

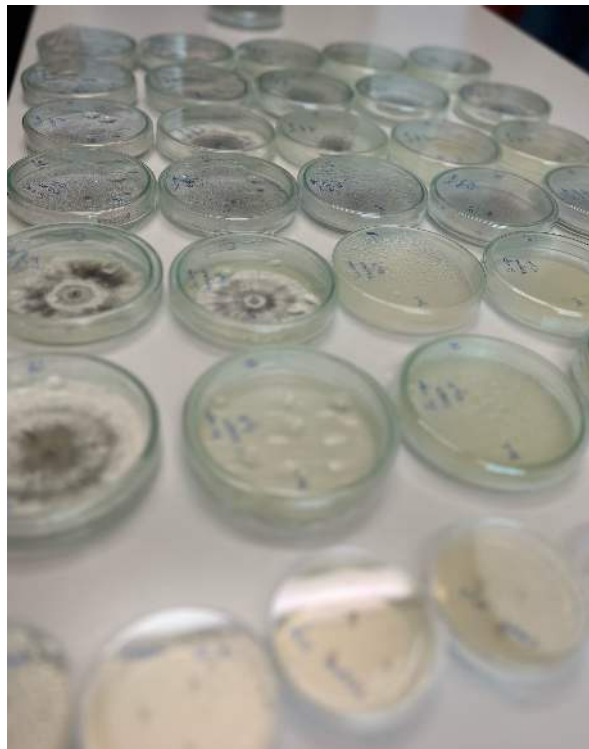


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Cooperation to Implement Innovative Methods
for the Assessment of Medicinal Plants with
Central Roles in Pharmaceuticals, Agriculture and
Nutrition

ERASMUS KA220-HED - Cooperation
partnerships in higher education

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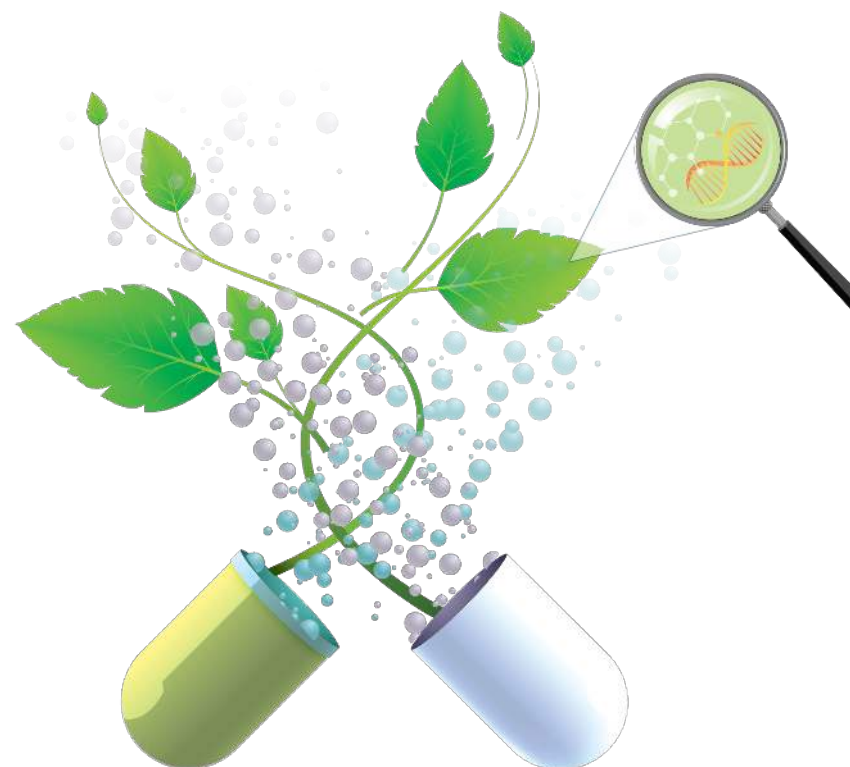




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The pharmacotoxicological approach of medicinal plants with a central role in pharmaceuticals

