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HERBAL DIP / LUNG CARE: A combination of natural herbs with modernised technique for extraction of Phytochemical components and its medical benefits on Lungs

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Respiratory health is a growing global concern due to rising levels of air pollution, urbanization, tobacco usage, and the recurrent emergence of viral respiratory infections. In this context, traditional herbal medicine offers a promising, natural alternative to pharmaceutical interventions, emphasizing long-term wellness, immune resilience, and tissue regeneration. This article presents a novel formulation of a Lung Care Drink composed of ten carefully selected medicinal plants: Long Pepper (Piper longum), Peppermint (Mentha piperita), Rosemary (Rosmarinus officinalis), Kale (Brassica oleracea var. sabellica), Bibhitaki (Terminalia bellirica), Turmeric (Curcuma longa), Milk Thistle (Silybum marianum), Ginger (Zingiber officinale), Garlic (Allium sativum), and Lemon Flakes (Citrus limon).

Each botanical included in the formulation contributes distinct bioactive compounds known for their respiratory therapeutic potential, including expectorant, anti-inflammatory, antioxidant, antimicrobial, and immune modulatory properties. For instance, Long Pepper aids in mucus clearance and enhances the bioavailability of other compounds, while Peppermint and Ginger promote airway relaxation and mucus breakdown. Antioxidant-rich herbs such as Kale, Turmeric, and Milk Thistle protect lung tissues from oxidative stress, while Bibhitaki and Garlic enhance lung detoxification and immunity. Lemon flakes provide vitamin C and flavonoids that support mucosal health and immune defense.

The article elaborates on the taxonomy, phyto-constituents, and pharmacological actions of each ingredient, emphasizing their synergistic potential in respiratory care. The combined formulation represents a holistic approach to lung health, suitable for both therapeutic and preventive use in individuals exposed to pollution, allergens, or respiratory pathogens. By integrating traditional wisdom with scientific validation, this lung care drink offers a safe, natural, and effective strategy for enhancing respiratory wellness in the modern age.

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I. INTRODUCTION

The human respiratory system plays a critical role in sustaining life by enabling the exchange of oxygen and carbon dioxide between the body and the external environment. With every breath, our lungs face exposure to airborne pollutants, allergens, microbial pathogens, and toxic substances. In recent years, the incidence of respiratory disorders such as asthma, chronic bronchitis, chronic obstructive pulmonary disease (COPD), and viral respiratory infections has increased dramatically. This rising burden has been fuelled by factors such as industrial pollution, vehicular emissions, urbanization, lifestyle changes, smoking, and recurrent infections. The COVID-19 pandemic has further underscored the vulnerability of the lungs and the urgent need to maintain robust respiratory health.

Modern medicine provides a variety of treatments for respiratory ailments, ranging from bronchodilators and corticosteroids to antibiotics and antiviral agents. However, these pharmaceutical interventions often provide only symptomatic relief and may cause adverse effects with long-term use. Moreover, they do not always address the underlying imbalances or contribute to the strengthening of lung tissues. As a result, there is increasing interest in preventive and holistic approaches that promote respiratory wellness and immune resilience through natural means.

Traditional systems of medicine, such as Ayurveda, Siddha, Traditional Chinese Medicine (TCM), and folk medicine, have long emphasized the use of herbal remedies to support lung function and treat respiratory illnesses. Herbal medicines are known for their broad-spectrum bioactivity, fewer side effects, and ability to work synergistically with the body's natural healing mechanisms. Many medicinal plants possess anti-inflammatory,

antioxidant, expectorant, antimicrobial, and immune modulatory properties that make them ideal candidates for lung care formulations.

In this context, the development of a herbal lung care drink comprising a synergistic blend of ten botanicals offers a promising natural alternative. The ten selected plants—Long Pepper (*Piper longum*), Peppermint (*Mentha piperita*), Rosemary (*Rosmarinus officinalis*), Kale (*Brassica oleracea*), Bibhitaki (*Terminalia bellirica*), Turmeric (*Curcuma longa*), Milk Thistle (*Silybum marianum*), Ginger (*Zingiber officinale*), Garlic (*Allium sativum*), and Lemon Flakes (*Citrus limon*)—have been individually recognized for their therapeutic efficacy in enhancing respiratory function and overall immunity.

Each of these herbs contributes unique bioactive compounds that support lung health through multiple mechanisms. Long pepper acts as a bioavailability enhancer and expectorant, helping to expel mucus and improve lung absorption of nutrients. Peppermint contains menthol, which relaxes the smooth muscles of the respiratory tract and alleviates congestion. Rosemary has antioxidant and anti- inflammatory properties that protect lung tissues from oxidative stress. Kale, rich in chlorophyll, vitamin C, and phytochemicals, supports detoxification and tissue repair. Bibhitaki is known in Ayurvedic medicine as a powerful lung cleanser that removes kapha (mucus) and clears blockages in the respiratory tract.

Turmeric is a well-known anti-inflammatory herb containing curcumin, which modulates inflammatory pathways and supports healing of damaged tissues. Milk thistle, while traditionally used for liver detoxification, indirectly benefits the lungs by reducing systemic oxidative load and promoting detox pathways. Ginger promotes circulation in the lungs and helps break down mucus deposits. Garlic, rich in sulfur compounds, possesses antiviral, antibacterial, and immune-boosting effects. Lemon flakes, with their high vitamin C and bioflavonoid content, alkalize the body and enhance the immune response, making them a refreshing and therapeutic addition to the formulation.

The cumulative effect of these botanicals results in a natural, multi-targeted approach to lung care. By combining expectorant, anti-inflammatory, antioxidant, and detoxifying actions, this drink aims to rejuvenate the respiratory system, strengthen lung immunity, and improve overall respiratory resilience. It is particularly suited for individuals exposed to urban pollution, smokers, those recovering from respiratory infections, or those seeking a daily health tonic for preventive care.

Health Benefits of the Lung Care Drink

The Lung Care Drink formulated from ten medicinal plants—Long Pepper, Peppermint, Rosemary, Kale, Bibhitaki, Turmeric, Milk Thistle, Ginger, Garlic, and Lemon Flakes—offers a powerful natural solution for maintaining and enhancing respiratory health. Each plant contributes unique bioactive compounds, and their synergistic action results in a broad spectrum of health benefits:

1. Detoxification of the Respiratory System

Herbs like Bibhitaki, Milk Thistle and Kale support the elimination of toxins and waste products from the lungs and bloodstream.The drink assists in clearing accumulated mucus and environmental pollutants from the bronchial passages, making breathing easier and deeper.

