Unlocking Livelihood Opportunities: A Model for Production and Commercialization of Essential Oils from Medicinal and Aromatic Plants

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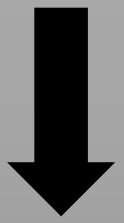
Outline

- Background
- Project Idea and rational
- Aims and objectives
- Research methods
- Expected outcome
- Student training
- Dissemination & awareness & Perspectives
- Current and Future Collaborative Projects

Background

Why is Valorization of Plant Biodiversity and Ecosystem Services important in the African Agri-Food Value Chain System?



Are there opportunities in the Valorization of Medicinal and Aromatic Plants Indigenous to Africa?


Healthy ecosystems
Animal health & Production
Soil health
Conservation of Plant biodiversity
Food security
Climate change mitigation
Human well-being

Medicinal & Aromatic Plants

MAPs represent a diverse plant species with significant therapeutic and economic potential. These plants are widely used in **many industrial fields, including medicine, food, cosmetics, and perfumes.** Medical plants are an important part of plant biodiversity.

- Traditional uses and cultural significance. Primary Healthcare: For centuries, MAPs have been the cornerstone of primary healthcare for a large proportion of the African population.

- Traditional healers, using their extensive knowledge passed down through generations, utilize various plant parts (roots, leaves, bark, fruits, seeds) to treat a wide range of ailments, from common colds and digestive issues to more complex conditions.

- Cultural Practices: MAPs are often integral to cultural and spiritual ceremonies, rituals, and social customs across different ethnic groups. They may be used in various traditions for purification, protection, or as symbolic elements.

- Knowledge Systems: The knowledge surrounding the identification, collection, preparation, and application of MAPs represents rich and complex indigenous knowledge systems, often deeply embedded within specific cultural contexts.

Underutilization of Medicinal & Aromatic Plant Species

- **In Africa, poor knowledge, due to a lack of research on plant biodiversity, adds to the challenges in enhancing the conservation and use of medicinal and aromatic plants.**

- **Limited Cultivation:** These species were used in the past but later became minor in value scale due to the difficulty of cultivation, yield/processing, value addition, and income/use.

- **Standardization of agricultural practices,** Mono-cropping trends, Food habits towards a few commodity crops dominating food systems, Impact of climate change, and anthropogenic forces.

- **Poor Infrastructure and Processing:** In many regions, there is a lack of adequate infrastructure for processing, storage, and quality control of MAPs. This limits their marketability and value addition.

- **Lack of Awareness and Traditional Knowledge Loss:** Traditional knowledge about the uses and benefits of MAPs is being lost, particularly among younger generations. This contributes to their neglect and underutilization.

- **Regulatory Bottlenecks and Market Barriers**: Complex regulatory frameworks and market access challenges can hinder the commercialization of MAP-based products

Opportunities for Valorization of MAPs

- Against these consequences, **innovative strategies** are required to develop tools for the characterization and improvement of indigenous medicinal plants, i.e.,
  - Develop and improve varieties,
  - Improve cultivation practices,
  - **Adapting technologies to remove drudgery in adding value**,
  - Organize efficient market chains for indigenous plant species.

- Moreover, the recognition and awareness of the benefits of maintaining biodiversity in Africa and the domestication of Indigenous medicinal plants, such as
- *Apium graveolens, Vernonia guineensis, Ziziphus mucronate, Okoubaka aubrvellei, Dioscoreophyllum cumminsii,* and *Moringa oleifera.*