CO – UMFVBT



EURO-PLANT-ACT



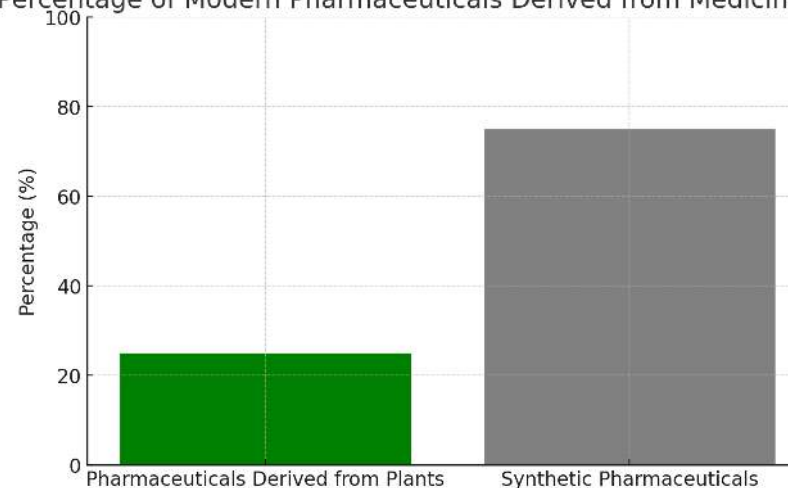
INTRODUCTION

- **What is Pharmaco-Toxicology?**
 - The study of how natural and synthetic compounds interact with biological systems, both beneficially and harmfully.
- **Why Focus on Medicinal Plants?**
 - Medicinal plants have a rich history in traditional medicine and are a source of numerous pharmaceutical drugs.
- **Purpose of the Presentation**
 - Explore the dual aspects: pharmacological benefits and toxicological risks.
 - Understand the methods used to evaluate plant safety and efficacy in drug development.

The Role of Medicinal Plants in Pharmaceuticals

- **Historical Use**
 - Medicinal plants like *Willow bark* (source of aspirin) and *Foxglove* (source of digitalis) have been used for centuries.
- **Modern Pharmaceuticals**
 - Approximately 25% of current pharmaceuticals are derived from plant sources.
- **Examples**
 - *Morphine* from *Papaver somniferum* (Opium Poppy)
 - *Quinine* from *Cinchona bark* for malaria treatment
- **Impact on Healthcare**
 - Cost-effective treatments and a significant role in global health, especially in resource-limited settings.

Percentage of Modern Pharmaceuticals Derived from Medicinal Plants



Pharmacological Properties of Medicinal Plants



Active Compounds

Alkaloids:

- Nitrogenous compounds like morphine and atropine.

Flavonoids:

- Antioxidants found in fruits and vegetables, contributing to anti-inflammatory properties.

Terpenes:

- Found in essential oils, known for antimicrobial and anti-inflammatory effects.



Mechanism of Action

Receptor Binding:

- How plant compounds mimic or block natural hormones and neurotransmitters.

Enzyme Inhibition:

- Impact on metabolic pathways (e.g., flavonoids inhibiting inflammatory enzymes).



Specific Examples

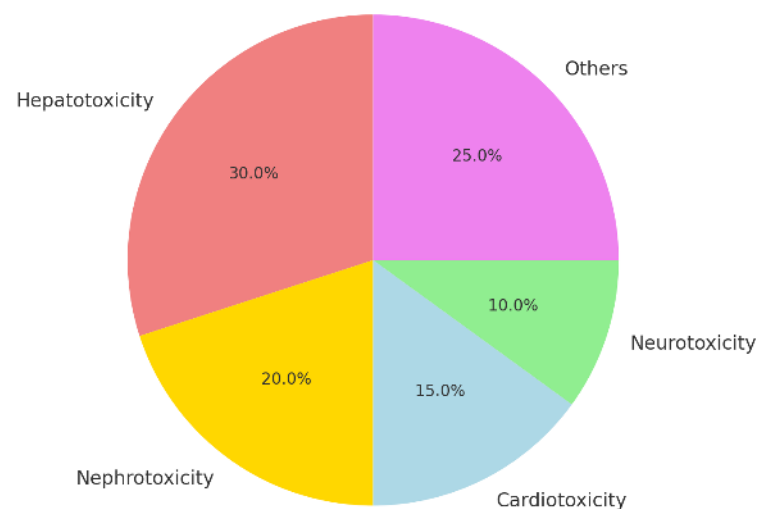
Curcuma longa (Turmeric):
Curcumin's anti-inflammatory and antioxidant mechanisms.

Echinacea: Immune-boosting properties and applications in common cold prevention.

Toxicological Considerations

- **Potential Risks**
 - Toxic compounds like cyanogenic glycosides in some seeds can release cyanide.
 - Examples of hepatotoxicity, nephrotoxicity, and cardiotoxicity associated with certain plants.
- **Dose-Dependency**
 - Low doses may be therapeutic, while high doses can be fatal (e.g., *Atropa belladonna*).
- **Cumulative Effects**
 - Chronic exposure and the risk of bioaccumulation.
- **Regulatory Standards**
 - Guidelines from agencies like the FDA and WHO to ensure the safety of plant-based products.

Proportion of Toxicological Risks Associated with Plant-Based Compound





Case Studies

Successful Example:

- *Artemisinin* from *Artemisia annua* for malaria treatment.

