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A Review on Extraction, Isolation and Separation Technique Studies of Rose Levels

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Abstract: *Rosa damascena is one of the most important Rosa species for the flavour and fragrance activities. Roses are well known as ornamental plants grown for their flowers in garden and indoors. This plant is cultivated all over the world including Iran, Europe, Bulgaria, Turkey and India. Various parts of Rosa damascena like petals, hips, stems, leaves and roots having medicinal properties and contains various secondary metabolites including vitamins and minerals. The flower petals of Rosa damascena are high in phytonutrients with antioxidant and antibacterial properties. This plant has been used in Ayurveda and Unani systems of medicine since ancient era and have many pharmacological properties including anti-HIV, antibacterial, antioxidant, antitussive, hypnotic, antidiabetic, antifungal, antiaging, antiinflammatory and others. Various products can be obtained from Rosa damascena are rose water, rose oil and medicinal products.*

Keywords: Rose damascenea, Damask rose ,Antioxidant activity, Roseoil, Rose water

I. INTRODUCTION

Okay, let's talk about antioxidants. You know how things rust, right? That's oxidation. It happens when stuff reacts with oxygen, and it can be a real pain, especially inside your body. Free radicals are these little troublemakers that float around and can cause damage. Think of them as little gremlins messing with your cells. Antioxidants are like superheroes that come in and stop the gremlins from doing too much damage. They basically get in the way of oxidation and protect your cells from getting all messed up. Now, scientists have found that antioxidants can help slow down the aging process. It's like they're helping your body stay young and healthy for longer. It's not a magic bullet, but they definitely play a role in keeping you feeling your best .Rose petals, those delicate symbols of love and beauty, hold more than meets the eye. The Rosa damascena Mill. variety, a star among roses for its captivating fragrance andflavor, leaves behind a treasure trove of potential after its essential oils are extracted. Imagine this: after the steam distillation process, a mountain of spent petals remains, their vibrant hues faded, but their potential far from exhausted. This bounty, often overlooked, could be a goldmine of natural antioxidants and antimicrobials, a boon to both health and the environment. This realization sparked a wave of curiosity among researchers, leading them to investigate the antioxidant and antibacterial properties of fresh Rosa damascena flower extracts. You know how roses go through all those stages, from a tiny bud to a full-blown bloom, then eventually fading away? Well, the essential oil they produce changes along with them. It's like a little magic trick! of the oil lives in the petals, tucked away in the cells of the epidermis and the parenchyma. That's about 93% of the total oil in the flower. On average, a rose flower holds about 0.035% oil, but depending on the variety, that number Most can swing from a measly 0.009% to a generous 0.062%. As the rose blossoms, the amount of oil and its composition shift. It's like the rose is constantly adjusting its recipe for this precious perfume. It's fascinating, really.Tucked away in the heart of the Balkan Peninsula, Bulgaria, a country not exactly known for its size, boasts a unique treasure: the fragrant heart of the rose. You might not picture Bulgaria as a rose haven, but its diverse climate, a blend of continental coolness in the north and Mediterranean warmth in the south, plays a starring role in this fragrant tale. This beautiful interplay of nature has nurtured a tradition, a love affair with the rose that stretches back over four centuries.

The "Valley of the Roses," a haven for these delicate blooms, nestled between the charming towns of Karlovo and Kazanlik, is where the magic happens. Imagine a landscape bathed in sunshine, a gentle breeze whispering through

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fields of pink and white, and the air thick with the intoxicating scent of roses. This is the birthplace of Bulgaria's famed rose oil, a treasure extracted from the petals of the Rosa damascena Mill, a variety prized for its exquisite aroma. It's a story of nature's artistry, a symphony of sun, soil, and the delicate dance of a flower, woven together to create a fragrant legacy.

Extraction Techniques

Essential oils can be extracted from several plants with different parts by various extraction methods. The manufacturing of essential oils, and the method used for essential oil extraction are normally dependent on botanical material used. Extraction method is one of prime factors that determine the quality of essential oil. Inappropriate extraction procedure can lead to the damage or alter action of chemical signature of essential oil. This results in the loss in bioactivity and natural characteristics.

