential oil to act as a natural preservative in food products (Burt 2004; Tahire 2018).


**Figure 16. Hydrogen Potential (pH)**

### 1.2.3 Refractive index

The refractive index value of Rosmarinus officinalis essential oil was found to be 1.46, as shown in Figure 17, which was consistent with ISO 1342:2012 and the European Pharmacopoeia standards for Rosmarinus officinalis essential oil, where the refractive index ranges from 1.464 to 1.472.

The low refractive index of 1.46 indicated weak light refraction, which supported our findings and suggested the potential suitability of this essential oil for use in cosmetic products.(Kanko *et al,* 2004).


**Figure 17. Refractive index**

Similar results were reported in other studies, such as that of (Ougaida and Fethi, 2018), who found a refractive index of (1.45).

### 1.2.4 Thin-layer chromatography (TLC)

TLC was performed to compare the chemical profiles of two Rosmarinus officinalis essential oil samples: one artisanal and the other commercial. The results showed that both samples exhibited two main spots with similar, though slightly different, Rf values, as shown in Figure 18.

**Comparison:**

According to (Pavia *et al,* 1995; Stahl 2011):

**1. Based on spot migration (relative position on the plate)**

Both samples displayed two spots each, with similar migration positions, suggesting the presence of comparable compounds in both essential oils.

The slight differences in migration may have been attributed to:

- ✓ Minor variations in concentration,
- ✓ Differences in purity or chemical composition (e.g., varying levels of specific aromatic compounds),
- ✓ Slight differences in experimental conditions, such as temperature, chamber saturation, or the nature of the mobile phase.

**2. Based on Rf values (retention factor)**

The Rf values are very close between the two oils as chows in the table 6:

- ✓ Spot 1: 0.24 (artisanal) vs 0.21 (commercial)
- ✓ Spot 2: 0.66 (artisanal) vs 0.63 (commercial)

This suggests that both oils likely contain the same main constituents, although their concentrations or proportions may vary slightly.

**Conclusion:**

Both essential oils appeared to have a similar qualitative composition.

The slight differences in Rf values possibly indicated minor variations in the concentration or quality of the compounds.

The artisanal essential oil might have contained more concentrated or purer substances; however, further analysis such as gas chromatography–mass spectrometry (GC-MS) would have been required to confirm this.

It was not possible to precisely identify the compounds corresponding to the different spots observed on the TLC plate, due to the lack of appropriate analytical equipment and the absence of reference standards.

Consequently, the interpretation was limited to a comparison of the chromatographic profiles—namely, the number of spots, their migration, and Rf values—without confirmation of the chemical identity of the substances present.

**Table 6. Thin-layer chromatography (TLC)**

| Sample | Spot 1 (Rf) | Spot 2 (Rf) |
|---|---|---|
| **Artisanal essential oil** | 0.24 | 0.66 |
| **Commercial essential oil** | 0.21 | 0.63 |

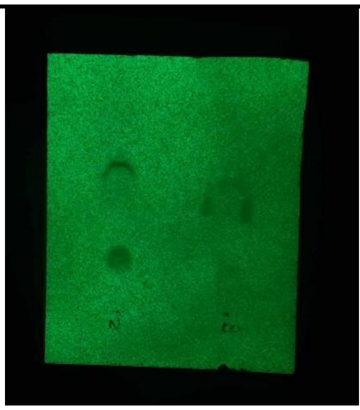


**Figure 18. Thin-layer chromatography (TLC)**

### 1.2.5 Density

The specific gravity of the essential oil was measured at 0.94, serving as a key indicator in assessing its purity. Typically, the specific gravity of most essential oils ranges from 0.696 to 1.88. Oils with a specific gravity below 1.0 are generally rich in oxygenated aromatic compounds.

A slightly lower density value was reported in another study by (Aouaichia, Bechiri, and Habtoun, 2024), who found a specific gravity of (0.901).

### 1.2.6 Acid index

The acid value of Rosmarinus officinalis essential oil was found to be 1.96 (Figure 19), which was consistent with the range reported by (Afnor 1992), falling between 0.5 and 2.

With an acid value of 1.96, the essential oil likely contained a low concentration of free fatty acids, indicating good quality, purity, and freshness. A low free fatty acid content is generally preferred, as it suggests that the oil underwent minimal chemical degradation and oxidation (Lion, 1955).

A slightly lower acid value was reported in another study by (Aouaichia, Bechiri, And Habtoun, 2024), with a value of (1.14).

**Figure 19. Acid index**

**1.2.7 Humidity**

The moisture content of the rosemary plant *(Rosmarinus officinalis)* was determined by oven drying at 40 °C until a constant weight was reached. Measurements showed an average moisture content of 65% in the freshly harvested leaves as chows in the figure 20.

The high moisture content (approximately 65%) observed in fresh rosemary highlights the importance of considering the condition of the raw material prior to essential oil extraction. In fact, using the fresh plant is generally preferred for several reasons:
The richness in volatile compounds is often greater in the fresh plant, as essential oils are more concentrated before drying. Drying may lead to a significant loss of certain aromatic and active compounds through evaporation or thermal degradation. Extraction from fresh material can yield a higher amount of essential oil with better organoleptic and chemical quality. Therefore, to maximize both the quality and quantity of extracted essential oils, it is recommended to use the fresh plant or to apply a controlled drying process that minimizes the loss of moisture and active constituents (Boutabia *et al.* 2016; Isma and Sabah 2021).

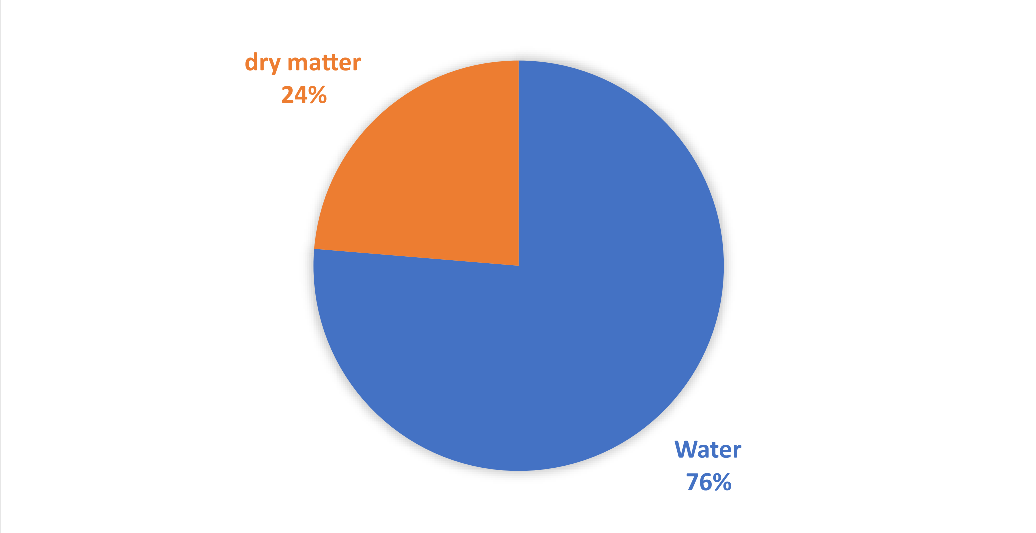



**Figure 20. humidity level of the Rosmarinus officinalis plant**

## 2 Soap analysis

### 2.1 Organoleptic Tests:

**Table 7. Organoleptic Tests**

| Morphological characteristics | Soap obtained |
|---|---|
| **Shape** | Rectangular |
| **Color** | Beige / off-white |
| **Homogeneity** | Homogeneous |
| **Consistency** | Dry and firm |
| **Odor** | Aromatic rosemary scent |
| **Weight** | 50 g |

### 2.2 The determination of hydrogen potential (pH)

One of the major current concerns regarding soap is its pH level. The pH is typically tested after the soap has cured for two weeks to two months, depending on the manufacturing method (tan tai and Lier 1999).

In this study, the pH was found to be 9.73, as shown in Figure 21, indicating a basic pH.

A comparison with widely available commercial soaps, such as Johnson's baby soap, whose pH ranges between 9.8 and 9.9, confirms that the results obtained fall within an acceptable range in the market (Ibouchoukene and Belaid 2024)

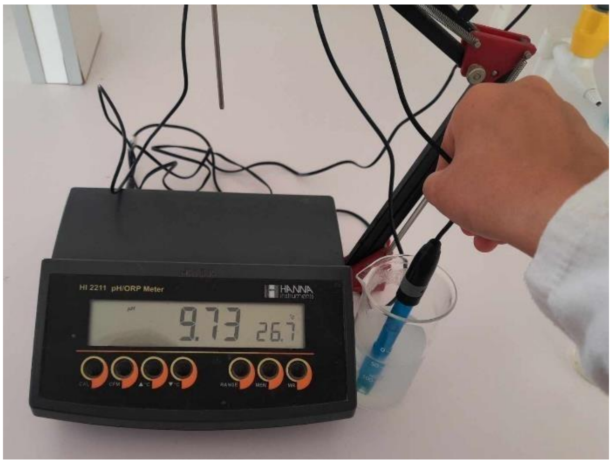



**Figure 21. Hydrogen potential (pH)**

### 2.3 Determination of foaming power

Foam is a biphasic medium composed of liquid and gas, with gas making up the majority of the foam and being dispersed throughout a small amount of liquid. The air bubbles within the foam trap dirt and impurities. It is therefore assumed that the firmer the foam, the more effective it is at cleaning (De L' *et al*,. 2023).

Depending on the nature of the starting fat, soaps could produce abundant foam (B and H 2023). The foaming ability of the cold-processed soaps in tap water indicated good solubility, with a calculated foam rate (FR) of 50%, as shown in Figure 22.

This value was comparable to that of commercial Dove soap, which was known for its good foaming power (Ibouchoukene and Belaid 2024).

Soaps with slightly lower foaming power may be formulated with oils and ingredients that produce less lather but offer other benefits, such as better hydration or soothing properties for the skin. For example, soaps made with vegetable oils rich in unsaturated fatty acids may produce less foam but are known for their nourishing and moisturizing benefits (Recioui and Chahma, 2024).