Pharmacological Success:

- Nobel Prize-winning discovery, minimal resistance when combined with other drugs.

Toxicity Case:

- *Pyrrolizidine alkaloids* in certain herbal teas causing liver damage.

Consequences:

- Severe health outcomes and increased regulatory scrutiny.

Discussion Points

- What we learn about balancing efficacy and safety.
- The importance of traditional knowledge in guiding scientific research.

Pharmaco-Toxicological Methods

- **Experimental Approaches**

- **Phytochemical Screening:**
 - Identifying and isolating active compounds.
- **In Vivo Studies:**
 - Animal models to assess safety and effectiveness.
- **In Vitro Studies:**
 - Cell cultures to observe biochemical effects.
- **In Vivo vs. In Vitro**
 - Pros and cons of each approach.
 - Relevance to understanding complex human systems.

- **Modern Technologies**

- **High-Throughput Screening:**
 - Rapid testing of thousands of compounds.
- **Computational Toxicology:**
 - Predictive modeling using AI and machine learning.

Pharmaco-Toxicological Methods Workflow





Challenges and Limitations

Complexity of Plant Extracts

- Difficulty in standardizing extracts due to multiple active compounds.
- Variability in concentration depending on cultivation and harvest conditions.

Quality Control

- Issues with adulteration and contamination in herbal products.
- Need for rigorous quality assurance and certification.

Safety and Efficacy

- Limited clinical trials for many medicinal plants.
- Concerns about herb-drug interactions, especially in polypharmacy patients.



Future Perspectives

Biotechnology and Genetic Engineering

- Engineering plants to increase the production of beneficial compounds.
- CRISPR technology for targeted modification.

Phytopharmaceuticals

- Growth of herbal medicine markets globally.
- Innovations in delivery methods (e.g., nanocarriers for plant-based drugs).

Sustainability Concerns

- Conservation of endangered medicinal plant species.
- Ethical sourcing and promoting biodiversity.

Conclusion

Summary of Key Points

- The pharmaco-toxicological approach is essential for developing safe, effective plant-based medications.
- Balancing the benefits with potential risks requires rigorous scientific evaluation.

Final Thoughts

- Continued interdisciplinary research is critical.
- Emphasize the role of traditional knowledge combined with modern science.

Q&A

- Open the floor for questions and invite discussion.



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Drug Regulation for Medicinal Plants

- Drug regulation for medicinal plants is a complex and essential process designed to ensure the safety, efficacy, and quality of plant-based medicinal products.
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Regulatory Agencies

- **Key Agencies:**

- Organizations like the U.S. Food and Drug Administration (FDA), European Medicines Agency (EMA), World Health Organization (WHO), and others are responsible for overseeing the regulation of herbal and plant-based medicines.

- **Role:**

- These agencies establish guidelines and standards to protect public health and ensure that medicinal plant products are safe and effective.



Classification of Plant-Based Products

Medicinal Products vs. Supplements: Medicinal Products

- Regulated more strictly. They require clinical evidence to prove their efficacy and safety before approval.

Dietary Supplements

- Generally regulated as food products. They have less stringent requirements, often focusing on safety rather than proven efficacy.

Traditional Herbal Medicines

- In some jurisdictions, traditional use can be considered as supporting evidence for safety and efficacy, provided there are no new safety concerns.

Standards for Quality and Safety

Phytochemical Analysis

- Ensuring the correct identification and quantification of active compounds in medicinal plants. This step is crucial for standardization.

Contaminant Testing

- Products must be free from harmful levels of contaminants such as heavy metals, pesticides, and microbial contaminants.

Good Manufacturing Practices (GMP)

- Manufacturers must adhere to GMP standards, which cover production processes, quality control, and proper labeling.



Preclinical and Clinical Evaluation

Preclinical Studies

- These are laboratory and animal studies conducted to assess the safety and biological activity of medicinal plant extracts or compounds.

Clinical Trials

- For plant-based drugs classified as medicinal products, clinical trials are necessary to demonstrate efficacy and monitor for adverse effects. The trials follow similar phases as conventional drug trials (Phase I, II, III, and IV).



Documentation and Evidence Requirements

Pharmacological Evidence

- Proof of how the medicinal plant works, based on scientific or traditional evidence.

Toxicological Studies

- Data on the safety of the medicinal plant, including the potential for acute or chronic toxicity.

Traditional Use

- In some cases, a long history of traditional use can be used to support the safety of a medicinal plant. However, additional studies may still be required to confirm efficacy and address any concerns about long-term safety.