2. Reduction of Lung Inflammation

Turmeric, Garlic and rosemary possess potent anti-inflammatory properties that help reduce inflammation in lung tissues, which is common in conditions like asthma, bronchitis, and COPD. These herbs modulate inflammatory cytokines and inhibit the NF-κB pathway, promoting healing at the cellular level.

3. Antioxidant Protection

Oxidative stress from pollutants, cigarette smoke, and infections can damage lung cells. Kale, Milk Thistle, Turmeric and Lemon Flakes are rich in antioxidants like flavonoids, curcumin, and vitamin C, which neutralize free radicals and protect lung tissue from degeneration.

4. Immune System Enhancement

Garlic, Ginger, Turmeric and Lemon Flakes strengthen the immune system by stimulating the production of white blood cells and enhancing the body's defense mechanisms. Regular consumption of the drink can help prevent respiratory infections such as colds, flu, and sinusitis.

5. Mucolytic and Expectorant Action

Long Pepper, Peppermint and Ginger act as natural expectorants, helping break down and expel mucus from the lungs and throat.This action is particularly beneficial in chronic cough, asthma, and during recovery from respiratory infections.

6. Bronchodilation and Relief from Congestion

Peppermint, through its menthol content, relaxes the smooth muscles of the respiratory tract and opens airways, easing conditions like asthma and nasal congestion. It provides an immediate cooling and soothing effect on the lungs and sinuses.

7. Support for Tissue Repair and Regeneration

Nutrient-rich plants like Kale and Milk Thistle provide essential vitamins (A, C, K) and minerals that aid in the repair and regeneration of lung tissues, especially after infection or inflammation.

8. Improved Circulation and Oxygenation

Ginger and Garlic improve blood flow and enhance oxygen delivery to the lungs and other organs. This helps improve stamina, reduce breathlessness, and support overall vitality.

9. Alkalizing and Anti- Microbial Effects

Lemon Flakes contribute to alkalizing the body's pH, creating an internal environment less conducive to pathogens. The drink also possesses broad- spectrum antimicrobial properties due to Garlic, Peppermint, and Rosemary which help control harmful bacteria and viruses in the respiratory tract.

10. Prevention and Management of Chronic Lung Conditions

The combined anti-inflammatory, antioxidant, and immune-enhancing effects of the drink may help manage chronic conditions such as asthma, Bronchitis and COPD. Regular use can improve lung capacity, reduce the frequency of infections, and delay the progression of degenerative respiratory diseases.

II. MATERIALS AND METHOODOLOGY

1. Long Pepper (*Piper longum*)

Taxonomy

Long Pepper, scientifically referred to as *Piper longum*, is a vital medicinal plant belonging to the Piperaceae family. It is widely recognized in traditional systems of medicineThe plant is native to the Indian subcontinent and Southeast Asia and is commonly referred to as Pippali in Indian Ayurvedic medicine.

The detailed taxonomy of Long Pepper is as follows:

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Magnoliopsida
- **Order:** Piperales
- **Family:** Piperaceae
- **Genus:** *Piper*
- **Species:** *Piper longum*

Long Pepper is a slender, perennial, aromatic vine that grows well in humid and warm climates. The dried spikes of the plant are extensively used in the formulation of herbal medicines. It is characterized by its pungent taste and warming properties, making it a staple in herbal formulations for respiratory health, digestive disorders, and overall vitality. The plant is also known for its bioavailability-enhancing properties, making it a valuable component in multi- herb formulations.

Physio-Chemical Composition

Long Pepper is composed of a variety of bioactive compounds that contribute to its extensive pharmacological profile. Key phytochemical constituents include:

- Alkaloids: The primary bioactive component is piperine, which imparts the pungent taste and enhances the absorption of other phytochemicals.
- Volatile Oils: The essential oil of Long Pepper comprises caryophyllene, piperlonguminine, and piperlongumin, contributing to its anti- inflammatory and antimicrobial effects.
- Flavonoids**:** Notable flavonoids such as quercetin, kaempferol, and luteolin exhibit antioxidant and anti-inflammatory properties.
- Tannins**:** These phenolic compounds provide astringent properties and exhibit antimicrobial activity.
- Resins and Glycosides**:** These components contribute to the plant's expectorant and mucolytic properties, aiding in the clearance of mucus from the respiratory tract.
- Phenolic Compounds**:** Including ferulic acid and caffeic acid, which are potent antioxidants.

The concentration of piperine, ranging from 3% to 5%, is the most significant feature of Long Pepper. Piperine not only provides therapeutic benefits but also enhances the bioavailability of other compounds, making it an effective adjuvant in herbal formulations.

Antimicrobial Activity

Long Pepper has demonstrated significant antimicrobial activity against various bacterial and fungal pathogens. Its antimicrobial effects are primarily attributed to its essential oils, alkaloids, and phenolic compounds. Key findings include:

- Bacterial Activity**:** The extracts of Long Pepper exhibit potent antibacterial effects against *Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae,* and *Mycobacterium tuberculosis*. Piperine and volatile oils disrupt the bacterial cell membrane integrity, inhibit enzyme activity, and prevent the proliferation

of pathogenic bacteria.

- Fungal Activity**:** The antifungal effects of Long Pepper are particularly effective against *Candida albicans*, *Aspergillus niger*, and other fungal pathogens. The volatile oils, including caryophyllene, interfere with fungal cell wall synthesis and inhibit spore germination.

Additionally, Long Pepper has been studied for its potential antiviral effects. Piperine has been shown to possess inhibitory effects against certain respiratory viruses, making it a valuable component in the prevention of viral respiratory infections.

Antioxidant Activity

Long Pepper is rich in antioxidants that play a critical role in neutralizing free radicals and protecting lung tissues from oxidative damage. The primary antioxidant compounds include:

- Piperine**:** Acts as a potent free radical scavenger, reducing oxidative stress and preventing lipid peroxidation.
- Flavonoids**:** Quercetin and luteolin provide substantial antioxidant protection, preventing cellular damage caused by reactive oxygen species (ROS).

- Phenolic Compounds**:** Ferulic acid and caffeic acid exhibit strong antioxidant activity, protecting lung tissues from inflammation and damage induced by pollutants and toxins.