**Figure 22. foaming power**

### 2.4 Total Free Alkali Content of Soaps

The free caustic alkali content determined in our soap was 0.016%. This value indicated the minimal amount of caustic soda present in the finished product. It could be stated that the value obtained complied with good practice guidelines, which specify that a residual sodium hydroxide level between 0.1% and 0.5% is generally considered acceptable for cold process soap making. For sensitive skin, however, a level of 0.1% is recommended (ISO 684:1974).

Other studies reported slightly higher results, such as those by (Ibouchoukene and Belaid, 2024), who found values of 0.08% and 0.09%, respectively.

### 2.5 Water Content (Moisture)

The moisture content values of the natural soap ranged between 1.57% and 4.02%, as shown in Figure 23. According to the literature, the moisture content of soaps varied between 24.90% and 43.24%, while commercial soaps typically had moisture contents between 30% and 35% (Croxen and Finlay 2010).

In this study, the natural soaps exhibited a lower moisture content, which could be attributed to the absence of additives that retain moisture. This low water content might also have been linked to the manufacturing methods used, which did not incorporate hygroscopic substances. Furthermore, under conditions of low humidity, soaps with less water were harder and more durable, making them more economical in the long run as they dissolved less quickly. The ISO 672-1978 standard sets a tolerance threshold between 13% and 16%.

**Before** **After**


**Figure 23. The moisture content values of the natural soap before an after draying**

### 2.6 Evaluation of the microbiological efficacy of prepared soaps:

**Evaluation of the antifungal efficacy of prepared soap after hand washing:**

Note: This test is performed to evaluate the antimicrobial activity of soaps, knowing that we have not added antiseptic compounds, so this activity is linked to that of essential oils used for the preparation of soaps.

This study aimed to assess the effectiveness and lasting impact of the soap after handwashing. The experimental procedure was adapted from a study evaluating a surgical soap (Tanneur 2006). However, our experiments involved one operator.

Figure 24 shows the agar plates from samples taken from Operator 1 before and after handwashing with the synthesized soap, following incubation. Bacterial colonies are visible on both the pre-wash (figure 24. a) and post-wash (figure 24. b) plates.

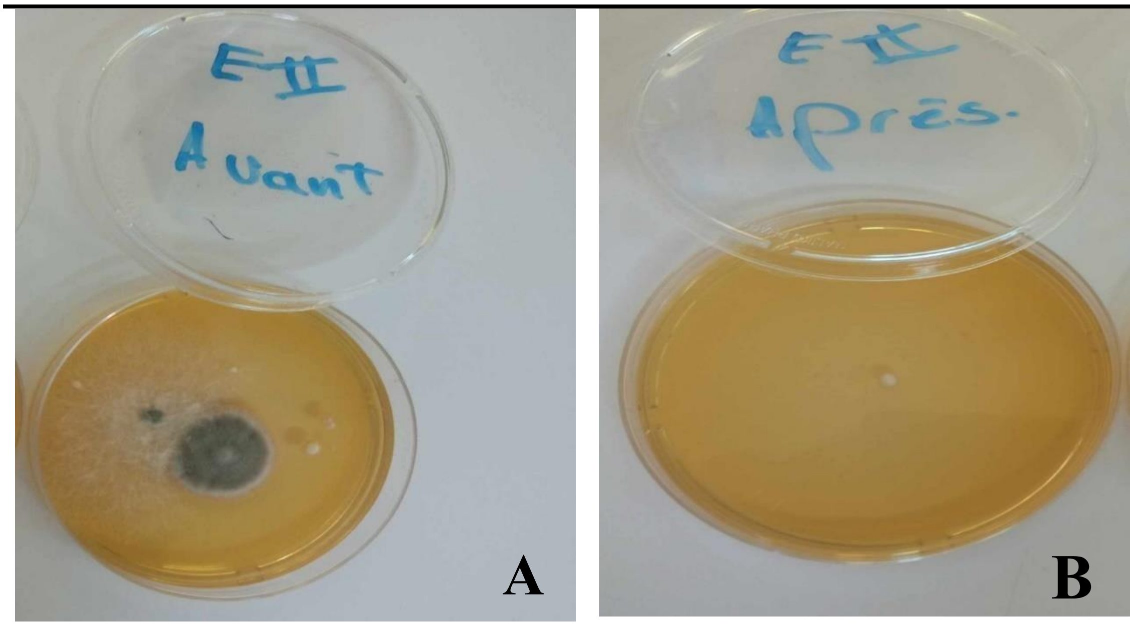



**Figure 24. agar plates from samples taken before and after handwashing**

After incubation, bacterial colonies and molds are visible on both boxes, and the comparison between the images of the different tests before and after washing with soaps added with rosemary essential oil and the negative control boxes (without sampling), the positive control (washing with simple soap), clearly show that the number of bacterial colonies and molds counted before hand washing with the synthesized soap is greatly reduced after washing, so the skin of the hands has not been recontaminated, despite the fact that the heat and humidity of the hands generate a very confined environment favorable to the development of bacteria and hands without washing or washing with simple soap seemed

## Conclusion and perspectives

Given the growing importance of skincare products and the increasing consumer shift towards

natural and safe alternatives, our interest in this topic stems from a desire to offer healthy and effective solutions based on plant-based ingredients such as rosemary

In this work essential oil of *Rosmarinus officinalis* (rosemary) was extracted and characterized. The essential oil was used in the formulation of a natural soap. The study covered both the physicochemical aspects of the soap obtained (pH, foaming power, moisture content, free alkalinity, etc.) and its microbiological efficacy.

The essential oil extracted from *Rosmarinus officinalis* presented characteristic physicochemical properties, including a pleasant aromatic odor, a pale-yellow color, and a density within the standard range. The yield obtained was approximately 0.29%, which is consistent with values reported in the literature for rosemary essential oil.

The pH of the oil was slightly acidic, which is favorable for skin application, and its moisture content was within the acceptable limits defined by ISO/AFNOR standards. In addition, the oil showed antifungal activity, particularly against certain fungal strains, which explains its contribution to the antiseptic properties of the formulated soap.

Chromatographic analysis revealed the presence of major bioactive compounds. These compounds likely contributed significantly to the overall effectiveness of the soap formulation, both in terms of hygiene and skin benefits.

The formulated soap has interesting hygienic properties, meeting cosmetic safety standards. Its foaming power was judged to be correct, even in comparison with commercial soaps, and the antiseptic effect was confirmed by the microbiological tests carried out.

However, certain limitations were noted. In perspective, it would be interesting to find another extraction methods, allowing a better yield for the essential oil extraction.

More in-depth microbiological analyses would be necessary to confirm the broad-spectrum efficacy of the product. The formulation could also be optimized, by integrating a reformulation procedure to improve the texture, stability, and sensory acceptability of the soap.

Finally, it would be interesting to study the commercialization of the product, by developing a

varied range of natural soaps based on local plants. This would make it possible to valorize natural resources while meeting a growing demand.

## References


- Achaw, Osei-Wusu, and Eric Danso-Boateng. 2021. *Chemical and Process Industries*. Springer.
- Afnor, Normes. 1992. "Recueil Des Normes Françaises: Huiles Essentielles." *AFNOR: Paris*.
- Amnudi, Nur Ameera, Muhammad Iqbal Yussuf, Siti Nur Hidayah Md Zain, and Fatimah Zahirah Abd Majid. 2015. "The Chemical and Physical Characteristics of Bar Soap."
- Anfal, Houfani. 2022. "Potentiel Allélopathique Des Feuilles et Des Fleurs de Rosmarinus Officinalis L." university center of abdalhafid boussouf-MILA.
- Anon. 1974. "ISO-684-1974." 1974.
- Anon. 2008. "(33) Ghomari SCIENCE DES MATERIAUX DE CONSTRUCTION Travaux Pratiques | Abdelhak E - Academia.Edu." 23;24;30.
- Azwanida, N. N. 2015. "A Review on the Extraction Methods Use in Medicinal Plants, Principle, Strength and Limitation." *Med Aromat Plants* 4(196):412–2167.
- B, Chahinez, and Manel H. 2023. "Les Anomalies Lipidiques Chez Trois Catégories de Patients: Sous Hémodialyse, Sous Dialyse Péritonéale Continue Ambulatoire et Transplantés Rénaux."
- Bakkali, Fadil, Simone Averbeck, Dietrich Averbeck, and Mouhamed Idaomar. 2008. "Biological Effects of Essential Oils--a Review." *Food and Chemical Toxicology* 46(2):446–75.
- Barel, André O., Marc Paye, and Howard I. Maibach. 2014. *Handbook of Cosmetic Science and Technology*. CRC press.
- Bellakhdar, Jamal. 2006. *Plantes Médicinales Au Maghreb et Soins de Base: Précis de Phytothérapie Moderne*. Eds Le Fennec.
- Benikhlef, Abouseyf. 2015. "Comparaissant Entre Les Huiles Essentielles et Leurs Effets Antibactériens Sur Rosmarinus Officinalis de La Région de Bechar et Ouargla."
- Bensebia, O., D. Barth, B. Bensebia, and A. Dahmani. 2009. "Supercritical CO2 Extraction of Rosemary: Effect of Extraction Parameters and Modelling." *The Journal of Supercritical Fluids* 49(2):161–66.
- Berbache, Nekaa, Racha 2022. 2022. *BERBACHE RAHMA Le 13/07/2022 NEKAA AMINA AMEUR RACHA*.
- Bockisch, Michael. 2015. *Fats and Oils Handbook (Nahrungsfette Und Öle)*. Elsevier.
- Bourahla, Soraya Arbane-Meriem. 2023. "Fabrication de Savon Artisanal et SemiIndustriel." faculté des sciences et de la technologie* univ bba.
- Boutabia, Lamia, Salah Telailia, Ismail Bouguetof, Faouzi Guenadil, and Azzedine Chefrour. 2016. "Composition Chimique et Activité Antibactérienne Des Huiles Essentielles de Rosmarinus Officinalis L. de La Région de Hammamet (TébessaAlgérie)." *Bulletin de La Société Royale Des Sciences de Liège* 85:174–89.

- Burt, Sara. 2004. "Essential Oils: Their Antibacterial Properties and Potential Applications in Foods—a Review." *International Journal of Food Microbiology* 94(3):223–53.
- Carvalho, Isabel T., Berta N. Estevinho, and Lúcia Santos. 2016. "Application of Microencapsulated Essential Oils in Cosmetic and Personal Healthcare Products--a Review." *International Journal of Cosmetic Science* 38(2):109–19.
- Cavitch, Susan Miller. 1995. *The Natural Soap Book: Making Herbal and VegetableBased Soaps*. Storey Publishing.