Post-Market Surveillance

Monitoring Adverse Effects

- Even after a plant-based medicinal product is approved, regulatory agencies require ongoing monitoring to detect any adverse effects or safety concerns.

Recalls and Warnings

- If a product is found to be unsafe, it can be recalled or subject to warnings. Regulatory agencies can take action to protect consumers.



Labeling and Claims

Strict Labeling Requirements

- The label must accurately describe the contents and include information about the proper usage, dosage, potential side effects, and any contraindications.

Health Claims

- For medicinal products, any health claims must be substantiated by clinical evidence. Supplements, on the other hand, must include a disclaimer that their claims have not been evaluated by regulatory agencies if they are not approved as medicinal products.



International Harmonization

Guidelines by WHO

- The World Health Organization has published guidelines on the quality control, safety assessment, and use of herbal medicines to help harmonize regulations globally.

Herbal Pharmacopeias

- Many countries have developed herbal pharmacopeias that provide detailed information on the standardization of medicinal plants.



Summary

Drug regulation for medicinal plants ensures that plant-based products are safe and effective for human use.

The process involves strict quality control, evidence-based safety and efficacy assessments, and ongoing monitoring once the products are on the market.

Regulation varies depending on whether a product is marketed as a traditional medicine, a supplement, or a pharmaceutical drug, with varying levels of scrutiny.



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Medicinal plants from the spontaneous flora and cultivated in Romania

P1 - USVT





INTRODUCTION

Overview

- Romania's unique geographical and climatic conditions have led to a diverse range of medicinal plants, both wild and cultivated.

Importance

- Medicinal plants are a crucial part of traditional medicine and modern pharmaceuticals in Romania.

Objective

- To understand the significant medicinal plants found in Romania, their uses, and the difference between wild and cultivated varieties.

Romania's Rich Biodiversity

Geographical Factors

- The Carpathian Mountains, Danube Delta, and fertile plains contribute to the variety of plant species.

Statistics

- Over 3,700 species of plants, with more than 700 used in traditional and modern medicine.

Unique Flora

- Romania's flora includes rare and endemic species that are valuable for medicinal purposes.



Medicinal Plants from Spontaneous Flora

Definition

- Spontaneous flora refers to plants growing naturally without human intervention.

Key Examples

- *Hypericum perforatum* (St. John's Wort): Used for depression and wound healing.
- *Arctium lappa* (Burdock): Known for detoxification and skin conditions.
- *Centaurea cyanus* (Cornflower): Used for anti-inflammatory and astringent properties.

Advantages

- Naturally adapted to the local environment, often richer in active compounds.

Cultivated Medicinal Plants in Romania

- **Reasons for Cultivation**

- Standardization, higher yield, and easier access for pharmaceutical use.

- **Key Examples:**

- *Mentha piperita* (Peppermint): Cultivated for essential oils and digestive benefits.
- *Calendula officinalis* (Marigold): Widely grown for its anti-inflammatory and skin-healing properties.
- *Melissa officinalis* (Lemon Balm): Cultivated for its calming and antiviral effects.

- **Benefits**

- Controlled growth conditions lead to consistent quality and availability.

Wild vs. Cultivated Medicinal Plants

Wild Medicinal Plants:

- Grow naturally without human intervention
- Rich in active compounds due to adaptation
- Higher risk of overharvesting and habitat loss

Cultivated Medicinal Plants:

- Grown in controlled conditions
- Consistent quality and yield
- Easier to standardize for pharmaceutical use



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Traditional Use of Medicinal Plants in Romania

Folk Medicine Practices

- How plants have been used for centuries in rural areas.

Herbal Remedies

- Common preparations such as teas, tinctures, and poultices.

Cultural Significance

- Role of medicinal plants in traditional rituals and healing ceremonies.



Modern Applications and Research

- **Integration into Pharmaceuticals**
 - Medicinal plants are used for developing natural remedies and pharmaceutical drugs.
- **Research Initiatives**
 - Studies conducted by Romanian universities and research centers.
- **Case Study**
 - A focus on a well-researched medicinal plant, like *Allium ursinum* (Wild Garlic), and its health benefits.



Conservation and Sustainability

Threats to Spontaneous Flora

- Overharvesting, habitat loss, and climate change.

Conservation Efforts

- Initiatives to protect and sustainably use medicinal plant resources.