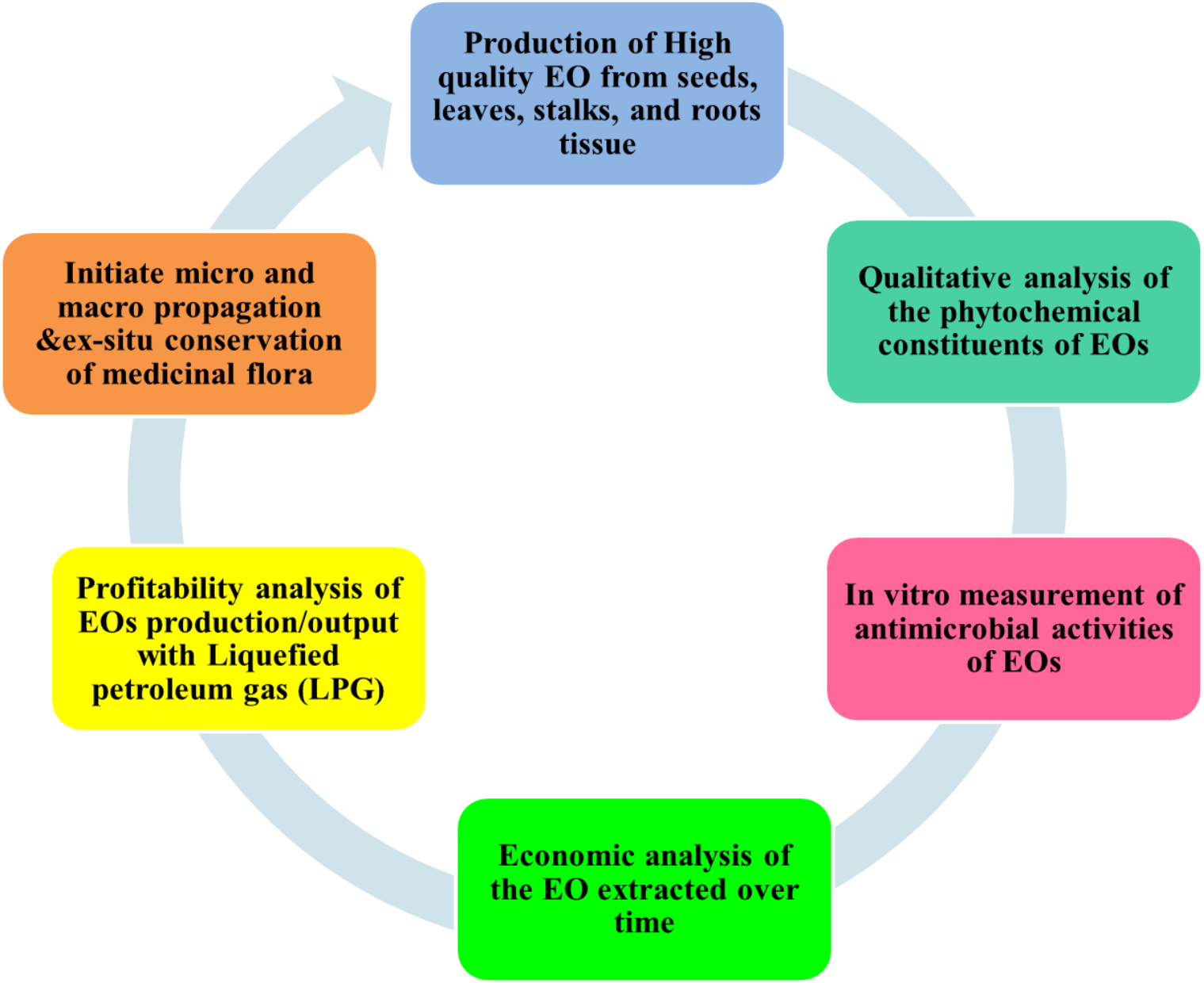
- in the areas of health, food application, nutrition, and income generation**, will open opportunities to scientists for the intensification and characterization as well as conservation and rehabilitation** of these fast-disappearing plant species in Africa.