  Charpentier, Brigitte, Alain Harlay, Florence Hamon-Lorleac'h, and Lionel Ridoux.

  2008. *Guide Du Préparateur En Pharmacie*. Elsevier Masson.

  Chevallier, Andrew. 1996. "The Encyclopedia of Medicinal Plants."
- Chungkrang, Lizamoni, Smita Bhuyan, and Ava Rani Phukan. 2021. "Natural Dyes: Extraction and Applications." *International Journal of Current Microbiology and Applied Sciences* 10(1):1669–77.
- Clevenger, J. F. 1928. "Apparatus for Volatile Oil Determination, Description of New Type." *American Perfumer \& Essential Oil Review* 17(4):345–49.
- Cloarec, Françoise, and Marc Lavaud. 2013. *L'âme Du Savon d'Alep*. Les Ed. Noir sur Blanc.
- Colleaux, Mélanie. 2018. *Je Crée Mes Cosmétiques à Base d'huiles Essentielles*. Éditions Jouvence.
- Croxen, Matthew A., and B. Brett Finlay. 2010. "Molecular Mechanisms of Escherichia Coli Pathogenicity." *Nature Reviews Microbiology* 8(1):26–38.
- Dai, Pangcong, and Hua Liu. 2021. "Research on the Biological Activity of Rosemary Extracts and Its Application in Food." P. 2034 in *E3S web of conferences*. Vol. 251.
- Delinska, Nikolaya, Mariyana Perifanova-Nemska, and Eva Dimitrova. 2024. "Chemical Characteristics of Soaps Obtained Using Red Hot Pepper Seeds Oil (Capsicum Annuum L.)." P. 1010 in *BIO Web of Conferences*. Vol. 122.
- Draelos, Zoe Diana. 2018. "The Science behind Skin Care: Cleansers." *Journal of Cosmetic Dermatology* 17(1):8–14.
- Draelos, Zoe Diana. 2021. *Cosmetic Dermatology: Products and Procedures*. John Wiley \& Sons.
- Ekambaram, Sanmuga Priya, Senthamil Selvan Perumal, Ajay Balakrishnan, Nathiya Marappan, Sabari Srinivasan Gajendran, and Vinodhini Viswanathan. 2016.
  "Antibacterial Synergy between Rosmarinic Acid and Antibiotics against MethicillinResistant Staphylococcus Aureus." *Journal of Intercultural Ethnopharmacology* 5(4):358.
- Enoua, Guy Crépin, Aristide H. W. Nakavoua, Victor N'goka, Tony Wheellyam Pouambeka, Prince Maho Diafouana Mahoungou, Narcisse Nicaise Obaya, Alain Brice Mbozo Vouidibio, Hubert Makomo, and Robin Pascal Ongoka. 2022.
  "Valorization of Cucurbita Pepo Seed Oil in Soap Production." *Green and Sustainable Chemistry* 12(4):104–17.
- Européenne, Pharmacopée. 1996. "Sainte Ruffine: Conseil de l'Europe Maisonneuve SA."

- Gamage, Sachith Gihan, and Mahagama Gedara Yohan Lasantha Mahagamage. 2024. "Consumer Perception of Personal Care Products and Cosmetics on Health and Environmental Effects." *Environmental Quality Management* 34(2):e22339.
- Goddard, E. Desmond, and James V Gruber. 1999. *Principles of Polymer Science and Technology in Cosmetics and Personal Care*. CRC press.
- GS, HATTIANGDI and WW, WALTON and JI, HOFFMAN. 1949. "Some Physical Chemical Properties of Aqueous Solutions of Soaps and Soapless Detergents." 361-368.
- Guan, Huaquan, Wenbin Luo, Beihua Bao, Yudan Cao, Fangfang Cheng, Sheng Yu, Qiaoling Fan, Li Zhang, Qinan Wu, and Mingqiu Shan. 2022. "A Comprehensive Review of Rosmarinic Acid: From Phytochemistry to Pharmacology and Its New Insight." *Molecules* 27(10):3292.
- Guenther, E. 1972. "The Essential Oils: History, Origin in Plants, Production." *Analysis* 1:147–51.
- Guerra, Eugenia, Maria Llompart, and Carmen Garcia-Jares. 2018. "Analysis of Dyes in Cosmetics: Challenges and Recent Developments." *Cosmetics* 5(3):47.
- Gunstone, Frank. 2011. *Vegetable Oils in Food Technology: Composition, Properties and Uses*. John Wiley \& Sons.
- Guo, Ying, Jianping Xie, Xia Li, Yun Yuan, Lanchun Zhang, Weiyan Hu, Haiyun Luo, Haofei Yu, and Rongping Zhang. 2018. "Antidepressant Effects ofRosemary Extracts Associate with Anti-Inflammatory Effect and Rebalance of Gut Microbiota." *Frontiers in Pharmacology* 9:1126.
- Handayani, Prima Astuti, Didit Rizky Aditiya, and Jannatin Ockta Almaidah. 2023. "Production of Liquid Soap from Virgin Coconut Oil with the Active Ingredient Citronella Oil." *Sainteknol: Jurnal Sains Dan Teknologi* 21(1):36–42.
- Harach, Taoufiq, Olivier Aprikian, Irina Monnard, Julie Moulin, Mathieu Membrez, Jean-Claude Béolor, Thomas Raab, Katherine Macé, and Christian Darimont. 2010. "Rosemary (Rosmarinus Officinalis L.) Leaf Extract Limits Weight Gain and Liver Steatosis in Mice Fed a High-Fat Diet." *Planta Medica* 76(06):566–71.
- Hassid, Alissar, Mohamed Salla, Maha Krayem, Sanaa Khaled, Hussein F. Hassan, and Sami El Khatib. 2025. "A Review on the Versatile Applications of Plant-Based Essential Oils in Food Flavoring, Culinary Uses and Health Benefits." *Discover Food* 5(1):1–17.
- Haston, Elspeth, James E. Richardson, Peter F. Stevens, Mark W. Chase, and David J.
- Harris. 2009. "The Linear Angiosperm Phylogeny Group (LAPG) III: A Linear Sequence of the Families in APG III." *Botanical Journal of the Linnean Society* 161(2):128–31.
- Herruzo-Cabrera, R., M. J. Vizcaino-Alcaide, and M. J. Fdez-Acinero. 2000. "Usefulness of an Alcohol Solution of N-Duopropenide for the Surgical Antisepsis of the Hands Compared with Handwashing with Iodine--Povidone and Chlorhexidine:
- Clinical Essay." *Journal of Surgical Research* 94(1):6–12.
- Honfo, Fernande G., Noel Akissoe, Anita R. Linnemann, Mohamed Soumanou, and Martinus A. J. S. Van Boekel. 2014. "Nutritional Composition of Shea

Products and Chemical Properties of Shea Butter: A Review." *Critical Reviews in Food Science and Nutrition* 54(5):673–86.

- Hüsnü Can Başer, K., and G. Buchbauer. 2015. "Handbook of Essential Oils: Science, Technology, and Applications."
- Ibarra, Alvin, Julien Cases, Marc Roller, Amparo Chiralt-Boix, Aurélie Coussaert, and Christophe Ripoll. 2011. "Carnosic Acid-Rich Rosemary (Rosmarinus Officinalis L.) Leaf Extract Limits Weight Gain and Improves Cholesterol Levels and Glycaemia in Mice on a High-Fat Diet." *British Journal of Nutrition* 106(8):1182–89.
- Ibouchoukene, Laeticia, and Mellissa Belaid. 2024. "Formulation d'une Base de Savon à l'huile d'olive Pour La Fabrication de Savonnettes Cosmétique Par La Technique de Fonte à Chaud (Melt \& Pour)." Université Mouloud Mammeri.
- Isma, Moussaoui, and Boualleg Sabah. 2021. "ETUDE PHYSICO-CHIMIQUE DE L'HUILE ESSENTIELLE DU ROMARIN SAUVAGE."
- Jouhar, A. J., and W. A. Poucher. 1991. *Poucher's Perfumes, Cosmetics and Soaps-Volume 1: The Raw Materials of Perfumery*. Springer Netherlands.
- Kaloustian, Jacques, and Francis Hadji-Minaglou. 2012. *La Connaissance Des Huiles Essentielles: Qualitologie et Aromathérapie; Entre Science et Tradition Pour Une Application Médicale Raisonnée*. Springer.
- Kanko, Coffi, Bamba El-Hadj Sawaliho, Soleymane Kone, Gérard Koukoua, and Yao Thomas N'Guessan. 2004. "Étude Des Propriétés Physico-Chimiques Des Huiles Essentielles de Lippia Multiflora, Cymbopogon Citratus, Cymbopogon Nardus, Cymbopogon Giganteus." *Comptes Rendus. Chimie* 7(10–11):1039–42.
- Kanyua, Nyagah Priscillah. 2016. "The Potential of Telfairia Pedata for Liquid Biofuel and Soap Production." *Kenyatta University*.
- Ke, Li, and Hu Zhimin. 2019. "Advances in Biological Effects of Rosmarinic Acid [J]." *International Journal of Laboratory Medicine* 40(09):1032–36.
- De L', Ministere, Enseignement Superieur, E. T. De, L. A. Recherche, M. Boubatra, Mcb Université, M. E. B. E. I. Bordj, Bou Arreridj, A. Bounegab Mca, and Université M. E. B. E. I. Bordj. 2023. *REPUBLIQUE ALGERIENNE DEMOCRATIQUE ET POPULAIRE Intitulé Présenté Par :-Soraya Arbane-Meriem Bourahla Fabrication de Savon Artisanal et Semi-Industriel*.
- Lapointe-Vignola, Carole. 2002. *Science et Technologie Du Lait: Transformation Du Lait*. Presses inter Polytechnique.
- Lima, E. B. C., C. N. S. Sousa, L. N. Meneses, N. C. Ximenes, Santos Júnior, G. S. Vasconcelos, N. B. C. Lima, Manoel Cláudio Azevedo Patroc\'\inio, D. Macedo, and S. M. M. Vasconcelos. 2015. "Cocos Nucifera (L.)(Arecaceae): A Phytochemical and Pharmacological Review." *Brazilian Journal of Medical and Biological Research* 48:953–64.
- Loussouarn, Margot, Anja Krieger-Liszkay, Ljubica Svilar, Antoine Bily, Simona Birtić, and Michel Havaux. 2017. "Carnosic Acid and Carnosol, Two Major Antioxidants of Rosemary, Act through Different Mechanisms." *Plant Physiology* 175(3):1381–94.
- Madadori, M. K. 1982. "Les Plantes Médicinales." *Guides Vert. Salar. 624p*.
- Mahesar, Sarfaraz Ahmed, Razia Chohan, and Syed Tufail Hussain Sherazi. 2019. "Evaluation of Physico-Chemical Properties in Selected Branded Soaps." *Pakistan Journal of Analytical \& Environmental Chemistry* 20(2).