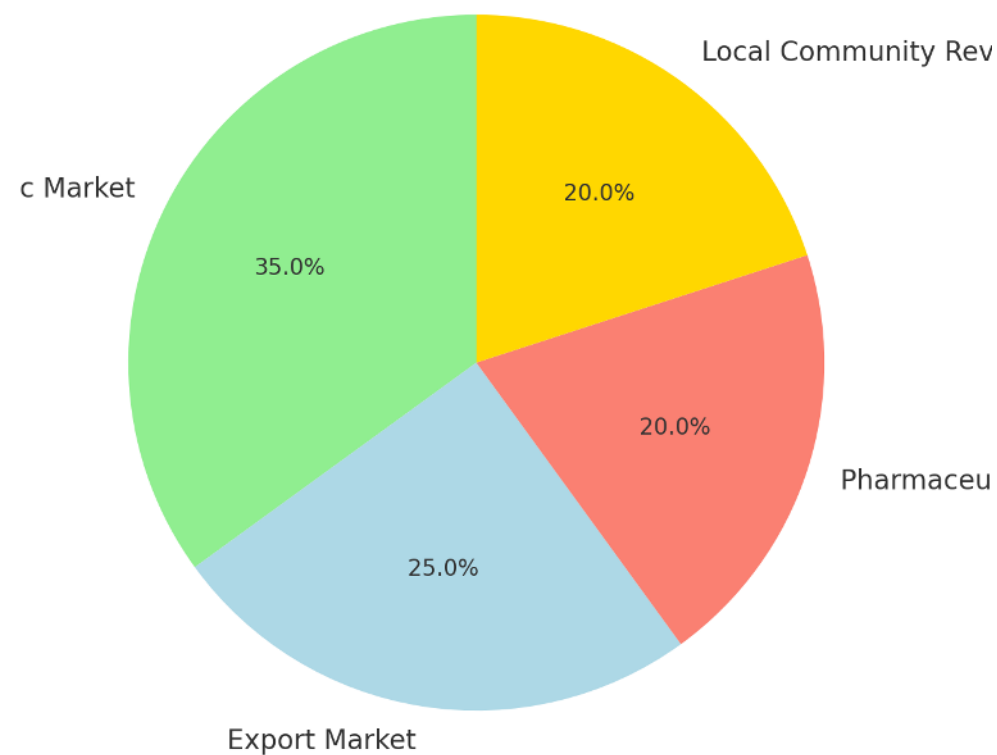
Cultivation Programs

- Encouraging local farmers to grow medicinal plants for commercial and conservation purposes.

Economic and Cultural Impact

- **Herbal Industry in Romania**
 - Contribution to the economy and export market.
- **Local Communities**
 - Impact of medicinal plant cultivation on rural livelihoods.
- **Cultural Heritage**
 - Preserving traditional knowledge and practices related to medicinal plants.

Economic Impact of the Herbal Industry in Romania



Conclusion

Summary

- Recap of the importance of medicinal plants in Romania's flora, their traditional and modern uses.

Future Directions

- Need for continued research, conservation, and sustainable use.

Q&A

- Open the floor for questions and discussion.

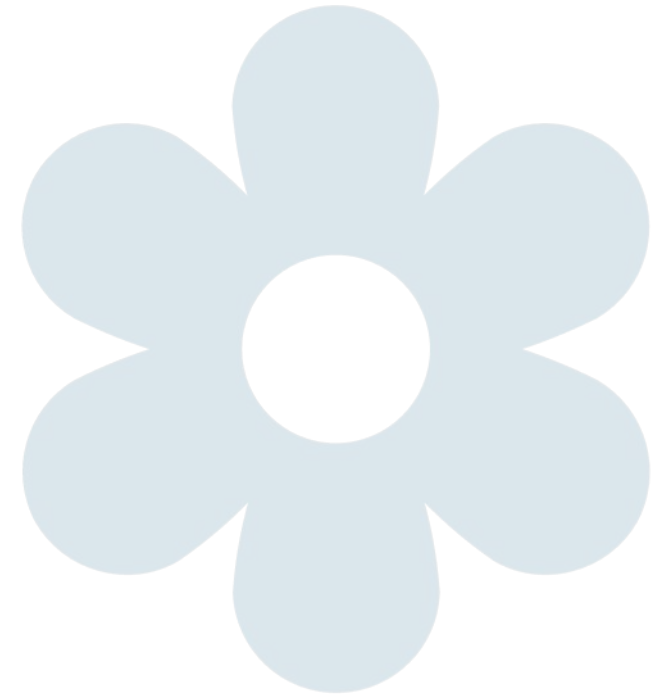


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Methods to Obtain Finite Plant-Based Products (Extracts, Essential Oils)

P3 - UNICAL



Introduction

Overview

- Explanation of plant-based products, focusing on extracts and essential oils.

Importance

- These products are widely used in pharmaceuticals, cosmetics, and the food industry.

Objective

- Understand the methods used to extract and purify active compounds from plants.