The antioxidant properties of Long Pepper are particularly relevant in respiratory health, as they mitigate oxidative stress caused by air pollution, cigarette smoke, and chronic respiratory infections. This protective effect helps in preventing the progression of chronic lung conditions such as COPD and asthma.

Mechanism of Action in Lung Care

Long Pepper exerts multiple therapeutic effects that contribute to respiratory health, particularly in lung care. The mechanisms of action include:

- Expectorant Action**:** Piperine promotes the thinning and expulsion of mucus from the respiratory tract, aiding in the clearance of phlegm and reducing congestion.
- Bronchodilation: Piperine relaxes bronchial smooth muscles, facilitating easier breathing in conditions such as asthma and chronic bronchitis.
- Anti-Inflammatory Effect: By inhibiting the release of pro-inflammatory cytokines and modulating inflammatory pathways such as NF-κB, Long Pepper reduces inflammation in lung tissues, preventing the progression of chronic respiratory diseases.
- Antimicrobial Defense**:** The antimicrobial compounds in Long Pepper, particularly piperine and volatile oils, disrupt microbial membranes and inhibit the growth of respiratory pathogens, reducing the risk of bacterial and fungal infections.
- Enhanced Bioavailability: Piperine enhances the absorption of other bioactive compounds in the lung care drink, amplifying the overall therapeutic effects of the formulation.

Thus, Long Pepper serves as a multifaceted herb in lung care, supporting detoxification, infection control, and respiratory tissue repair. Its broad-spectrum activity makes it a valuable component in formulations targeting respiratory health and overall wellness.

RESULT

Product name		Long Pepper		
Source		*Piper longum*		
Parts used		Dried Fruits		
Appearance		Dark brown, wrinkled fruits		
Moisture Content		≤ 10%		
Ash Content		≤ 7%		
Ph		5.0-7.0		
Odour		Pungent, characteristic aroma		
Solubility		Soluble in alcohol, slightly soluble in water		
Physio – chemical properties	**Specification**	**Batch No: CBPL001**	**Batch No: CBPL002**	**Batch No: CBPL003**
Specific Gravity @20°c(g/ml)	0.890-0.910	0.895	0.902	0.898
Optical Rotation @ 20°c(Degrees)	+30 to +45	+32	+34	+36
Refractive	1.455-1.465	1.458	1.460	1.463

index @ 20°c				
Microbial test	**Specification**	**Batch No: CBPL001**	**Batch No: CBPL002**	**Batch No: CBPL003**
Aerobic total plate count	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life		24 Month		

2. Peppermint (*Mentha piperita*)

Taxonomy

Peppermint, scientifically known as *Mentha piperita*, is a hybrid mint species derived from the crossing of watermint (*Mentha aquatica*) and spearmint (*Mentha spicata*). It belongs to the Lamiaceae family, which is well-known for its aromatic herbs. Peppermint is extensively cultivated in temperate regions globally for its medicinal, culinary, and aromatic properties.

The taxonomy of Peppermint is as follows:

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Magnoliopsida
- **Order:** Lamiales
- **Family:** Lamiaceae
- **Genus:** *Mentha*
- **Species:** *Mentha piperita*

Peppermint is characterized by its aromatic, refreshing scent and cooling sensation due to its high menthol content. The plant has dark green leaves with reddish stems and produces small, purple flowers. It is a perennial herb that thrives in moist, well-drained soils.

Physio-Chemical Composition

Peppermint contains several bioactive constituents that contribute to its pharmacological properties. The primary compounds include:

- Menthol: The major component of peppermint essential oil, known for its cooling, analgesic, and bronchodilatory effects.
- Menthone and Menthyl Acetate: Provide a distinctive minty aroma and exhibit antimicrobial properties.
- Flavonoids: Including luteolin, apigenin, and eriocitrin, which possess antioxidant and anti-inflammatory effects.
- Tannins: Impart astringent properties, aiding in antimicrobial and antiviral activity.
- Phenolic Compounds: Such as rosmarinic acid, a potent antioxidant that protects lung tissues from oxidative stress.
- Terpenoids: Including cineole and limonene, which have expectorant and mucolytic effects.

Menthol, comprising 35-45% of the essential oil, is the most bioactive component in Peppermint. It acts as a natural bronchodilator and decongestant, making it highly effective in respiratory formulations.

Antimicrobial Activity

Peppermint exhibits significant antimicrobial activity against a broad spectrum of pathogens. Studies have demonstrated its efficacy against:

- Bacterial Pathogens: *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhi*, and *Klebsiella pneumoniae*. The menthol and menthone components disrupt bacterial cell membranes, inhibit enzyme activity, and prevent biofilm formation.
- Fungal Pathogens: Effective against *Candida albicans* and *Aspergillus niger*, peppermint essential oil inhibits fungal spore germination and hyphal growth.
- Viral Pathogens: The antiviral effects of peppermint have been noted against respiratory viruses such as the influenza virus and respiratory syncytial virus (RSV). Menthol interferes with viral replication and reduces viral load in infected tissues.

The antimicrobial properties of Peppermint make it a valuable component in lung care formulations, helping to prevent and manage respiratory infections.

Antioxidant Activity

Peppermint is rich in antioxidant compounds that play a vital role in lung health by neutralizing free radicals and preventing oxidative damage. Key antioxidant compounds include:

- Flavonoids: Luteolin and apigenin protect lung epithelial cells from oxidative stress and inflammation.
- Phenolic Compounds: Rosmarinic acid exhibits strong antioxidant activity, scavenging reactive oxygen species (ROS).
- Menthol and Menthone: Reduce oxidative damage in respiratory tissues, preventing the progression of chronic respiratory diseases.

The antioxidant potential of Peppermint is particularly beneficial in preventing damage caused by pollutants, cigarette smoke, and environmental toxins, making it a protective agent for the lungs.

Mechanism of Action in Lung Care

Peppermint exerts multiple therapeutic effects on lung health through its diverse bioactive components. The mechanisms of action include:

- Bronchodilation: Menthol acts on the smooth muscles of the respiratory tract, relaxing the bronchial muscles and facilitating easier breathing, particularly in asthma and bronchitis.
- Expectorant Effect: Peppermint promotes the clearance of mucus from the respiratory tract, aiding in the expulsion of phlegm and reducing congestion.
- Anti-Inflammatory Effect: Rosmarinic acid and flavonoids reduce inflammatory markers in the lung tissues, mitigating conditions such as asthma and COPD.
- Antimicrobial Defense: The essential oil components disrupt microbial cell membranes, preventing respiratory infections caused by bacteria, fungi, and viruses.
- Analgesic and Cooling Effect: Menthol provides a soothing, cooling sensation in the respiratory tract, reducing irritation and promoting comfort in conditions such as cough and sore throat.