- Makhloufi, A. 2010. “Etude Des Activités Antimicrobienne et Antioxydante de Deux Plantes Médicinales Poussant à l’état Spontané Dans La Région de Bechar (Matricaria Pubescens (Desf.) et Rosmarinus Officinalis L) et Leur Impact Sur La Conservation Des Dattes et Du Beurre Cru.” *Mémoire d’obtenir Le Grade de Doctorat d’état En Biologie. Université Aboubaker Belkaid. Bechar P* 166.
- MANCION, Pietro. n.d. “27 Ème VENTE GARDEN PARTY.”
- Marchetti, Maria Gabriella, G. Kampf, G. Finzi, and Germano Salvatorelli. 2003. “Evaluation of the Bactericidal Effect of Five Products for Surgical Hand Disinfection According to PrEN 12054 and PrEN 12791.” *Journal of Hospital Infection* 54(1):63– 67.
- Martini, Marie-Claude. 2011. *Introduction à La Dermopharmacie et à La Cosmétologie*. Lavoisier.
- Marwa, BENMEBAREK, BOULKRAOUT Rania BOUHENOUNA, and others. 2023. “Etude Ethnobotanique, Screening Phytochimique et Activité Antibactérienne de La Plante {\guillemotleft}Rosmarinus Officinalis{\guillemotright} Dans La Région de Mila.” University center of Abdalhafid Boussouf-MILA.
- May, Pierre. 2014. *Guide Pratique de Phyto-Aromathérapie Pour Les Animaux de Compagnie*. Med’Com
- Mijaljica, Dalibor, Fabrizio Spada, and Ian P. Harrison. 2022. “Skin Cleansing without or with Compromise: Soaps and Syndets.” *Molecules* 27(6):2010.
- Morin, Odile, and Xavier Pagès-Xatart-Parès. 2012. “Huiles et Corps Gras Végétaux: Ressources Fonctionnelles et Intérêt Nutritionnel.” *Oléagineux, Corps Gras, Lipides* 19(2):63–75.
- Mouas, Yamina. 2018. “Effet Comparatif Des Parametres Physiologiques, Biochimiques et Therapeutiques de Romarin Rosmarinus Officinalis L.”
- Mukhtar, Ahmad, Umar Shafiq, Ali Feroz Khan, Hafiz Abdul Qadir, and Masooma Qizilbash. 2015. “Estimation of Parameters of Arrhenius Equation for Ethyl Acetate Saponification Reaction.” *Research Journal of Chemical Sciences ISSN* 2231:606X.
- Murata, Kazuya, Kazuma Noguchi, Masato Kondo, Mariko Onishi, Naoko Watanabe, Katsumasa Okamura, and Hideaki Matsuda. 2013. “Promotion of Hair Growth by Rosmarinus Officinalis Leaf Extract.” *Phytotherapy Research* 27(2):212–17.
- Myers, Drew. 2020. *Surfactant Science and Technology*. John Wiley \& Sons.
- Nieto, Gema, Gaspar Ros, and Julián Castillo. 2018. “Antioxidant and Antimicrobial Properties of Rosemary (Rosmarinus Officinalis, L.): A Review.” *Medicines* 5(3):98.
- Pavia, Donald L., Gary M. Lampman, George S. Kriz, and Randall G. Engel. 1995. “Organic Laboratory Techniques.” *Brooks/Cole*.
- Pelikan, J. 1986. “Matiers Première Du Règne Végétale. Ed.”
- Petersen, Kristina S., Kevin C. Maki, Philip C. Calder, Martha A. Belury, Mark Messina, Carol F. Kirkpatrick, and William S. Harris. 2024. “Perspective on the Health Effects of Unsaturated Fatty Acids and Commonly Consumed Plant Oils High in Unsaturated Fat.” *British Journal of Nutrition* 1–12.
- Petkova, B., S. Tcholakova, M. Chenkova, K. Golemanov, N. Denkov, D. Thorley, and S. Stoyanov. 2020. “Foamability of Aqueous Solutions: Role of

Surfactant Type and Concentration." *Advances in Colloid and Interface Science* 276:102084.
- Petrović, Zoran S. 2008. "Polyurethanes from Vegetable Oils." *Polymer Reviews* 48(1):109–55.
- Poljšak, Nina, and Nina Kočevar Glavač. 2022. "Vegetable Butters and Oils as Therapeutically and Cosmetically Active Ingredients for Dermal Use: A Review of Clinical Studies." *Frontiers in Pharmacology* 13:868461.
- Poré, Jean. 1992. *Émulsions, Micro-Émulsions, Émulsions Multiples: Les Agents de Surface. 2, Balance Hydrophile*. Éd. techniques des industries des corps gras.
- Ramadan, Mohamed, and Jörg-Thomas Mörsel. 2002. "Oil Composition of Coriander (Coriandrum Sativum L.) Fruit-Seeds." *European Food Research and Technology* 215:204–9.
- RECIOUI, Zohra, and Maroua CHAHMA. 2024. "FORMULATION ET CARACTERISATION PHYSICO-CHIMIQUE D'UN SAVON ANTISEPTIQUE A BASE D'HUILES NATURELLES VEGETALES." university ghardaia.
- Rosen, Milton J., and Joy T. Kunjappu. 2012. *Surfactants and Interfacial Phenomena*. John Wiley \& Sons.
- Saadoudi Hadjer, Allou Rokaya. 2022. "Savon à Base d'huile de Friture Usagée." faculté des sciences et de la technologie univ bba.
- Segarra-Moragues, José Gabriel, Yolanda Carrión Marco, Mar\'\ia Clara Castellanos, Mar\'\ia José Molina, and Patricio Garc\'\ia-Fayos. 2016. "Ecological and Historical Determinants of Population Genetic Structure and Diversity in the Mediterranean Shrub Rosmarinus Officinalis (Lamiaceae)." *Botanical Journal of the Linnean Society* 180(1):50–63.
- Sharmeen, Jugreet B., Fawzi M. Mahomoodally, Gokhan Zengin, and Filippo Maggi. 2021. "Essential Oils as Natural Sources of Fragrance Compounds for Cosmetics and Cosmeceuticals." *Molecules* 26(3):666.
- da Silva Favero, Juliana, Jonathan Parisotto-Peterle, Valéria Weiss-Angeli, Rosmary Nichele Brandalise, Lucas Bonan Gomes, Carlos Pérez Bergmann, and Venina dos Santos. 2016. "Physical and Chemical Characterization and Method for the Decontamination of Clays for Application in Cosmetics." *Applied Clay Science* 124:252–59.
- Simmons, William Herbert, and H. A. Appleton. 1908. *The Handbook of Soap Manufacture*. Cononiari LLC.
- Skoog, Douglas A., and Donald M. West. 2015. *Chimie Analytique*. De Boeck Supérieur.
- SLIMANI, Amira, and Manel MAGHNINI. 2023. "Contribution Aux Contrôles Physico-Chimiques de Quelques Échantillons d'huiles Essentielles Commercialisées Dans La Wilaya de Tizi Ouzou."
- Soni, Himanshi, Manvinder Kaur, and Meenakshi Verma. 2024. "Recent Advances in the Production of Soap from Used Cooking Oil for Environment Remediation." P. 3014 in *E3S Web of Conferences*. Vol. 509.
- STAHL, EGON. 2011. "Handbook on Thin-Layer Chromatography (in 1962 and 2nd." *75 Years of Chromatography: A Historical Dialogue* 17:425.
- TAHIRE, Keltoume. 2018. "Les Huiles Essentielles de Rosmarinus Officinalis : Caractéristiques Physico-Chimiques et Activité Antioxydante."

- tan tai, Louis Ho, and Jean Lier. 1999. *Détergents et Produits de Soins Corporels*. Dunod.
- Tanneur, Marie-Laure. 2006. “Etude de l’efficacité in Vivo d’un Savon Chirurgical à Base de Chlorhexidine.”
- Tian, Mingke, Yuchen Bai, Hongyu Tian, and Xuebing Zhao. 2023. “The Chemical Composition and Health-Promoting Benefits of Vegetable Oils—a Review.” *Molecules* 28(17):6393.
- Vargas Jentzsch, Paul, Luis A. Ramos, and Valerian Ciobot\ua. 2015. “Handheld Raman Spectroscopy for the Distinction of Essential Oils Used in the Cosmetics Industry.” *Cosmetics* 2(2):162–76.
- Vergallo, Cristian. 2020. “Nutraceutical Vegetable Oil Nanoformulations for Prevention and Management of Diseases.” *Nanomaterials* 10(6):1232.
- Virbel-Alonso, Christine. 2012. *Savon de Marseille et Autres Savons Naturels: Un Concentré de Bienfaits Pour Votre Maison et Votre Bien-Être*. Editions Eyrolles.
- Vivian, Onyango P., Oyaro Nathan, Aloys Osano, Linda Mesopirr, and Wesley Nyaigoti Omwoyo. 2014. “Assessment of the Physicochemical Properties of Selected Commercial Soaps Manufactured and Sold in Kenya.”
- Williams, Lyall R., and Isaac Lusunzi. 1994. “Essential Oil from Melaleuca Dissitiflora: A Potential Source of High Quality Tea Tree Oil.” *Industrial Crops and Products* 2(3):211–17.
- YAACOUBE, Rahma, and Imane TLIDJANE. 2018. “Caractérisation PhysicoChimiques et Analyses Biologiques de l’huile Essentielle Des Grains de Cuminum Cyminum L. et de Foeniculum Vulgare Mill. Extraite Par Hydrodistillation et CO2. Supercritique: Etude Comparative.”
- Yarovoy, Yury, and Albert J. Post. 2016. “Soap Bar Performance Evaluation Methods.” *Soap Manufacturing Technology* 247–66.
- Zhang, Hui, Clarence A. Miller, Peter R. Garrett, and Kirk H. Raney. 2003. “Mechanism for Defoaming by Oils and Calcium Soap in Aqueous Systems.” *Journal of Colloid and Interface Science* 263(2):633–44.