Classification of Plant-Based Products

- **Extracts**
 - Concentrated forms of plant materials obtained using solvents.
- **Essential Oils**
 - Volatile, aromatic compounds obtained through distillation.
- **Other Products**
 - Hydrosols, tinctures, and resins.

Detailed Plant-Based Product Categories

Extracts	Essential Oils	Tinctures	Resins	Hydrosols
Alcoholic Extracts - Tinctures Aqueous Extracts - Decoctions Glycerin Extracts - Glycerites	Common Oils - Lavender Oil Citrus Oils - Lemon Oil - Orange Oil - Bergamot Oil	Single Herb - Echinacea Multi-Herb - Herbal Blends - Immunity Boosters	Tree Resins - Frankincense Bee Resins - Propolis	Floral Waters - Rose Water Citrus Waters - Orange Blossom Water

Overview of Extraction Methods

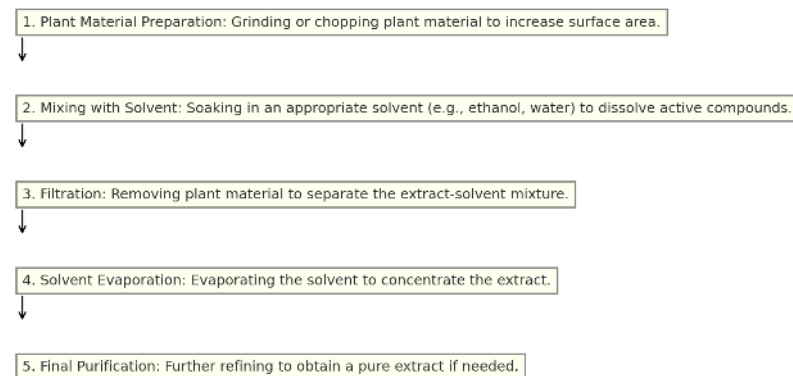
- **Solvent Extraction**
 - Use of solvents like ethanol or methanol to extract compounds.
- **Steam Distillation**
 - Common method for obtaining essential oils.
- **Cold Pressing**
 - Used for citrus peels to get essential oils.
- **Maceration and Percolation**
 - Techniques for obtaining extracts.



Solvent Extraction

- **Process**
 - Soaking plant material in a solvent to dissolve active compounds.
- **Types of Solvents**
 - Water, ethanol, hexane, etc.
- **Advantages**
 - Efficient for a wide range of compounds.
- **Disadvantages**
 - Risk of residual solvents, may alter heat-sensitive compounds.

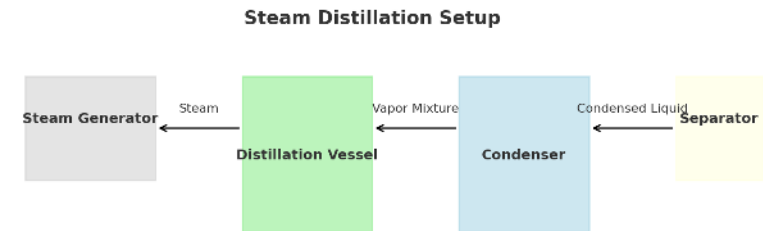
Solvent Extraction Process





Steam Distillation

- **How It Works**
 - Steam passes through plant material, carrying essential oils, which are then condensed and separated.
- **Common Uses**
 - Extraction of lavender, eucalyptus, and peppermint oils.
- **Advantages**
 - High purity of essential oils.
- **Disadvantages**
 - Not suitable for heat-sensitive or resinous materials.





Cold Pressing

- **Description**

- Mechanical method used to extract essential oils from citrus peels.

- **Process Steps**

- Washing, pressing, and centrifuging.

- **Advantages**

- Preserves the natural aroma of citrus oils.

- **Limitations**

- Only suitable for citrus fruits.

Simplified Cold Pressing Process



Maceration and Percolation

- **Maceration**

- Plant material is soaked in a solvent at room temperature.

- **Percolation**

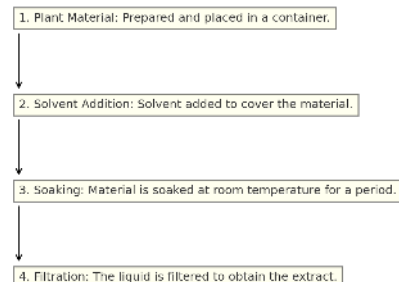
- Continuous flow of solvent through plant material for extraction.

- **Applications**

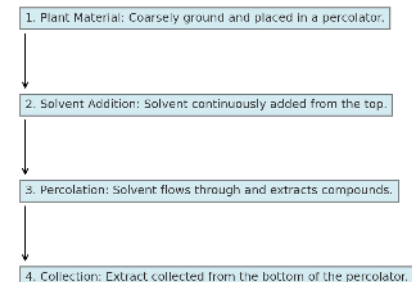
- Used for soft plant materials and delicate flowers.