1. Maceration: Macerationof rose leaves is a process that involves soaking the leaves in a solvent, such as ethanol, methanol, or water, to extract the desired compounds. Here is a step-by-step guide to maceration of rose leaves:

Procedure of Maceration

1. Prepare the rose leaves: Dry the rose leaves completely, or use fresh leaves. Remove any stems or debris.
2. Choose a solvent: Select a solvent that is appropriate for the desired compounds to be extracted.
3. Combine rose leaves and solvent: Place the rose leaves in the glass jar or container and pour the solvent over them. Ensure that the leaves are completely covered.
4. Steep: Cover the jar with a lid and let it steep for 2-3 days or up to 2 weeks, depending on the desired strength of the extract.
5. Shake: Shake the jar daily to agitate the mixture and promote extraction.
6. Strain: After the steeping period, strain the mixture through cheesecloth or a coffee filter into another container. Discard the solids.
7. Filter: Filter the liquid extract to remove any impurities.
8. Concentrate: Concentrate the extract through evaporation, distillation, or freeze-drying, if desired.
9. Store: Store the rose leaf extract in a clean, dark container, labeled and dated

2. Soxhlet Extraction: Ordinary solvents like acetone, petroleum ether, hexane, methanol, or ethanol have been implemented by this technique to extract fragile or delicate flower materials which cannot be extracted using heat or steam supplied]. Generally, the plant samples are mixed with solvents to be extracted by mildly heating the mixture, and the process is followed by filtration and evaporation of the solvents. The filtrate contains a resin (resinoid), or the mixture of wax, fragrance, and essential oil. Alcohol is combined with the filtrate mixture in order to dissolve the essential oil into it and thereafter distilled at low temperature.

Process:

The round-bottom flask containing the solvent is heated, causing the solvent to evaporate and travel upwards.
The vapor reaches the condenser, where it cools and condenses, then drips into the extractor chamber containing the plant material.
The solvent gradually fills the chamber, allowing the target compounds to dissolve into the solvent.
Once the chamber reaches a certain level, it siphons back down to the flask, carrying the dissolved compounds with it.
cycle repeats continuously, with fresh solvent contacting the plant material until the extraction process is complete.

3. Ultrasound-Assisted Extraction (UAE): Ultrasonic-assisted extraction (UAE) is a technique that uses ultrasonic waves to facilitate the extraction of bioactive compounds from plant materials like rose leaves. This method can enhance the efficiency and yield of the extraction process by using high-frequency sound waves to create cavitation (the formation and collapse of tiny bubbles) in the solvent, which helps to break down the plant cells and release the compounds into the solvent.

Procedure of Ultrasound-Assisted Extraction

1. Preparation of Plant Material:Collect and clean the rose leaves to remove dirt and contaminants.
Chop or crush the leaves to increase the surface area for extraction.

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2. Selection of Solvent: Choose an appropriate solvent based on the compounds you wish to extract (e.g., flavonoids, polyphenols, essential oils).Common solvents include ethanol, methanol, or water. A mixture of water and ethanol can also be used to extract both polar and non-polar compounds.
3. Preparation of Extraction Solution: Weigh the appropriate amount of rose leaves. Add the solvent at a solvent-to-plant ratio typically between 1:10 to 1:20 (e.g., 10–20 mL of solvent for every 1 gram of plant material).
4. Ultrasonic Extraction Process: Place the rose leaves and solvent mixture in a beaker or container. Submerge the ultrasonic probe into the solution or place the beaker in the ultrasonic bath. Apply ultrasonic waves (typically at a frequency of 20-40 kHz) for a specified duration, usually between 15 to 30 minutes. Adjust power levels depending on the setup and the sensitivity of the compounds being extracted. The ultrasonic waves cause cavitation, which disrupts the plant cell walls, aiding in the release of bioactive compounds.
5. Filtration or Separation: After the extraction, filter the mixture to remove solid plant material using filter paper or a centrifuge if necessary. Collect the liquid extract, which now contains the dissolved bioactive compounds from the rose leaves.

4. Microwave-Assisted Extraction (MAE): Microwave-assisted extraction (MAE) is another advanced method used to extract bioactive compounds from plant materials like rose leaves. This technique uses microwave energy to heat the solvent and plant material, facilitating the release of target compounds. The microwave energy causes rapid heating, which results in the disruption of plant cell walls, enhancing the extraction process..

Procedure of Microwave-Assisted Extraction
1. Preparation of Plant Material: Collect and clean the rose leaves thoroughly to remove dirt and contaminants.Chop or grind the leaves to increase surface area, which improves the extraction efficiency.
2. Solvent Selection: Choose an appropriate solvent based on the compounds you are targeting. Common solvents include:Ethanol or methanol for extracting phenolic compounds, flavonoids, and other polar metabolites.Water or water-ethanol mixtures for a broad range of compounds.
3. Preparation of Extraction Solution: Weigh an appropriate amount of rose leaves (e.g., 1–10 grams).Add the solvent in a suitable ratio, often 10–20 mL of solvent per gram of plant material.
4. Microwave Extraction Process: Place the rose leaves and solvent mixture into a microwave-safe container or beaketSet the microwave-assisted extraction unit to the desired parameters. Common conditions include:
Power: Typically 300–600 W (microwave power), but this can vary based on the plant material and solvent.
Time: Microwave-assisted extraction times can vary from 2 to 15 minutes, depending on the solvent and compounds being extracted.
Temperature: The extraction temperature should be controlled to prevent degradation of sensitive compounds. Common extraction temperatures range from 40°C to 90°C.