## Web sites

[1]
https://www.google.com/search?sca_esv=cfac171d552bca21&sxsrf=AE3TifNraDyBNlS8bj3Tro4rtj6eES7gQ:1751488068742&q=saponification+r%C3%A9action&udm=2&fbs=AIIjpHx4nJjfGojPVHhEACUHPiMQ_pbg5bWizQs3A_kIenjtcpTTqBUdyVgzq0c3_k8z34EAuM72an33lMW6RWde9ePJpwNFtZw3UQvFloZy04_0a7Y_s9Q2prhO8GUp_-RabNr5rSZ9AdpA4VO4X1nKrz9IwSM5Dw3Ua2AAoBf4fL2b1Qbd1Zqsu1eNOActDxzSeM1kZWvhvVAA1i OzozO9MczT3vu2g&sa=X&ved=2ahUKEwi5vqnBgZ-OAxVb0AIHHSwvBioQtKgLKAF6BAgWEAE&biw=1366&bih=607&dpr=1#vhid=UC_vzHl3y0sM3M&vssid=mosaic

[2] https://pedagogie.ac-toulouse.fr/mathematiques-physique-chimie/node/167

[3] https://fr.wikipedia.org/wiki/Savon_de_Marseille#/media/Fichier:Marseiller_Seife.jpg

[4] https://fr.wikipedia.org/wiki/Savon_d%27Alep#/media/Fichier:Savon_d'Alep.JPG

[5] https://www.absolution-cosmetics.com/fr/nettoyant/92-le-savon-blanc.html

[6] https://jidamarket.com/produit/savon-noir-du-ghana/

[7] https://almaproduits.com/product/savon-glycerine-transparent-1kg/31412

[8] https://www.louiseemoi.com/blog/le-savon-liquide-des-huiles-bio-et-de-lamour/ [9]
https://www.mon-droguiste.com/feuilles-savon.html

# *Annex*

# المحور الأول: تقديم المشروع

## المحور الأول: تقديم المشروع

### 1 / فكرة المشروع

مشروع "صابون طبيعي بالزيت الأساسي لإكليل الجبل" هو مشروع إنتاجي يندرج ضمن مجال الصناعات التجميلية الطبيعية، ويهدف إلى تقديم منتج عالي الجودة مصنوع يدويًا من مكونات طبيعية وآمنة على البشرة، خالٍ تمامًا من المواد الكيميائية والعطور الاصطناعية التي قد تسبب الحساسية أو التهيج. يعتمد هذا الصابون في تركيبته على الزيت العطري لإكليل الجبل، وهو زيت مشهور بخصائصه المطهرة، المنشطة للدورة الدموية، والمفيدة للبشرة الدهنية والمعرضة لحب الشباب. جاءت فكرة المشروع من خلال ملاحظة التوجه المتزايد لدى المستهلكين نحو المنتجات الطبيعية والعضوية، خاصة مع الوعي المتصاعد بالمخاطر الصحية للمواد الكيميائية الصناعية، وقد تطورت هذه الفكرة بعد الاطلاع على طرق صناعة الصابون التقليدية والحديثة، والتجريب العملي للتركيبات واختبار فعالية المنتج الأولي

يهدف المشروع إلى إنتاج صابون مميز من حيث الجودة والشكل والرائحة، يتم تصنيعه بطريقة "الصابون البارد" التي تسمح بالحفاظ على خصائص الزيوت الطبيعية، مع استخدام مكونات إضافية مثل زيت الزيتون وزيت جوز الهند، وأحيانًا أوارق إكليل الجبل المجففة لتعزيز الفائدة الجمالية والطبية

سيتم تنفيذ المشروع على مراحل، تبدأ بالتجريب في وحدات صغيرة لصناعة الصابون ثم التوسع إلى إنتاج تجاري، مع الحرص على تصميم عبوات صديقة للبيئة وتسويق المنتج عبر الإنترنت وفي الأسواق المحلية. سينجز هذا المشروع فريق صغير مكوّن من أفراد لديهم خلفية في الكيمياء ، وستعطى الأولوية للنساء والشباب من المجتمع المحلي لتوفير فرص عمل وتشجيع ريادة الأعمال المحلية. يهدف المشروع إلى تقديم منتج صحي ومفيد، مع المحافظة على البيئة وتثمين الموارد الطبيعية المتوفرة .

سينجز المشروع من طرف صاحبات الفكرة، اللائي يتولون مهام التصنيع اليدوي، واختيار المكونات، وضبط التركيبات، إلى جانب إدارة الجوانب التنظيمية مثل التعبئة والتسويق،. أما مكان إنجاز المشورع فسيكون في ورشة صغيرة مجهزة داخل المنزل أو في محل صغير مخصص لهذا الغرض، بحيث تتوفر فيه شروط النظافة والتهوية الجيدة والسلامة، إلى جانب معدات

أساسية مثل أوعية الخلط، قوالب السيليكون، ميزان دقيق، خلاط يدوي، و رفوف للتجفيف. مع تطور المشروع وزيادة الطلب، يمكن توسيع النشاط نحو وحدة إنتاج أكبر، أو المشاركة في المعارض والأسواق المحلية لتسويق المنتجات على نطاق أوسع.

## 2 / القيم المقترحة لصابون طبيعي بزيت إكليل الجبل الأساسي

### 1.2 الطبيعية

الصابون مصنوع بالكامل من مكونات نباتية طبيعية، دون أي مواد مضافة صناعية أو كيميائية. هذا يعكس التزام المنتج بالعودة إلى الطبيعة وتلبية طلب المستهلكين المتزايد على المنتجات "الخضراء" والعضوية

### 2.2 الفعالية

الزيت الأساسي لإكليل الجبل معروف بخصائصه المطهّرة والمضادة للميكروبات. يعمل الصابون على تنظيف عميق .للبشرة، محاربة البكتيريا، وتهدئة الالتهابات الجلدية، مما يجعله منتجًا فعالًا في النظافة والعناية اليومية

### 3.2 الاستدامة

استخدام مواد قابلة للتحلل، وتجنب البلاستيك في التغليف، كلها عناصر تساهم في تقليل الأثر البيئي. هذه القيمة تهم المستهلك الواعي الذي يبحث عن منتجات تحترم البيئة

### 4.2 الأمان

التركيبة الخفيفة والطبيعية تجعل هذا الصابون مناسبًا لجميع أنواع البشرة، حتى الحساسة منها. خالٍ من البارابين، الكبريتات، والعطور الصناعية، ما يجعله آمنًا للاستخدام اليومي دون خطر التهيج أو التحسس

### 5.2 الرفاهية

رائحة إكليل الجبل المنعشة تساعد على تنشيط الحواس وتحسين المزاج. يمنح لحظة استرخاء حقيقية أثناء الاستخدام، مما يضيف بعدًا حسيًا لتجربة الاستحمام.

## 6.2 الحرفية

يُصنع الصابون يدويًا باستخدام تقنيات تقليدية مثل التصببين البارد، مما يسمح بالحفاظ على خصائص الزيوت النباتية ويمنح كل قطعة صابون طابعًا فريدًا وجودة عالية

## 7.2 التنوع

منتج متعدد الاستخدامات: يمكن استعماله للجسم، الوجه، واليدين، مما يضيف له قيمة عملية ويوفر على المستهلك شراء منتجات متعددة.

## 8.2 الابتكار

يجمع بين التراث النباتي والمعرفة الحديثة بالعناية بالبشرة، مما يخلق منتجًا مبتكرًا يلبي حاجات الجيل الجديد من المستهلكين الباحثين عن الفعالية والالتزام الأخلاقي

## 3 /فريق العمل

**الطالبة 1** : جدادوة نهاد اختصاص كيمياء حيوية و تطبيقية في جامعة قالمة 8 ماي 1945 ، وهي خريجة ليسانس كيمياء حيوية من جامعة قالمة 8 ماي 1945 للسنة الد ارسية 2023/2022

**الطالبة 2** : بود ارع نورجيهان اختصاص كيمياء حيوية و تطبيقية في جامعة قالمة 8 ماي 1945 ، وهي خريجة ليسانس كيمياء حيوية من جامعة قالمة 8 ماي 1945 للسنة الد ارسية 2023/2022

**الطالبة 3**: خالد مروة اختصاص كيمياء حيوية وتطبيقية في جامعة قالمة 8 ماي 1945، وهي خريجة ليسانس كيمياء حيوية من جامعة قالمة 8 ماي 1945 للسنة الد ارسية 2022/ 2023

## 4 / اهداف المشروع

- ✓ **إنتاج صابون طبيعي صحي وآمن:** يهدف المشروع إلى تصنيع صابون طبيعي خالٍ من المواد الكيميائية الضارة، يعتمد في تركيبته على الزيت الأساسي لإكليل الجبل المعروف بخصائصه المطهّرة والمضادة للالتهابات، مما يجعله مناسبًا للعناية اليومية بالبشرة .
- ✓ **الاستفادة من الخصائص العلاجية لإكليل الجبل:** يطمح المشروع إلى تقديم منتج يجمع بين النظافة والعلاج الطبيعي، من خلال استغلال فوائد زيت إكليل الجبل في تحسين الدورة الدموية، تهدئة البشرة، وتقوية الشعر
- ✓ **تشجيع العودة إلى المنتجات التقليدية والطبيعية:** المساهمة في نشر ثقافة استخدام منتجات العناية البديلة والصديقة للبشرة، بعيدًا عن الصناعات التجميلية الكيميائية
- ✓ **تثمين الموارد الطبيعية المحلية** دعم الاقتصاد المحلي من خلال الاعتماد على نبات إكليل الجبل المتوفر بكثرة في البيئة المحلية، وتشجيع استغلال النباتات العطرية والطبية بطريقة مستدامة
- ✓ **.تقديم منتج بيئي ومستدام** يهدف المشروع إلى احترام المعايير البيئية من خلال اختيار مواد أولية قابلة للتحلل، وتقنيات إنتاج منخفضة التأثير على البيئة، وتغليف خالٍ من البلاستيك
- ✓ **.خلق منتج مبتكر يجمع بين الجودة والجاذبية** تصميم صابون يجمع بين فعالية المكونات الطبيعية والجاذبية البصرية والتجارية، لتلبية تطلعات المستهلك العصري الباحث عن الجودة والهوية البسيطة
- ✓ **.فتح آفاق مهنية وحرفية جديدة تطوير فكرة قابلة للتوسّع في المستقبل،** من خلال إمكانية إنتاج مجموعة واسعة من الصابون المعزز بزيوت أساسية مختلفة، مع فتح فرص عمل محلية في مجال الحرف الطبيعية