Comparison of Maceration and Percolation

Maceration



Percolation





Advanced Techniques

- **Supercritical CO₂ Extraction**

- Use of carbon dioxide at high pressure and low temperature to extract compounds.

- **Advantages**

- No solvent residues, high-quality extracts.

- **Applications**

- Used for cannabis and other sensitive plant materials.

- **Ultrasound-Assisted Extraction**

- Use of ultrasonic waves to increase yield and efficiency.

- **Benefits**

- Faster extraction, reduced solvent use.

Quality Control and Purity

- **Testing Methods**
 - Chromatography, spectrometry, and microbiological analysis.
- **Importance**
 - Ensures safety, efficacy, and consistency of extracts and essential oils.
- **Regulatory Standards**
 - Guidelines from pharmacopeias and health authorities.



Applications in Various Industries

Pharmaceuticals

Use of extracts in
herbal medicines
and drugs.

Cosmetics

Essential oils and
plant extracts in
skincare and
perfumes.

Food Industry

Natural flavoring
agents and
preservatives.

Conclusion

Recap

- Overview of the various extraction methods and their applications.

Future Trends

- Emerging technologies in plant extraction.

Q&A

- Open the floor for questions and discussions.



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Implementing the efficient use of plant- derived products in the bakery and flour products industry

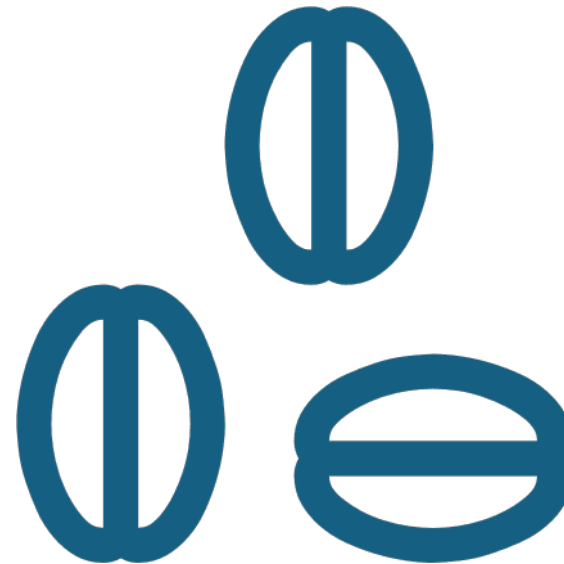
P4 - ROMPAN





Introduction

- **Overview**
 - The bakery industry is evolving with a focus on healthier and sustainable ingredients.
- **Importance**
 - Using plant-derived products can improve nutrition, extend shelf life, and create innovative flavors and textures.
- **Objective**
 - Explore the types, benefits, and implementation strategies for plant-derived products in the bakery industry.





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Types of Plant-Derived Products for the Bakery Industry

Plant-Based Proteins:

- Examples include pea protein, soy protein, and wheat protein.

Fiber and Starches:

- Sources like oat fiber, resistant starch, and psyllium husk.

Natural Sweeteners:

- Stevia, agave, and monk fruit.

Essential Oils and Extracts:

- Vanilla extract, citrus oils for flavor enhancement.

Emulsifiers and Thickeners:

- Guar gum, xanthan gum, and lecithin.

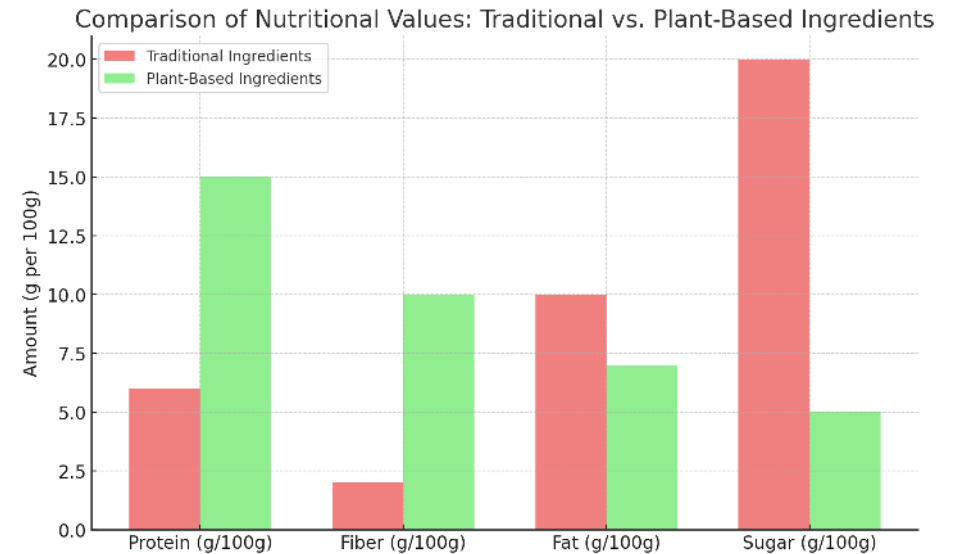
Plant-Derived Ingredients for the Bakery Industry