5. Supercritical Fluid Extraction (SFE): SupercriticalFluid Extraction (SFE) is a highly effective and advanced technique used to extract bioactive compounds from plant materials, including rose leaves. This method utilizes supercritical fluids, most commonly carbon dioxide (CO_2), to extract essential oils, phenolic compounds, flavonoids, and other bioactive substances. Supercritical CO_2 is preferred because it is non-toxic, inexpensive, and can be easily removed after extraction.

Procedure of Supercritical Fluid Extraction:
1.Selection of Supercritical Fluid (CO_2): Carbon Dioxide (CO_2) is the most commonly used solvent due to its non-toxicity, low cost, and ease of separation from the extracted compounds. The CO_2 is stored in a liquid form at high pressure, and it's pumped into the extraction chamber.
2. Extraction Process: Once the CO_2 reaches its supercritical state, it flows through the plant material, dissolving and extracting the compounds from the rose leaves. The process can last anywhere from 30 minutes to several hours, depending on factors like the type of compound being extracted and the efficiency of the system.In some systems, co-

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solvents (like ethanol or methanol) may be added to increase the extraction of certain polar compounds, though this is not always necessary.

6. Hydrodistillation: Hydrodistillation is a traditional and widely used technique for extracting essential oils and other volatile compounds from plant materials, including rose leaves. This method involves using water or steam to distill volatile compounds from the plant material, making it an effective way to extract essential oils, fragrances, and other bioactive substances.

1. Preparation of Rose Leaves: Collection and Cleaning: Collect fresh rose leaves. Wash them thoroughly to remove dust, dirt, or other contaminants.

Size Reduction: Cut or shred the rose leaves into smaller pieces to increase the surface area and facilitate better extraction of volatile compound.

2. Hydrodistillation Process:

Heating: Heat the water in the boiler, bringing it to a boil. As the water boils, steam will rise through the plant material and carry the volatile compounds from the rose leaves into the condenser.

Steam and Condensation: The steam, now carrying essential oils and other volatile compounds, enters the condenser where it cools and condenses back into liquid form.

Collection: The condensed liquid will flow into the collection flask. The mixture will contain both essential oil and hydrosol.

Isolation and Separation Techniques

Once the compounds are extracted, further isolation and separation are required to purify specific bioactive compounds. Techniques used for Rose levels include chromatography, electrophoresis, and other advanced methods, each with varying degrees of specificity and resolution.

1. Chromatography: Chromatography techniques, including thin-layer chromatography (TLC), high-performance liquid chromatography (HPLC), and gas chromatography (GC), are widely used for separating and purifying bioactive compounds. HPLC is particularly effective in isolating Rose compounds due to its high resolution and versatility in separating different types of compounds based on polarity and molecular weight. TLC is often used for initial screening and rapid qualitative analysis, while GC is suitable for volatile compounds such as essential oils. Chromatographic methods have been widely applied in isolating phenolics, flavonoids, and glucosinolates from Rose extracts.

2. Electrophoresis: Electrophoretic techniques, such as capillary electrophoresis (CE), offer high-resolution separation based on the charge-to-size ratio of molecules. Capillary electrophoresis is suitable for analyzing Rose levels smaller bioactive compounds and offers rapid analysis with minimal sample and solvent requirements. However, it may be less effective for larger, non-ionic compounds, limiting its application for certain Rose levels constituents.

3. Liquid-Liquid Extraction (LLE): LLE separates compounds based on their solubility in different solvents. It is a simple yet effective technique for fractionating Rose levels extracts into polar and non-polar components. LLE has been used as a preliminary separation step before further purification, particularly for isolating hydrophilic and lipophilic compounds in Rose levels extracts.

4. Preparative HPLC: This technique is an advanced form of HPLC used to isolate large quantities of purified compounds for further study or application. Preparative HPLC has proven effective in isolating Rose levels bioactive constituents with high purity, though it requires sophisticated equipment and expertise.

II. CONCLUSION

Essential oils, those fragrant extracts from plants, have been capturing hearts and minds for centuries. Their applications, from aromatherapy to culinary delights, are well-known. But did you know that these potent liquids are also being explored for their potential in medicine? Researchers are diving deep into the world of essential oils, fascinated by their ability to fight cancer cells, viruses, and bacteria. They're even investigating how these oils could be used to enhance the absorption of medications through the skin. It's a fascinating journey, fueled by the growing demand for natural solutions in a world increasingly reliant on synthetic alternatives. However, there's a catch. Essential oils are like finicky friends – prone to spoiling and easily evaporating. This makes them a bit tricky to work with, especially in the pharmaceutical field where precision is paramount. But fear not! Scientists are on the case, developing innovative ways to harness the power of essential oils while overcoming their limitations. Imagine a future where the

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healing properties of these natural wonders are fully realized, transforming the way we approach medicine. It's a tantalizing prospect, isn't it?

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