## 5 / الجدول الزمني لإنجاز المشروع

| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | الدارسات الأولية :<br>اختيار مقر الوحدة الانتاجية ، تجهيز الوثائق المطلوبة | ✓ | ✓ | | | | | |
| 2 | | طلب التجهيزات من الخارج | | ✓ | ✓ | | | | |
| 3 | | بناء مقر للانتاج (المصنع) | | | | ✓ | ✓ | | |
| 4 | | تركيب المعدات | | | | | ✓ | ✓ | |
| 5 | | اقتناء المواد الأولي ة | | | | | | ✓ | |
| 6 | | بداية انتاج اول منتج | | | | | | ✓ | ✓ |

# المحور الثاني: الجوانب الابتكارية

## المحور الثاني: الجوانب الابتكارية

### 1 / طبيعة الابتكارت

يتمثل الابتكار في هذا المشروع في التحول من صناعة الصابون التقليدي أو الصناعي إلى إنتاج صابون طبيعي 100% يعتمد على مواد أولية محلية مثل الزيت الأساسي لإكليل الجبل، المعروف بخصائصه المطهرة والمضادة للميكروبات الابتكار لا يقتصر فقط على المكونات، بل يشمل أيضًا:

- ✓ **ابتكار بيئي:** من خلال استخدام مواد طبيعية وتغليف صديق للبيئة
- ✓ **ابتكار صحي:** تقديم منتج خالٍ من المركبات الكيميائية التي قد تضر بالبشرة
- ✓ **ابتكار اجتماعي:** تشجيع الإنتاج المحلي وتمكين الفئات الريفية، خاصة النساء
- ✓ **ابتكار تسويقي:** اعتماد وسائل ترويج رقمية ومنتجات قابلة للتخصيص حسب حاجيات الزبائن وبالتالي،

يمثل المشروع ابتكارًا متكاملاً يجمع بين الطبيعة، الصحة، الاقتصاد المحلي والتقنيات البسيطة الفعالة

### 2 / مجالات الابتكا ر

يتجلى الطابع الابتكاري لمشروع صناعة الصابون الطبيعي من الزيت الأساسي لإكليل الجبل في عدة مجالات متكاملة، تشمل ما يلي:

1. الابتكار في المواد الأولية استغلال نباتات طبية وعطرية محلية، خاصة إكليل الجبل، كمصدر طبيعي وفعال للزيوت الأساسية، عوضًا عن المكونات الكيميائية المستوردة. هذا يعزز من قيمة المنتجات الطبيعية المحلية ويشجع الفلاحة المستدامة.
2. الابتكار في العملية الإنتاجية اعتماد طرق إنتاج طبيعية وشبه حرفية، مع احترام معايير الصحة والنظافة، واستعمال تقنيات استخلاص حديثة (مثل التقطير بالبخار) للحفاظ على جودة وفعالية الزيت العطري المستخدم.
3. الابتكار في المنتج النهائي تصنيع صابون طبيعي متعدد الفوائد (مطهر، مرطب، مضاد للبكتيريا...) قابل للتخصيص حسب نوع البشرة أو الذوق، ويتميز عن المنتجات الصناعية من حيث التركيب والجودة

4. .الابتكار في التغليف والتسويق تصميم تغليف صديق للبيئة، جذاب، ومعاصر. بالإضافة إلى تبني استراتيجيات تسويق رقمي حديثة (مواقع التواصل الاجتماعي، المتاجر الإلكترونية)، مما يسمح بوصول أفضل للمنتج إلى فئات واسعة من الزبائن.

5. الابتكار الاجتماعي والمحلي دمج الفاعلين المحليين في سلسلة الإنتاج، كالمزارعين والحرفيين، خاصة في المناطق الريفية، ما يخلق ديناميكية اقتصادية محلية مستدامة.

# المحور الثالث: التحليل الاستراتيجي للسوق

# المحور الثالث: التحليل الاستارتيجي للسوق

## 1 / عرض القطاع السوقي

**1.1 السوق المحتمل** : هو كل شخص يهتم بالنظافة الشخصية ويرغب باستخدام منتجات طبيعية وآمنة للبشرة ،خصوصًا الأشخاص الذين يعانون من حساسية من المواد الكيميائية محبّي العناية بالبشرة بشكل طبيعي الأشخاص الذين يتبعون نمط حياة صحي وبيئي مثل: "كل شخص يستطيع ويرغب في استخدام صابون طبيعي خالٍ من المواد الكيميائية

**2.1 السوق المستهدف** : نستهدف فئة محددة من الزبائن الذين يفضّلون المنتجات التجميلية الطبيعية والمحلية يهتمون بصحة البشرة والجسم لديهم وعي بيئي يبحثون عن منتجات ذات رائحة منعشة ومريحة مثل زيت إكليل الجبل يعانون من مشاكل جلدية خفيفة مثل الجفاف أو الحساسية (مثال: نساء من 20 إلى 45 سنة في المدن، يهتممن بالعناية بالبشرة والمنتجات البيئية

**3.1 السوق المتاح** :وهو الجزء الذي يمكنك فعليًا الوصول إليه من خلال :نقاط البيع المحلية (محلات الأعشاب، الصيدليات) المنصات الإلكترونية ومواقع التواصل المعارض الحرفية والأسواق التقليدية حسب قدرتك الحالية على التوزيع، والتسويق، والإنتاج

**4.1 مبرارت اختيار السوق المستهدف** : الوعي المتزايد بفوائد المنتجات الطبيعية الطلب المتزايد على مستحضرات التجميل الخالية من المواد الكيميائية الرغبة في دعم المنتجات المحلية والحرفية زيت إكليل الجبل معروف برائحته المنعشة وخصائصه المضادة للبكتيريا

**5.1 إمكانية إبرام عقود شراء : يمكن استهداف** : محلات المنتجات الطبيعية أو النوادي الصحية (spa) منصات إلكترونية خاصة بالمنتجات العضوية

## 2 / قياس شدة المنافس ة

**لمنافسون المباشرون** :صُنّاع محليون ينتجون صابون طبيعي يدويًا، غالبًا عبر صفحات فيسبوك أو المعارض التقليدية .

علامات صغيرة تروج لمنتجات خالية من المواد الكيميائية بزيوت عطرية مثل: اللافندر، النعناع، إكليل الجبل.

**المنافسون غير المباشرين** :شركات التجميل الصناعية التي تقدم صابون تجميلي تجاري "ذو مظهر طبيعي" لكنه يحتوي على مواد حافظة .مستحضرات استحمام سائلة بروائح صناعية تسوَّق كبدائل عصرية."

عددهم في تزايد خاصة على المنصات الرقمية .السوق لا يزال غير مشبع تمامًا، مما يعطي فرصًا للمشاريع الجديدة .

الحصص الكبرى يمسك بها :منتجات مستوردة ذات تغليف جذاب .علامات جزائرية تعتمد على "الكمية والإنتاج الصناعي" من

بين اصولهم اقدميتهم في السوق الجزائرية وقوة العلامة التجارية ومن بين نقاط ضعفهم سعر المنتجات

## 3 / استارتيجية التسويق

تعتمد استراتيجيتنا التسويقية على تقديم منتج طبيعي عالي الجودة و وضع استراتيجية تسعير تنافسية تراعي القدرة الشرائية للعملاء وتبرز القيمة المضافة لمنتجنا

نقوم بتوزيع منتجاتنا عبر قنوات فعالة تشمل وسائل التواصل الاجتماعي والمعارض والفعاليات المرتبطة بالتغذية والصحة، حيث نشارك فيها بشكل دوري للتعريف بالمنتج، وتقديم عروض خاصة، وإنشاء اربط مباشر مع العملاء والمهتمين

نحرص على إرضاء العملاء من خلال تقديم خصومات للزبائن الجدد، وتحفيز الولاء من خلال تجربة استخدام مميزة. كما نُجري بشكل دوري تحليلات للسوق لفهم احتياجات العملاء وتوجهاتهم، والتعرف على المنافسين، الفرص، والتهديدات، مما يمكّننا من تطوير استراتيجيات دقيقة تتماشى مع متغيرات السوق وتدعم استمرارية المشروع.

# المحور الرابع: خطة الإنتاج والتنظيم

# المحور الرابع: خطة الإنتاج والتنظيم

## 1 /عملية الإنتاج

اقتناء المادة الاولية ← تجفيف و تنظيم المادة الاولية ← استخلاص الزيت الاساسي ← تحضير خليط الصابون ← صب و تشكيل الصابون ← تغليف و تسويق الصابون

المخطط 01 : مراحل انتاج الصابون الطبيعي بزيت اكليل الجبل الأساسي

### 1.1اقتناء المادة الأولية

اقتناء المواد الأولية زيت الزيتون، زيت جوز الهند، زيت النخيل، زيت الخروع. (كأساس صابوني.) زيت أساسي لإكليل الجبل (كمكوّن عطري وعلاجي) .محلول هيدروكسيد الصوديوم (للصبن).

ماء مقطر .قوالب السيليكون، أدوات قياس، خلاط.

### 2.1التصنيع

الخطوة 1: وزن الزيوت الصلبة والسائلة بدقة.

الخطوة 2: تسخين الزيوت وخلطها حتى الذوبان.

الخطوة 3: تحضير محلول الصودا الكاوية (بتوخي الحذر) وتركه يبرد.

الخطوة 4: دمج الصودا مع الزيوت مع المزج المستمر حتى يتكاثف الخليط ( مرحلة.trace )

الخطوة 5: إضافة زيت إكليل الجبل في نهاية المزج للمحافظة على خصائصه.