Plant-Based Proteins	Fiber and Starches	Natural Sweeteners	Essential Oils and Extracts	Emulsifiers and Thickeners
- Pea Protein	- Oat Fiber	- Stevia	- Vanilla Extract	- Guar Gum
- Soy Protein	- Resistant Starch	- Agave	- Citrus Oils	- Xanthan Gum
- Wheat Protein	- Psyllium Husk	- Monk Fruit	- Almond Extract	- Lecithin
- Almond Protein	- Potato Starch	- Maple Syrup	- Cinnamon Oil	- Agar-Agar



Benefits of Using Plant-Derived Products

- **Nutritional Enhancement**
 - Increased fiber, protein, and healthy fats.
- **Functional Benefits**
 - Improved dough strength, moisture retention, and texture.
- **Natural Preservation**
 - Certain plant extracts act as antimicrobials, extending shelf life.
- **Sustainability**
 - Reduced environmental impact compared to animal-based ingredients.





Application in Bakery Products

Bread and Rolls

- Using plant-based proteins for gluten-free options and adding fibers for digestive health.

Cakes and Pastries

- Incorporating natural sweeteners and plant-based emulsifiers for a healthier profile.

Cookies and Crackers

- Enhancing texture and flavor with plant extracts and oils.

Gluten-Free Products

- Substituting traditional wheat flour with plant-based alternatives like almond or chickpea flour.



Case Studies and Industry Examples

Example 1

- A successful implementation of pea protein in bread for a higher protein content.

Example 2

- Use of stevia in cookies to reduce sugar content without compromising taste.

Discussion

- Impact of these implementations on consumer health and market acceptance.



Implementation Process of Plant-Based Ingredients

1. Ingredient Sourcing: Identify reliable and sustainable suppliers of plant-based ingredients.



2. Formulation Development: Adjust recipes to maintain taste, texture, and nutritional profile.



3. Testing and Quality Control: Conduct trials to ensure product consistency and consumer acceptability.



4. Consumer Education: Highlight the benefits of plant-based ingredients through marketing and packaging.



5. Market Launch: Introduce products and monitor feedback for continuous improvement.



Challenges in Implementation

Cost Implications

- Plant-based ingredients can be more expensive than traditional ingredients.

Taste and Texture Adjustments

- Balancing flavor and achieving the desired texture in baked goods.

Supply Chain and Sourcing

- Ensuring a reliable and sustainable supply of plant-derived products.



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Challenges and Potential Solutions for Integrating Plant-Based Products in Baking



Cost Implications

Explore bulk purchasing, develop partnerships with suppliers, and optimize ingredient use to reduce waste.

Taste and Texture Adjustments

Invest in research to balance flavors and textures; use flavor enhancers and binders to mimic traditional ingredients.

Supply Chain and Sourcing

Develop local sourcing strategies, work with certified sustainable suppliers, and diversify ingredient options.

Consumer Acceptance

Educate consumers on health benefits, emphasize clean labels, and offer free samples for taste testing.

Shelf Life and Stability

Incorporate natural preservatives like rosemary extract and optimize packaging to extend shelf life.



Strategies for Efficient Implementation

Formulation Adjustments

- Testing and tweaking recipes to maintain product quality.

Collaboration with Suppliers

- Working with ingredient suppliers for the best quality and innovative solutions.

Consumer Education

- Highlighting the benefits of plant-derived ingredients on packaging and in marketing campaigns.

Research and Development

- Investing in R&D to create new plant-based formulations.



Future Trends in Plant-Based Baking

Innovations in Plant Proteins

- Emerging sources like fava bean and lentil protein.

Clean Label Movement

- Demand for recognizable and natural ingredients.

Personalized Nutrition

- Tailoring bakery products to meet individual dietary needs

Alternative Flours

- Popularity of flours like cassava, banana, and quinoa.

Conclusion

Summary

- Recap of the benefits and potential of plant-derived products in the bakery industry.

Call to Action

- Encourage the adoption of sustainable, health-oriented ingredients.

Q&A

- Open the floor for questions and discussion.