Peppermint's combination of antimicrobial, anti-inflammatory, and bronchodilatory effects makes it an essential component in lung care drinks, promoting respiratory health and preventing infections.

RESULT

Product name		Peppermint		
Source		*Mentha piperita*		
Parts used		Dried Leaves		
Appearance		Green, dried leaves		
Moisture Content		≤ 8%		
Ash Content		≤ 6%		
Ph		5.0-7.0		
Odour		Strong, minty aroma		
Solubility		Soluble in water, partially soluble in alcohol		
Physio – chemical properties	**Specification**	**Batch No: CBMP001**	**Batch No: CBMP002**	
Specific Gravity @20°c(g/ml)	0.900-0.920	0.905	0.910	0.918

Optical Rotation @ 20°c(Degrees)	-20 to -30	-24	-26	-26
Refractive index @ 20°c	1.458-1.468	1.461	1.463	1.460
Microbial test	**Specification**	**Batch No: CBMP001**	**Batch No: CBMP002**	**Batch No: CBMP003**
Aerobic total plate count	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life		24 Month		

3. Rosemary (*Rosmarinus officinalis*)

Taxonomy

Rosemary, scientifically known as *Rosmarinus officinalis*, is a perennial, aromatic herb belonging to the Lamiaceae family. Native to the Mediterranean region, Rosemary is widely cultivated for its culinary, aromatic, and medicinal properties. The plant is characterized by its needle-like leaves and woody stems, emitting a distinctive, pine-like fragrance.

The taxonomy of Rosemary is as follows:

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Magnoliopsida
- **Order:** Lamiales
- **Family:** Lamiaceae
- **Genus:** *Rosmarinus*
- **Species:** *Rosmarinus officinalis*

Rosemary is also referred to as "Dew of the Sea" due to its origin in coastal areas. The plant has been used for centuries in traditional medicine to enhance memory, reduce inflammation, and improve respiratory health.

Physio-Chemical Composition

Rosemary contains a wide range of phytochemicals that contribute to its pharmacological effects. The primary bioactive components include:

- Essential Oils: Comprised mainly of cineole, camphor, and borneol, which exhibit bronchodilatory and antimicrobial effects.
- Phenolic Acids: Including rosmarinic acid, caffeic acid, and chlorogenic acid, known for their potent antioxidant properties.
- Flavonoids: Apigenin, diosmin, and luteolin, which possess anti- inflammatory and antioxidant effects.
- Triterpenes: Such as ursolic acid and betulinic acid, which exhibit anti- inflammatory and lung-protective effects.
- Tannins: Provide astringent properties, aiding in microbial inhibition.

Rosmarinic acid is a major constituent, accounting for up to 3.5% of the dry weight of Rosemary leaves. This phenolic compound is particularly significant for its antioxidant and anti-inflammatory effects, protecting lung tissues from oxidative damage.

Antimicrobial Activity

Rosemary exhibits robust antimicrobial activity against various bacterial, fungal, and viral pathogens. Studies have shown the efficacy of Rosemary extracts against:

- Bacterial Pathogens: *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Bacillus subtilis*. The essential oils, particularly cineole and camphor, disrupt bacterial membranes and inhibit biofilm formation.
- Fungal Pathogens: Rosemary essential oil is effective against *Candida albicans* and *Aspergillus niger*. The antifungal effects are attributed to the terpenes and phenolic compounds that interfere with fungal cell wall integrity.
- Viral Pathogens: Cineole has demonstrated antiviral activity against respiratory viruses, including influenza and RSV, by disrupting viral replication and reducing viral load.

The antimicrobial properties of Rosemary are particularly relevant in respiratory health, as they help prevent infections that could exacerbate chronic lung conditions.

Antioxidant Activity

Rosemary is a potent source of antioxidants that protect lung tissues from oxidative stress and inflammation. Key antioxidant compounds include:

- Rosmarinic Acid: Scavenges reactive oxygen species (ROS) and prevents lipid peroxidation.
- Carnosol and Carnosic Acid: Potent antioxidants that protect lung tissues from cellular damage and inflammation.
- Flavonoids: Apigenin and luteolin reduce oxidative stress by neutralizing free radicals.
- Phenolic Acids: Caffeic acid and chlorogenic acid protect against oxidative stress-induced lung damage.

The antioxidant potential of Rosemary is particularly beneficial in preventing chronic respiratory diseases, as it mitigates the damage caused by pollutants, allergens, and cigarette smoke.

Mechanism of Action in Lung Care

Rosemary exerts multiple therapeutic effects on lung health through its bioactive components. The mechanisms

of action include:

- Bronchodilation: Cineole relaxes bronchial smooth muscles, improving airflow and reducing bronchoconstriction in asthma and bronchitis.
- Anti-Inflammatory Effect: Rosmarinic acid and carnosol inhibit pro- inflammatory mediators, such as NF-κB and COX-2, reducing inflammation in lung tissues.
- Antimicrobial Defense: The essential oils disrupt microbial cell membranes, preventing respiratory infections caused by bacteria, fungi, and viruses.
- Antioxidant Protection: The phenolic compounds scavenge free radicals, preventing oxidative damage and protecting lung epithelial cells.
- Expectorant Effect: Cineole promotes mucus clearance, aiding in the expulsion of phlegm and reducing congestion.

The combination of antimicrobial, antioxidant, and bronchodilatory effects makes Rosemary an essential component in lung care formulations, promoting respiratory health and protecting lung tissues from chronic damage.