### 3.1تكييف المنتج

صب الخليط في قوالب مخصصة .تركه في درجة حرارة الغرفة لمدة 24 –48 ساعة حتى يتماسك .

نزع القوالب وترك الصابون في مكان جاف لمدة 4 –6 أسابيع (مرحلة التجفيف أو المعالجة)

### 4.1التغليف والتعليب

تغليفه بورق كرافت طبيعي أو عبوات كرتونية مع ملصقات تحمل :اسم المنتج .المكونات .الخصائص (منعّم، مطهر، مناسب للبشرة الحساسة) …

## 2 /التموين

1 **تحديد سياسة الشراء المواد الأولية:** زيت أكليل الجبل الأساسي عالي الجودة، نقاء مضمون (يفضل عضوي). زيوت أخرى أساسية أو قواعد صابون (زيت زيتون، زيت جوز الهند، الصودا الكاوية...). المواد واللوازم: مواد مساعدة مثل العطور الطبيعية، الألوان الطبيعية، المكونات النباتية الإضافية. عبوات التعبئة والتغليف الصديقة للبيئة. التجهيزات: معدات الخلط والتعبئة. أدوات القياس والتحكم بالجودة .معدات التخزين المناسبة 5خزانات باردة وجافة لحفظ الزيوت°.
سياسة الشراء: الشراء بناءً على خطة إنتاج شهرية لتجنب الفائض أو النقص. اختيار المواد ذات الجودة العالية بأسعار تنافسية. إبرام عقود مع موردين ثابتين لضمان الاستمرارية.

2 **تحديد أهم الموردين البحث عن موردين متخصصين في الزيوت الأساسية وخاصة زيت أكليل الجبل:** تفضيل الموردين المحليين عند توفر الجودة لتقليل تكلفة النقل. تقييم الموردين بناءً على جودة المنتج، الأسعار، وسمعة السوق. الاعتماد على الموردين الذين يوفرون شهادات جودة 5مثل شهادات التحليل أو العضوية°.

3 **تحديد سياسة الدفع المسبق الجزئي** : (مثلاً 30% عند الطلب ) لضمان جدية الطلب .دفع الباقي بعد استلام المواد والتأكد من جودتها .الاتفاق على طرق دفع مناسبة (تحويل بنكي، شيكات، أو إلكترونية).وضع نظام متابعة للدفعات لتجنب التأخير وضمان سيولة الشركة .

4 **تحديد وقت الاستلام تحديد جدول استلام شهري يتماشى مع خطة الإنتاج:** الاتفاق مع الموردين على مواعيد تسليم دقيقة وواضحة. توفير وقت احتياطي للطوارئ أو في حال حدوث تأخيرات. تنظيم النقل والتخزين فور الاستلام للحفاظ على جودة الزيت.

## 3 / اليد العاملة

- **عدد المناصب التي يمكن أن يخلقها المشروع:** من المتوقع ألا يساهم المشروع في خلق منصب شغل مباشرة في مرحلة الإطلاق، مع إمكانية الزيادة تدريجية حسب توسع الإنتاج والتوزيع.
- **طبيعة ونوعية اليد العاملة يد عاملة غير مؤهلة:** لتولي مهام بسيطة مثل التعبئة، القص، التنظيف، يمكن تدريبها بسرعة، ويفضل توظيف نساء من المناطق الريفية. يد عاملة شبه مؤهلة: في المهام المتعلقة بالتصنيع اليدوي أو استخدام آلات بسيطة. يد عاملة مؤهلة: مثل تقنيين في الكيمياء، مراقبة الجودة، أو التسويق الرقمي.
- **أماكن تواجد اليد العاملة:** تتوفر اليد العاملة غير المؤهلة والمؤهلة بكثرة في القرى والمناطق الريفية، خاصة في المناطق المعروفة بإنتاج إكليل الجبل (الشرق الجزائري، منطقة الأوراس، جيجل، خنشلة...).

إمكانية التعاون مع خريجي معاهد التكوين المهني والجامعات في تخصصات البيولوجيا، الكيمياء، التسويق.

- **إمكانية اللجوء إلى المناولة:** نعم، يمكن اللجوء إلى المناولة في بعض الم ارحل، خاصة في البداية لتقليل التكاليف: تقطير الزيت الأساسي لدى وحدات قائمة (distilleries locales) تغليف الصابون في ورش متخصصة. النقل والتوزيع عبر شركات خاصة. تصميم الملصقات والتغليف من خلال وكالات خارجية أو مستقلين. يسمح ذلك بتركيز الجهد على التصنيع وضمان الجودة، مع تقليل الاستثمار الأولي في المعدات.

### 4 / الشركات الرئيسي ة

1( الموردون المحليون للنباتات الطبية والعطرية

2( وحدات التقطير أو شركات استخلاص الزيوت الأساسية

3( شركات إنتاج وتوريد المواد الأولية التكميلية

4( .شركات التغليف والطباعة.

5( شركات التوزيع والنقل

6( مخابر التحاليل والمراقبة

7( الوكالات الرقمية وشبكات البيع

# المحور الخامس: الخطة المالية

## المحور الخامس : الخطة المالية

### 1 /التكاليف والأعباء

### 1.1التكاليف الثابتة

| البيا ن | المبلغ شهري ا | المبلغ سنوي ا |
|---|---|---|
| المبنى | **24000** | **288000** |
| الآلات | **1.301.265.00** | / |
| النقل | **30.000.00** | / |
| تجهيزات مكتبية | **50.000.00** | / |
| المجموع | **2.469.265.00** | / |

| | Désignation | Qta | Prix unitaire | Prix total |
|---|---|---|---|---|
| 1 | Hydro-distillateur 200 L 05 | **05** | **300.000.00** | **1.500.000.00** |
| 2 | Distillateur BTM instruments | **03** | **190.000.00** | **570.000.00** |
| 3 | Frigidaire | **03** | **70.000.00** | **210.000.00** |
| 4 | Agitateur | **03** | **95.000.00** | **285.000.00** |
| 5 | Refractomètre | **03** | **70.000.00** | **210.000.00** |
| 6 | Ph mètre | **03** | **90.000.00** | **270.000.00** |
| 7 | Four | 02 | **72.000.00** | **144.000.00** |
| 8 | Bain marie | 02 | **13.000.00** | **26.000.00** |
| 9 | Balance | 05 | **12.500.00** | **62.500.00** |
| 10 | Réservoir 300 ml | 03 | **45.000.00** | **135.000.00** |
| 11 | Les verreries de labo | 04 | **75.000.00** | **300.000.00** |
| 12 | Broyeur | 03 | **28.000.00** | **84.000.00** |
| 13 | Sécateur | 04 | **25.000.00** | **100.000.00** |
| | | | **Totale** | **3.896.500 .00** |

### 2.1 التكاليف المتغيرة كل شهر

المحور الخامس الخطة المالية

| البيان | المبل غ |
|---|---|
| اكليل الجبل | **1500دج للكيلوغرام الواحد** |
| شتلة الاكليل | **50دج للشتلة الواحدة** |
| ورق ك ارفت | **80 للمتر الواحد** |
| منظفات و غيرها | **10000دج** |
| ماء و كهرباء | **50000دج** |
| التسويق | **200000دج** |
| طباعة الملصقات و العلب | **1000دج لورقة 4A** |

### 3.1 التكاليف المتغيرة في اليوم الواحد

| | |
|---|---|
| 50 كغ الاكليل | **75000دج** |
| لتر و نصف زيت زيتون | **1800دج** |
| 773 ملليتر جوز الهند | **2000دج** |
| الأشياء الأخرى | **20000دج** |

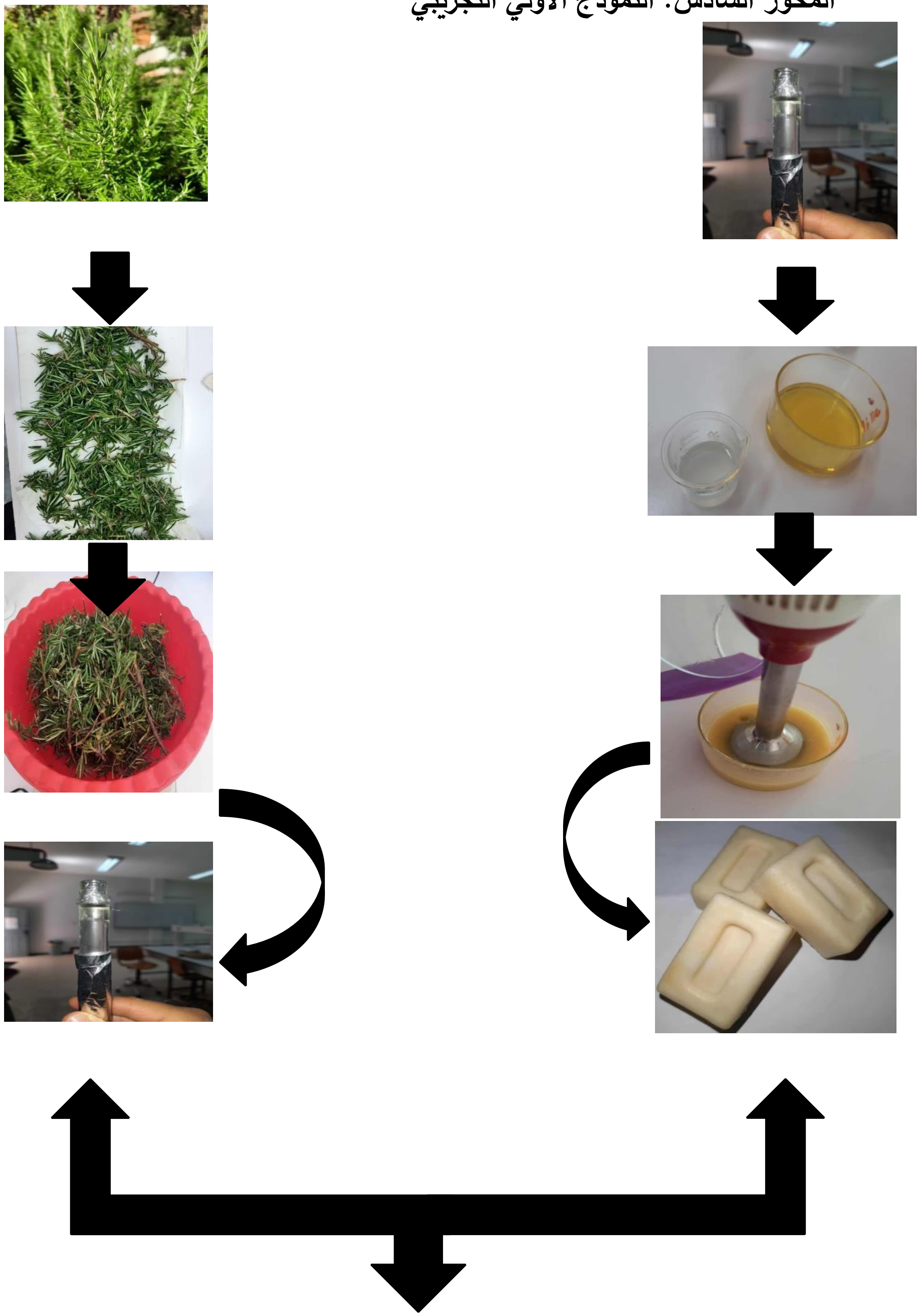
التموين يكون من طرف حاضنة جامعة 8 ماي 1945