Rationale for Producing Essential Oils from Underutilized Medicinal

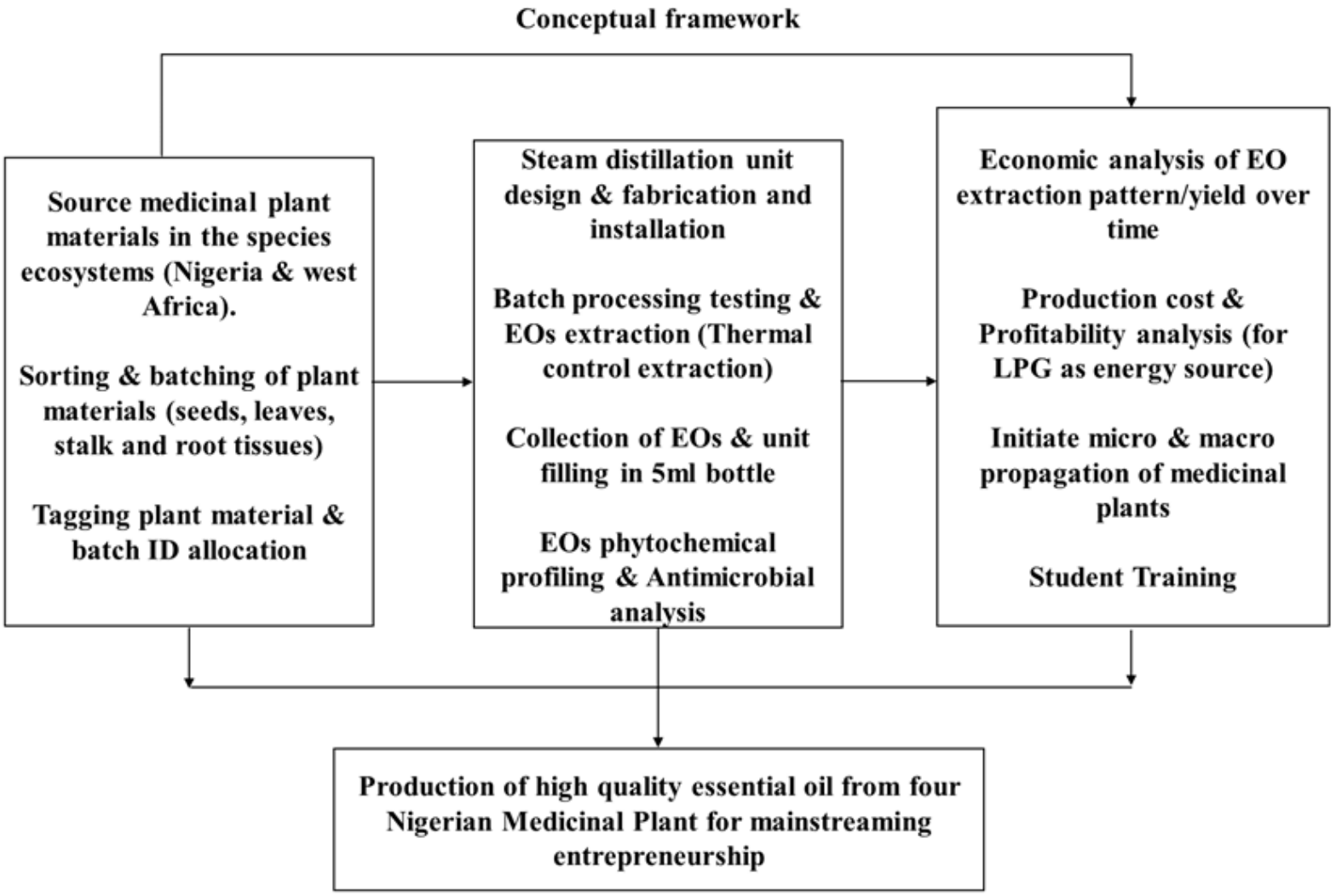
- Many valuable medicinal plants remain endangered and/or threatened due to habitat loss and degradation of biodiversity.
  - Many indigenous medical plants with nutritional-nutraceutical potentials are undervalued, neglected, and underutilized.
  - They are neither domesticated nor characterized.
  - They do not contribute to livelihood and food systems.

- Thus, reversing this trend requires concrete, efficient, and sustainable actions
  - Protect, conserve and sustainably use of indigenous medicinal plants.
  - Develop value-added products, including essential oils, pill, syrup, fortified food, cosmetics, tinctures, and blended products.
  - Sustainable exploitation of the medicinal are necessary to prevent its disappearance in the coming decades.