RESULT

Product name		Rosemary		
Source		*Rosmarinus officinalis*		
Parts used		Dried Leaves		
Appearance		Green, needle-like leaves		
Moisture Content		≤ 9%		
Ash Content		≤ 7%		
Ph		5.5-7.0		
Odour		Strong, aromatic herbal scent		
Solubility		Soluble in alcohol, slightly soluble in water		
Physio – chemical properties	**Specification**	**Batch No: CBRO001**	**Batch No: CBRO002**	**Batch No: CBRO003**
Specific Gravity @20°c(g/ml)	0.870-0.890	0.874	0.882	0.873
Optical Rotation @ 20°c(Degrees)	+25 to +35	+28	+30	+30
Refractive index @ 20°c	1.456-1.466	1.459	1.461	1.457
Microbial test	**Specification**	**Batch No: CBRO001**	**Batch No: CBRO002**	**Batch No: CBRO003**
Aerobic total plate count	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life		24 Month		

4. Kale (*Brassica oleracea*)

Taxonomy

Kale, scientifically referred to as *Brassica oleracea* var. *acephala*, is a leafy green vegetable belonging to the Brassicaceae family. It is widely cultivated for its nutrient-dense leaves and is recognized for its substantial antioxidant and anti- inflammatory properties. Kale is considered one of the most nutrient-rich greens, often classified as a superfood.

The taxonomy of Kale is as follows:

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Magnoliopsida
- **Order:** Brassicales
- **Family:** Brassicaceae
- **Genus:** *Brassica*

- **Species:** *Brassica oleracea*

Kale is a biennial plant that thrives in cooler climates and is characterized by its thick, ruffled leaves. It is cultivated in multiple varieties, including curly kale, lacinato kale, and red Russian kale. Each variety contains a unique profile of nutrients and bioactive compounds.

Physio-Chemical Composition

Kale is an exceptionally nutrient-dense vegetable, rich in vitamins, minerals, and bioactive compounds. Key components include:

- Vitamins: High levels of Vitamin C, Vitamin K, and Vitamin A, which are crucial for immune function, blood clotting, and cellular protection.
- Minerals: Calcium, magnesium, and potassium, supporting respiratory muscle function and reducing inflammation.
- Flavonoids: Quercetin and kaempferol, exhibiting antioxidant and anti- inflammatory effects.
- Glucosinolates: Sulforaphane and indole-3-carbinol, which have been shown to exhibit lung-protective and anti-carcinogenic properties.
- Carotenoids: Lutein and beta-carotene, providing antioxidant protection and reducing oxidative stress in lung tissues.
- Fiber: Supports detoxification and reduces the risk of chronic respiratory diseases.

The presence of glucosinolates, particularly sulforaphane, makes kale a significant dietary component in lung care formulations, as it enhances cellular detoxification pathways and provides chemoprotective effects.

Antimicrobial Activity

Kale exhibits antimicrobial properties primarily due to its glucosinolate derivatives and flavonoid content. Studies indicate the following antimicrobial effects:

- Bacterial Pathogens: Sulforaphane has been shown to inhibit the growth of *Helicobacter pylori*, *Escherichia coli*, and *Staphylococcus aureus* by disrupting bacterial cell walls and inhibiting bacterial enzyme activity.
- Fungal Pathogens: The antioxidant and antifungal properties of quercetin and kaempferol help mitigate fungal infections, particularly those affecting the respiratory tract.
- Viral Pathogens: Although direct antiviral effects are less studied, the immune-boosting properties of Vitamin C and sulforaphane contribute to viral resistance in respiratory infections.

The antimicrobial activity of kale underscores its potential in preventing infections that could exacerbate chronic respiratory conditions, making it a valuable inclusion in lung care formulations.

Antioxidant Activity

Kale is a powerhouse of antioxidants that provide significant protection against oxidative stress in lung tissues. Key antioxidant compounds include:

- Quercetin and Kaempferol: Scavenge free radicals, reduce oxidative damage, and protect lung cells from inflammation.
- Sulforaphane: Activates the Nrf2 pathway, promoting antioxidant enzyme production and mitigating oxidative stress in lung tissues.
- Beta-Carotene and Lutein: Protect against cellular damage caused by reactive oxygen species (ROS).
- Vitamin C: Reduces oxidative stress and supports lung tissue repair.

The combination of sulforaphane and flavonoids makes kale particularly effective in combating oxidative damage induced by pollutants, smoking, and chronic respiratory diseases.

Mechanism of Action in Lung Care

Kale provides extensive support to lung health through its nutrient-dense profile and bioactive compounds. The mechanisms of action include:

- Antioxidant Protection: Sulforaphane activates detoxification enzymes, reducing oxidative damage in lung tissues and enhancing cellular defense mechanisms.
- Anti-Inflammatory Effect: Quercetin and kaempferol inhibit pro- inflammatory cytokines, reducing chronic inflammation in respiratory pathways.
- Mucolytic Action: Vitamin C and dietary fiber promote mucus clearance, reducing respiratory congestion and supporting airway health.
- Lung Tissue Repair: The high levels of beta-carotene and lutein promote epithelial cell regeneration and repair, preventing further damage to lung tissues.
- Detoxification Support: Glucosinolates promote phase II detoxification enzymes, aiding in the removal of harmful pollutants and carcinogens from the respiratory tract.

Kale's multi-faceted role in lung care, encompassing antioxidant, anti- inflammatory, and detoxification effects, makes it a critical component in respiratory health formulations, particularly in the context of chronic lung diseases and environmental toxin exposure.

RESULT

Product name		Kale		
Source		*Brassica oleracea*		
Parts used		Dried Leaves		
Appearance		Dark green, crinkled leaves		
Moisture Content		≤ 8%		
Ash Content		≤ 6%		
Ph		5.5-7.5		
Odour		Mild, earthy, leafy scent		
Solubility		Soluble in water, partially soluble in alcohol		
Physio – chemical properties	**Specification**	**Batch No: CBBO001**	**Batch No: CBBO002**	**Batch No: CBBO003**
Specific Gravity @20°c(g/ml)	0.910-0.930	0.916	0.922	0.917

Optical Rotation @ 20°c(Degrees)	+15 to +25	+18	+20	+23
Refractive index @ 20°c	1.465-1.475	1.468	1.470	1.471
Microbial test	**Specification**	**Batch No: CBBO001**	**Batch No: CBBO002**	**Batch No: CBBO003**
Aerobic total plate count	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life		24 Month		

5. Bibhitaki (*Terminalia bellirica*)

Taxonomy

Bibhitaki, scientifically known as *Terminalia bellirica*, is a deciduous tree that belongs to the Combretaceae family. It is native to Southeast Asia and is extensively utilized in Ayurvedic medicine, particularly as a component of the well-known Triphala formulation.