### 2/ رقم الاعمال

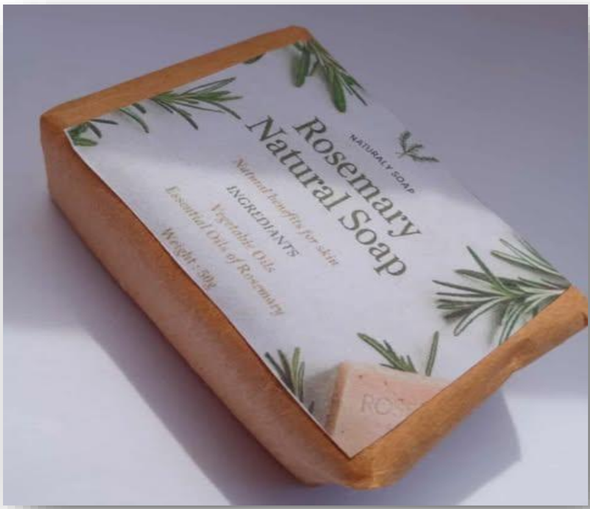
- سعر قارورة زيت اكليل الجبل سعة 10 ملل بمبلغ 1700 دج
- سعر صابون بمبلغ 238 دج
- مجموع طباعة الملصقات تقدر ب 70200 دج

# المحور السادس: النموذج الاولي التجريبي

## المحور السادس: النموذج الاولي التجريبي



النموذج الاولي للصابون الطبيعي






## مخطط الاعمال

<table dir="rtl">
<tr><th>شرائح العملاء</th><th>العلاقات مع الزبائن</th><th>القيمة لمقدم ة</th><th>الأنشطة الرئيسي ة</th><th>الشركات الرئيسية</th></tr>
<tr><td rowspan="3">_تركيز على تسويق منتجاتنا محليًا داخل ولاية قالمة، ثم على المستوى الوطني<br>_ نستهدف النساء والرجال، صغا ارً وكبا ارً، أي جميع الفئات العمرية، وبالأخص الذين يعانون من مشاكل في البشرة<br>_نستهدف الأشخاص المهتمين باكليل الجبل ومنتجاته الغنية بالفوائد</td><td>_تقديم تخفيضات جذابة.<br>_استخدام بطاقات دعائية للترويج للمنتجات.<br>_وضع لافتات إعلانية في أماكن استراتيجية.<br>_توفير تغليف خاص لكسب ثقة الزبون<br>_سهولة التوصيل</td><td rowspan="3">_منتج محلي جديد على مستوى ولاية قالم ة<br>_الاستعمال الشخصي<br>_منتجات طبيعية نقية<br>_الاستغناء عن المواد الكيمائية في منتجات التجميل</td><td>_الاستخلاص و مراقبة الجودة<br>_إنتاج الصابون وتجربة وصفاته.<br>_تعبئة وتغليف المنتجات.<br>_التسويق والترويج الرقمي.<br>_إدارة الطلبات وخدمة العملاء.</td><td rowspan="3">_الموردين بالمادة الأولية و العتاد الصناع ي<br>_مخابر تحليل جودة (للتحاليل الفيزيائية والكيميائية للصابون).<br>_جمعيات أو تعاونيات زراعية محلية (لتوفير إكليل الجبل).<br>_الموزعين</td></tr>
<tr><th>القنوات</th><th>الموارد الرئيسية</th></tr>
<tr><td>_محل للبيع المباشر<br>_ التسويق عبر مواقع التواصل الاجتماعي او الاشهار التلفزيوني<br>_ منصة إلكترونية خاصة بالمشروع</td><td>_كراء محل وشاحنة لنقل المواد الأولية<br>_آلات الإنتاج<br>_ المواد الكيميائية<br>_ المعرفة والخبرة</td></tr>
<tr><th colspan="2">مصادر الإيرادات</th><th colspan="3">هيكل التكاليف</th></tr>
<tr><td colspan="2">_بيع قطع الصابون بوحدات أو باقات.<br>_ بيع منتجات مرافقة (مثل زيوت عطرية أو مقش ارت طبيعية).<br>_عروض موسمية وهدايا خاصة.<br>_ ورشات تعليمية لصناعة الصابون الطبيعي</td><td colspan="3">_تكلفة المواد الأولية (زيوت، إكليل الجبل)...<br>_ تكاليف التغليف والوسم.<br>_أدوات التصنيع والصيانة.<br>_تكاليف التسويق والإعلانات.<br>_ تكاليف التوزيع (توصيل، شحن)....</td></tr>
</table>

الجمهورية الجزائرية الديمقراطية الشعبية

وزارة التعليم العالي والبحث العلمي

جامعة 8 ماي 1945 - قالمة -

الرقم: 236/ 24/CDE-UGU

وزارة اقتصاد المعرفة والمؤسسات الناشئة والمؤسسات المصغرة

NESDA

الوكالة الوطنية لدعم وتنمية المقاولاتية

# شهادة تكوين في المقاولاتية

سلمت هذه الشهادة الى السيد (ة): بودراع نور جيهان الحامل (ة) للرقم التعريفي الوطني الوحيد: 110020853013690008

إثباتا لمتابعته (ها) للدورة التكوينية في المقاولاتية وإنشاء المؤسسات المصغرة، المنظمة خلال الفترة الممتدة من: 2025/05/11 الى: 2025/05/29

حرر بقالمة في: 2025/05/29

مدير المؤسسة الجامعية

مدير الجامعة

الأستاذ الدكتور صالح العقون

عن المدير العام للوكالة الوطنية لدعم وتنمية المقاولاتية

NESDA

حررت هذه الشهادة للاستعمالها في إطار القرار الصادر عن وزير اقتصاد المعرفة والمؤسسات الناشئة والمؤسسات المصغرة المؤرخ في 29 رجب عام 1444 الموافق سنة 2023، يحدد تنظيم وسير لجنة انتقاء واعتماد وتمويل المشاريع الاستثمارية المحدثة على مستوى الوكالة الوطنية لدعم وتنمية المقاولاتية وكذا كيفيات معالجة ومضمون الملفات المتعلقة بهذه المشاريع

الجمهورية الجزائرية الديمقراطية الشعبية

وزارة التعليم العالي والبحث العلمي

جامعة 8 ماي 1945 - قالمة -

الرقم: 235/ 24/CDE-UGU

وزارة اقتصاد المعرفة والمؤسسات الناشئة والمؤسسات المصغرة

NESDA

الوكالة الوطنية لدعم وتنمية المقاولاتية

# شهادة تكوين في المقاولاتية

سلمت هذه الشهادة الى السيد (ة): خالد مروة الحامل (ة) للرقم التعريفي الوطني الوحيد: 110020853011910002

إثباتا لمتابعته (ها) للدورة التكوينية في المقاولاتية وإنشاء المؤسسات المصغرة، المنظمة خلال الفترة الممتدة من:2025/05/11 الى:2025/05/29

حرر بقالمة في: 2025/05/29

مدير المؤسسة الجامعية

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NESDA

حررت هذه الشهادة للاستعمالها في إطار القرار الصادر عن وزير اقتصاد المعرفة والمؤسسات الناشئة والمؤسسات المصغرة المؤرخ في 29 رجب عام 1444 الموافق 20 فبراير سنة 2023، يحدد تنظيم وسير لجنة انتقاء واعتماد وتمويل المشاريع الاستثمارية المحدثة على مستوى الوكالة الوطنية لدعم وتنمية المقاولاتية وكذا كيفيات معالجة ومضمون الملفات المتعلقة بهذه المشاريع.

الجمهورية الجزائرية الديمقراطية الشعبية

وزارة التعليم العالي والبحث العلمي

جامعة 8 ماي 1945 - قالمة -

الرقم: 234/ 24/CDE-UGU

وزارة اقتصاد المعرفة والمؤسسات الناشئة والمؤسسات المصغرة

NESDA

الوكالة الوطنية لدعم وتنمية المقاولاتية

# شهادة تكوين في المقاولاتية

سلمت هذه الشهادة الى السيد (ة): جدادوة نهاد الحامل (ة) للرقم التعريفي الوطني الوحيد: 110010841070540002

إثباتا لمتابعته (ها) للدورة التكوينية في المقاولاتية و إنشاء المؤسسات المصغرة، المنظمة خلال الفترة الممتدة من:2025/05/11الى:2025/05/29

حرر بقالمة في: 2025/05/29

مدير المؤسسة الجامعية

عن المدير العام للوكالة الوطنية لدعم وتنمية المقاولاتية

حررت هذه الشهادة للاستعمال في إطار القرار الصادر عن وزير اقتصاد المعرفة والمؤسسات الناشئة والمؤسسات المصغرة المؤرخ في 29 رجب عام 1444 الموافق 20 فبراير سنة 2023، يحدد تنظيم وسير لجنة انتقاء واعتماد وتمويل المشاريع الاستثمارية المعدلة على مستوى الوكالة الوطنية لدعم وتنمية المقاولاتية وكذا كيفيات معالجة ومضمون الملفات المتعلقة بهذه المشاريع