Aims and Objectives



Project Framework



Project milestones and deliverables

M1

- Design of portable Steam Distillation Unit (SDU) for EO extraction
- Fabrication and installation of SDU
- Extraction of EOs from medicinal plants

M2

- Sourcing of Plant materials
- Sample preparation and batching
- EO collection, ultrafiltration, bottle filling and capping

M3

- Physical and chemical properties of extracted EOs
- Gas chromatography-mass spectrometry (GC–TOF-MS) analyses of EO

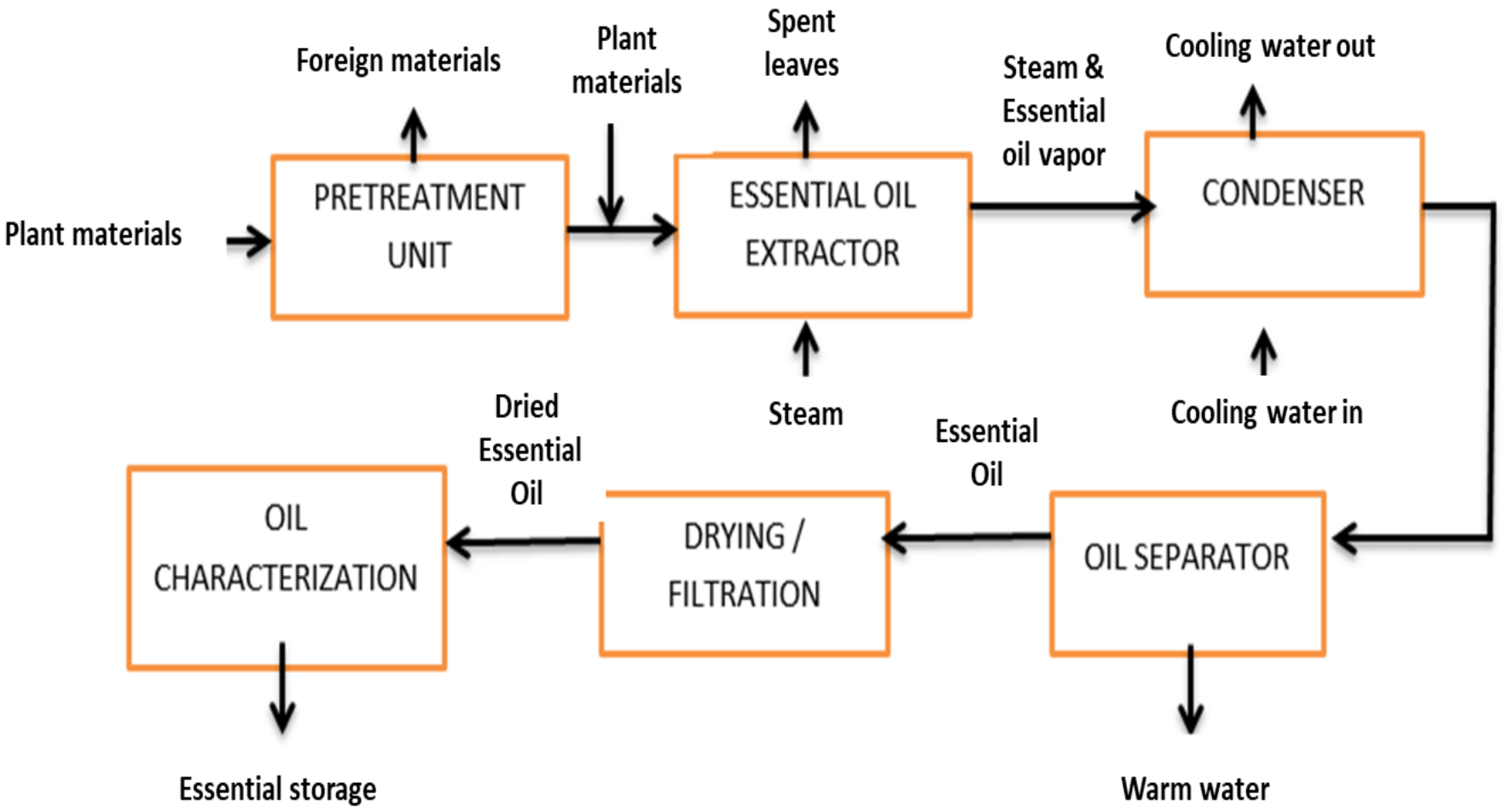
M4

- Bioassay guided in vitro Antimicrobial activity studies
- Production cost & Profitability analysis of EO pilot production