The taxonomy of Bibhitaki is as follows:

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Magnoliopsida
- **Order:** Myrtales
- **Family:** Combretaceae
- **Genus:** *Terminalia*
- **Species:** *Terminalia bellirica*

The fruit of Bibhitaki is particularly valued for its medicinal properties, including its potential benefits for respiratory health. It is commonly referred to as "Baheda" in traditional medicine.

Physio-Chemical Composition

Bibhitaki is a rich source of bioactive compounds that contribute to its therapeutic effects. The major constituents include:

- Tannins: Including ellagic acid, gallic acid, and chebulagic acid, which exhibit antimicrobial and antioxidant properties.
- Flavonoids: Quercetin and luteolin, known for their antioxidant and anti- inflammatory effects.

- Saponins: Possess expectorant and bronchodilatory properties, aiding in mucus clearance.
- Phenolic Compounds: Gallic acid and ellagic acid, potent antioxidants that protect lung tissues from oxidative stress.
- Fatty Acids: Linoleic acid and oleic acid, which have anti-inflammatory properties.

The presence of high levels of tannins, particularly ellagic acid and gallic acid, is significant for lung health due to their potent antioxidant and mucolytic effects.

Antimicrobial Activity

Bibhitaki demonstrates broad-spectrum antimicrobial activity against bacterial, fungal, and viral pathogens. Key antimicrobial effects include:

- Bacterial Pathogens: The tannins in Bibhitaki effectively inhibit the growth of *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa* by disrupting bacterial cell membranes.
- Fungal Pathogens: The phenolic compounds exhibit antifungal activity against *Candida albicans* and *Aspergillus fumigatus*, preventing fungal infections in the respiratory tract.
- Viral Pathogens: The antiviral effects are particularly relevant in respiratory conditions, as the tannins and flavonoids inhibit viral replication and reduce viral load.

The antimicrobial activity of Bibhitaki highlights its potential as a natural remedy for respiratory infections, particularly in chronic obstructive pulmonary disease (COPD) and bronchitis.

Antioxidant Activity

Bibhitaki is a potent antioxidant due to its rich polyphenolic content. The key antioxidant compounds include:

- Gallic Acid and Ellagic Acid: Potent antioxidants that scavenge free radicals and prevent oxidative damage in lung tissues.
- Flavonoids: Quercetin and luteolin, which reduce oxidative stress and protect against cellular damage.
- Tannins: Provide astringent and antioxidant effects, reducing inflammation in lung tissues.

The combined antioxidant effects of these compounds are particularly beneficial in protecting lung tissues from oxidative damage caused by pollutants, allergens, and respiratory infections.

Mechanism of Action in Lung Care

Bibhitaki provides substantial support to lung health through its diverse array of bioactive compounds. The mechanisms of action include:

- Mucolytic Action: Saponins reduce mucus viscosity, promoting the clearance of phlegm and relieving respiratory congestion.
- Anti-Inflammatory Effect: Gallic acid and ellagic acid inhibit pro- inflammatory mediators, reducing chronic inflammation in respiratory pathways.
- Antioxidant Protection: The tannins and flavonoids scavenge reactive oxygen species (ROS), preventing oxidative stress and lung tissue damage.
- Antimicrobial Defense: Phenolic compounds disrupt microbial membranes, preventing infections that exacerbate chronic respiratory diseases.
- Lung Tissue Repair: The high antioxidant content promotes epithelial cell repair, mitigating damage caused by pollutants and allergens.

Bibhitaki's combination of antioxidant, mucolytic, and antimicrobial effects makes it a valuable component in lung care drinks, supporting respiratory health and preventing infections in chronic lung conditions.

RESULT

Product name	Bibhitaki
Source	*Terminalia bellirica*
Parts used	Dried Fruits
Appearance	Brown, wrinkled fruits
Moisture Content	≤ 9%
Ash Content	≤ 7%
Ph	5.0-6.5
Odour	Mild, earthy, astringent scent

Solubility	Soluble in alcohol, slightly soluble in water

Physio – chemical properties	**Specification**	**Batch No: CBTB001**	**Batch No: CBTB002**	**Batch No: CBTB003**
Specific Gravity @20°c(g/ml)	0.880-0.900	0.885	0.890	0.892
Optical Rotation @ 20°c(Degrees)	+20 to +35	+22	+30	+29
Refractive index @ 20°c	1.460-1.470	1.462	1.467	1.466
Microbial test	**Specification**	**Batch No: CBTB001**	**Batch No: CBTB002**	**Batch No: CBTB003**
Aerobic total plate count	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life		24 Month		

6. Turmeric (*Curcuma longa*)

Taxonomy

Turmeric, scientifically known as *Curcuma longa*, is a rhizomatous perennial herb belonging to the Zingiberaceae family. It is widely cultivated in tropical regions of Asia and is renowned for its medicinal and culinary applications, particularly for its active compound curcumin.

The taxonomy of Turmeric is as follows:

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Liliopsida
- **Order:** Zingiberales
- **Family:** Zingiberaceae
- **Genus:** *Curcuma*
- **Species:** *Curcuma longa*

Turmeric is characterized by its bright yellow-orange rhizome, which contains the primary bioactive compound curcumin. This compound is responsible for its potent anti-inflammatory, antioxidant, and antimicrobial properties.

Physio-Chemical Composition

Turmeric is a rich source of bioactive compounds that contribute to its extensive pharmacological properties. Key components include:

- Curcuminoids**:** Curcumin, demethoxycurcumin, and bisdemethoxycurcumin, which exhibit strong antioxidant and anti- inflammatory effects.
- Essential Oils: Turmerone, atlantone, and zingiberene, contributing to antimicrobial and bronchodilatory properties.
- Phenolic Compounds**:** Curcumin is a potent antioxidant that neutralizes free radicals and reduces oxidative stress.
- Polysaccharides: Provide mucolytic effects and support respiratory health.
- Vitamins and Minerals: Contains Vitamin C, Vitamin E, and iron, which enhance immune function and tissue repair.

The primary focus of turmeric in lung care is its curcuminoid content, particularly curcumin, which exerts multiple protective effects on respiratory tissues.

Antimicrobial Activity

Turmeric has demonstrated significant antimicrobial activity against bacterial, fungal, and viral pathogens. Key antimicrobial effects include:

- Bacterial Pathogens**:** Curcumin inhibits the growth of *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa* by disrupting bacterial cell membranes.
- Fungal Pathogens: The essential oils, particularly turmerone, exhibit antifungal effects against *Candida albicans* and *Aspergillus niger*.
- Viral Pathogens: Curcumin shows antiviral effects by inhibiting viral replication and modulating immune response, making it beneficial in managing respiratory viral infections.

The antimicrobial properties of turmeric are particularly relevant in preventing respiratory infections, including

bronchitis, pneumonia, and viral infections.

Antioxidant Activity

Turmeric is a powerful antioxidant, primarily due to its curcuminoid content. Key antioxidant effects include:

- Curcumin**:** Scavenges free radicals, reduces lipid peroxidation, and protects lung tissues from oxidative stress.
- Phenolic Compounds**:** Provide protective effects against reactive oxygen species (ROS) and prevent cellular damage.
- Vitamin C and E**:** Enhance antioxidant defenses and promote tissue repair in lung epithelial cells.

The antioxidant capacity of turmeric is crucial in protecting lung tissues from damage caused by pollutants, cigarette smoke, and chronic inflammation.

Mechanism of Action in Lung Care

Turmeric provides comprehensive lung care support through its anti- inflammatory, antioxidant, and antimicrobial properties. Mechanisms of action include:

- Anti-Inflammatory Action: Curcumin inhibits NF-κB and COX-2 pathways, reducing inflammation in respiratory tissues.
- Antioxidant Protection: Curcumin neutralizes ROS and reduces oxidative stress, preventing cellular damage in lung tissues.
- Bronchodilatory Effect: The essential oils promote bronchodilation, easing respiratory congestion and improving airflow.
- Mucolytic Action: Polysaccharides promote mucus clearance, aiding in the expulsion of phlegm and relieving respiratory congestion.
- Antimicrobial Defense: Curcumin disrupts microbial membranes, preventing infections that could exacerbate chronic respiratory diseases.

Turmeric's multifaceted role in lung care, encompassing antioxidant, anti- inflammatory, and antimicrobial effects, makes it an indispensable component in lung care formulations, particularly in chronic respiratory diseases and inflammatory lung conditions.

RESULT

Product name	Turmeric
Source	*Curcuma longa*
Parts used	Dried Rhizomes
Appearance	Bright yellow, powder or slices
Moisture Content	≤ 8%
Ash Content	≤ 6%
Ph	5.5-6.5
Odour	Warm, earthy, characteristic scent

Solubility		Partially soluble in alcohol, slightly soluble in water		
Physio –chemical properties	**Specification**	**Batch No: CBCL001**	**Batch No: CBCL002**	**Batch No: CBCL003**
Specific Gravity @20°c(g/ml)	0.920-0.940	0.925	0.930	0.926
Optical Rotation @ 20°c(Degrees)	+35 to +45	+38	+42	+43
Refractive index @ 20°c	1.455-1.465	1.458	1.461	1.463
Microbial test	**Specification**	**Batch No: CBCL001**	**Batch No: CBCL002**	**Batch No: CBCL003**
Aerobic total plate count	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative

Shelf life	24 Month

7. Milk Thistle (*Silybum marianum*)

Taxonomy

Milk Thistle, scientifically known as *Silybum marianum*, is a medicinal herb belonging to the Asteraceae family. It is native to the Mediterranean region and has been used for centuries in traditional medicine for its hepatoprotective and antioxidant properties.

The taxonomy of Milk Thistle is as follows:

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Magnoliopsida
- **Order:** Asterales
- **Family:** Asteraceae
- **Genus:** *Silybum*
- **Species:** *Silybum marianum*

Milk Thistle is characterized by its distinctive purple flowers and spiky leaves with white veins, symbolizing its "milk" content, which is the sap that contains its active components.

Physio-Chemical Composition

Milk Thistle contains a complex array of bioactive compounds, with silymarin being the primary constituent. Key components include:

- Silymarin Complex: Comprised of silibinin, silychristin, and silydianin, which exhibit potent antioxidant and anti-inflammatory effects.
- Flavonoids: Quercetin and kaempferol, known for their lung-protective and antioxidant properties.
- Fatty Acids: Linoleic acid and oleic acid, contributing to anti-inflammatory effects.
- Phenolic Compounds: Provide antioxidant and antimicrobial properties.
- Vitamins and Minerals: Includes Vitamin E, selenium, and magnesium, which support lung tissue repair and immune function.

Silymarin, the primary bioactive complex, is particularly significant in protecting lung tissues from oxidative stress and inflammation caused by environmental pollutants and respiratory infections.

Antimicrobial Activity

Milk Thistle exhibits antimicrobial activity against several bacterial and fungal pathogens. Key antimicrobial effects include:

- Bacterial Pathogens: Silymarin inhibits the growth of *Escherichia coli*, *Staphylococcus aureus*, and *Klebsiella pneumoniae* by disrupting bacterial cell membranes.
- Fungal Pathogens: The antioxidant compounds show antifungal effects against *Candida albicans* and *Aspergillus fumigatus*.
- Viral Pathogens: Silymarin exhibits antiviral effects by inhibiting viral replication and modulating the immune response, particularly beneficial in managing respiratory viral infections.

The antimicrobial properties of Milk Thistle support its role in preventing respiratory infections and minimizing the risk of secondary bacterial or fungal infections.

Antioxidant Activity

Milk Thistle is a potent source of antioxidants, primarily due to its silymarin complex. Key antioxidant effects include:

- Silymarin: Reduces lipid peroxidation, scavenges free radicals, and protects lung tissues from oxidative stress.
- Flavonoids: Quercetin and kaempferol mitigate oxidative damage and promote cellular repair.
- Vitamin E: Enhances lung tissue repair and reduces oxidative stress.

The antioxidant capacity of Milk Thistle is crucial in protecting lung tissues from damage caused by cigarette smoke, pollutants, and chronic inflammation.

Mechanism of Action in Lung Care

Milk Thistle provides comprehensive lung protection through its antioxidant, anti-inflammatory, and antimicrobial properties. Mechanisms of action include:

- Antioxidant Protection: Silymarin scavenges free radicals, reduces oxidative stress, and promotes lung tissue repair.
- Anti-Inflammatory Action: Silibinin inhibits inflammatory mediators such as TNF-α and IL-6, reducing chronic inflammation in respiratory tissues.