M5

- Tissue culture guided micro-propagation of medicinal plants
- Macro propagation of medicinal plants

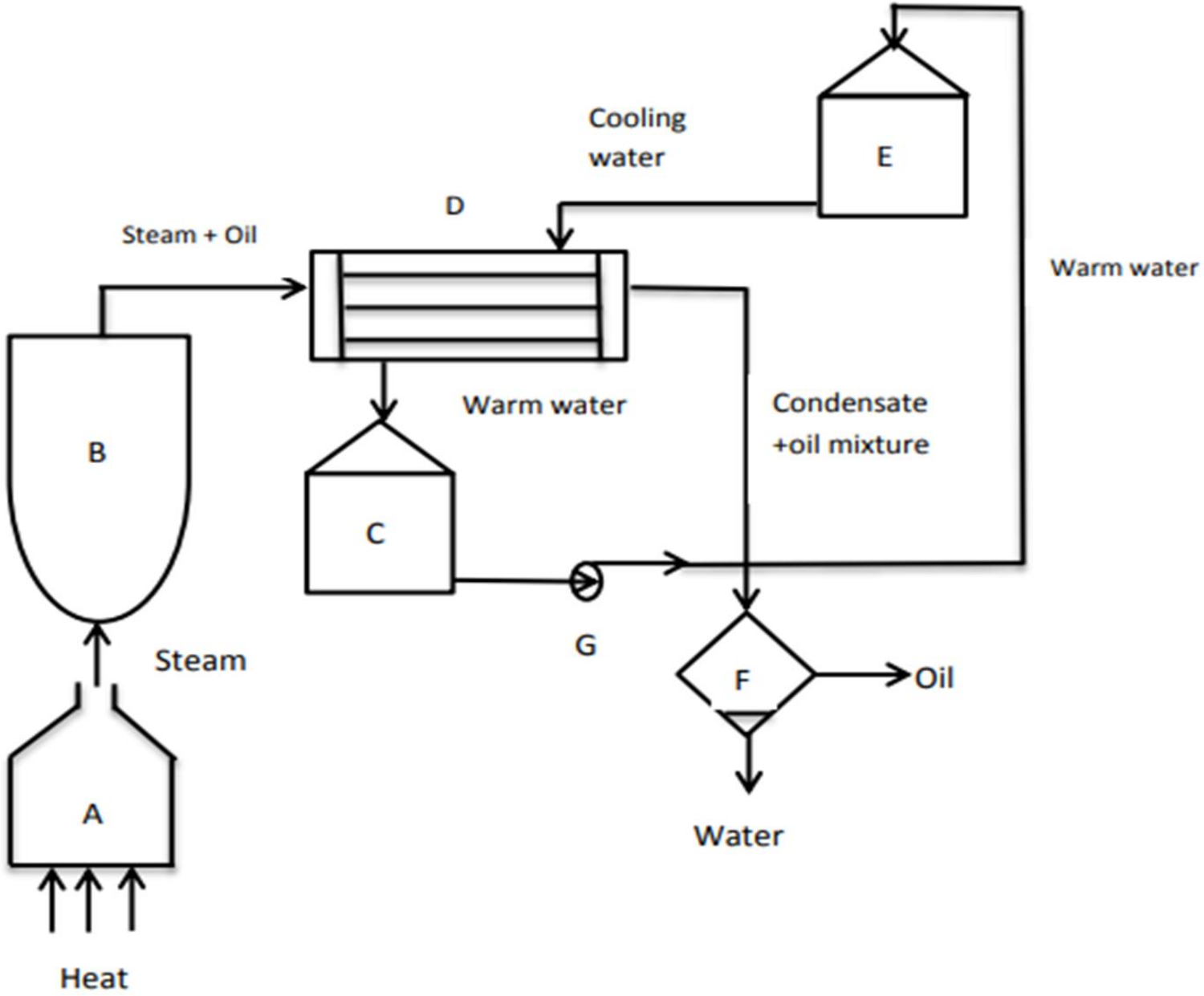
Essential Oil Extraction Process



Components of A Steam Distillation Plant

- Steam boiler:- A device used to generate steam by applying heat energy to water.
- Tank Steel:- A cylindrical container fabricated with stainless steel, and contains the plant raw material for oil distillation.
- Condenser:- Condenser is a heat exchanger used to condense a gaseous substance into a liquid state through cooling by removing the latent heat.
- Oil Separator:- An aspirator or a transparent glass container for separating the essential oil from the condensed steam.
- Burner Unit:- The burner unit essentially consists of a Gas storage tank (12.5kg gas cylinder) and a firing burner.

Schematics of the Process Flow



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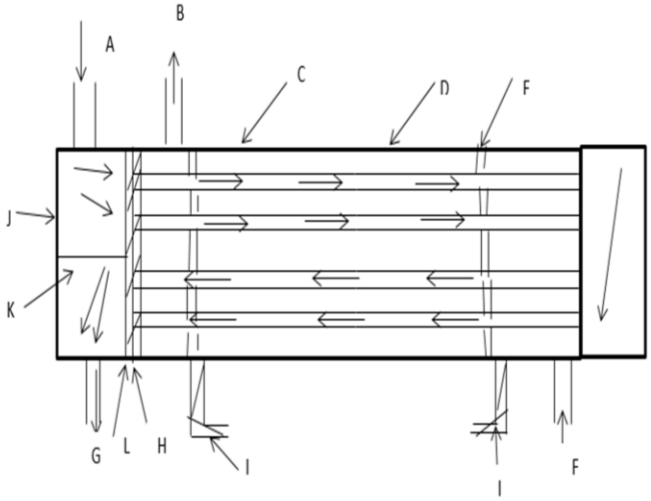
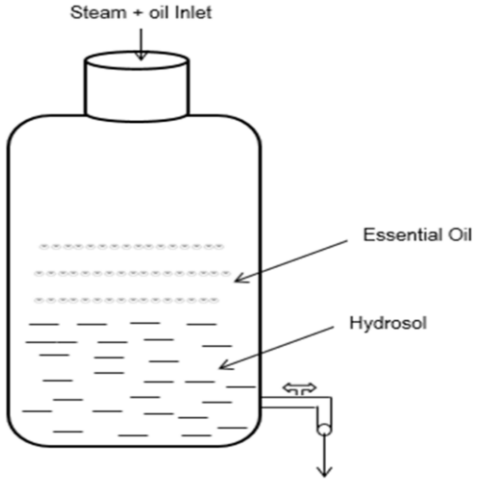
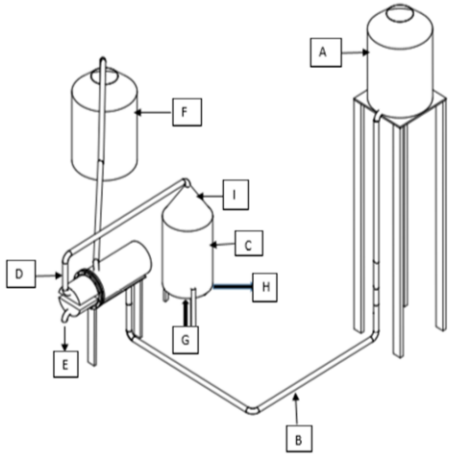


Cross section of the Condenser



Two immiscible layers of oil and hydrosol



Schematic diagram of EO distillation process

Selected medicinal plants for EO extraction

Lemon grass

Aframomum Danielli Leaves

Aframomum Danielli Seeds

Moringa seeds

Ocimum gratissimum

Ocimum gratissimum