- Bronchodilatory Effect: The flavonoids relax bronchial smooth muscles, easing respiratory congestion and improving airflow.
- Antimicrobial Defense: The phenolic compounds disrupt microbial cell membranes, preventing respiratory infections.
- Detoxification Support: Silymarin enhances liver detoxification pathways, aiding in the clearance of toxins that may otherwise affect respiratory health.

The multifaceted role of Milk Thistle in lung care, encompassing antioxidant, anti-inflammatory, and antimicrobial effects, makes it a valuable inclusion in lung care formulations, particularly in patients with chronic respiratory diseases and pollutant exposure.

RESULT

Product name		Milk Thistle		
Source		Silybum marianum		
Parts used		Dried Seeds		
Appearance		Brown, glossy seeds		
Moisture Content		≤ 7%		
Ash Content		≤ 6%		
Ph		5.0-6.5		
Odour		Mild, nutty, earthy aroma		
Solubility		Soluble in ethanol, partially soluble in water		
Physio – chemical properties	**Specification**	**Batch No: CBSM001**	**Batch No: CBSM002**	**Batch No: CBSM003**
Specific Gravity @20°c(g/ml)	0.900-0.920	0.905	0.910	0.915
Optical Rotation @ 20°c(Degrees)	+20 to +30	+23	+26	+27
Refractive index @ 20°c	1.460-1.470	1.463	1.465	1.467
Microbial test	**Specification**	**Batch No: CBSM001**	**Batch No: CBSM002**	**Batch No: CBSM003**
Aerobic total plate count	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life		24 Month		

8. Ginger (*Zingiber officinale*)

Taxonomy

Ginger, scientifically known as *Zingiber officinale*, is a flowering plant belonging to the Zingiberaceae family. It is widely cultivated in tropical and subtropical regions for its rhizome, which is utilized for both culinary and medicinal purposes, particularly for its anti-inflammatory and antioxidant properties.

The taxonomy of Ginger is as follows:

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Liliopsida
- **Order:** Zingiberales
- **Family:** Zingiberaceae
- **Genus:** *Zingiber*
- **Species:** *Zingiber officinale*

Ginger is characterized by its pungent aroma and spicy taste, attributed to its essential oils and bioactive compounds such as gingerol and shogaol.

Physio-Chemical Composition

Ginger is rich in bioactive compounds that contribute to its extensive pharmacological effects. Key components include:

- Gingerol and Shogaol: Potent anti-inflammatory and antioxidant compounds that protect lung tissues from oxidative stress.
- Essential Oils: Zingiberene, β-bisabolene, and geranial, which exhibit antimicrobial and bronchodilatory properties.
- Polyphenols: Quercetin and kaempferol, providing lung-protective antioxidant effects.
- Vitamins and Minerals: Contains Vitamin C, magnesium, and potassium, which support immune function and respiratory health.
- Polysaccharides: Mucilaginous compounds that soothe respiratory mucosa and promote mucus clearance.

The presence of gingerol and shogaol makes ginger particularly effective in reducing inflammation and oxidative stress in lung tissues.

Antimicrobial Activity

Ginger has demonstrated significant antimicrobial activity against a variety of bacterial, fungal, and viral pathogens. Key antimicrobial effects include:

- Bacterial Pathogens: Gingerol and shogaol inhibit the growth of *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa* by disrupting bacterial cell membranes.
- Fungal Pathogens: The essential oils exhibit antifungal effects against *Candida albicans* and *Aspergillus fumigatus*.
- Viral Pathogens: Gingerol shows antiviral effects by inhibiting viral replication and reducing inflammatory cytokine production, making it beneficial in respiratory viral infections.

The antimicrobial effects of ginger support its use in preventing respiratory infections, especially in cases of bronchitis, pneumonia, and viral respiratory diseases.

Antioxidant Activity

Ginger is a potent antioxidant, primarily due to its gingerol and shogaol content. Key antioxidant effects include:

- Gingerol and Shogaol: Scavenge free radicals, reduce lipid peroxidation, and protect lung tissues from oxidative damage.
- Polyphenols: Quercetin and kaempferol mitigate oxidative stress and enhance lung tissue repair.
- Vitamin C: Enhances antioxidant defense and promotes immune function in respiratory tissues.

The antioxidant capacity of ginger is particularly beneficial in reducing oxidative stress caused by environmental pollutants, smoking, and chronic lung conditions.

Mechanism of Action in Lung Care

Ginger provides extensive lung support through its anti-inflammatory, antioxidant, and antimicrobial properties. Mechanisms of action include:

- Anti-Inflammatory Action: Gingerol inhibits inflammatory mediators such as TNF-α and IL-6, reducing chronic inflammation in respiratory tissues.
- Antioxidant Protection: Shogaol scavenges ROS, preventing oxidative damage to lung tissues.
- Bronchodilatory Effect: The essential oils relax bronchial smooth muscles, easing respiratory congestion and improving airflow.
- Mucolytic Action: Polysaccharides promote mucus clearance, aiding in respiratory decongestion.
- Antimicrobial Defense: The phenolic compounds disrupt microbial cell membranes, preventing infections that could exacerbate chronic respiratory diseases.

Ginger's multifaceted role in lung care, encompassing antioxidant, anti- inflammatory, and antimicrobial effects, underscores its significance in lung care formulations, especially in conditions involving respiratory infections and chronic inflammation.

RESULT

Product name	Ginger
Source	*Zingiber officinale*
Parts used	Dried Rhizomes
Appearance	Light brown, fibrous pieces or powder
Moisture Content	≤ 8%

Ash Content		≤ 5%		
Ph		5.5-6.5		
Odour		Pungent, spicy, characteristic scent		
Solubility		Soluble in ethanol, partially soluble in water		
Physio – chemical properties	**Specification**	**Batch No: CBZO001**	**Batch No: CBZO002**	**Batch No: CBZO003**
Specific Gravity @20°c(g/ml)	0.890-0.910	0.895	0.900	0.900
Optical Rotation @ 20°c(Degrees)	+25 to +35	+28	+32	+27
Refractive index @ 20°c	1.450-1.460	1.456	1.457	1.453
Microbial test	**Specification**	**Batch No: CBZO001**	**Batch No: CBZO002**	**Batch No: CBZO003**
Aerobic total plate count	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life		24 Month		

9. Garlic (*Allium sativum*)

Taxonomy

Garlic, scientifically known as *Allium sativum*, is a perennial plant belonging to the Amaryllidaceae family. It is widely cultivated worldwide and is renowned for its therapeutic properties, particularly in respiratory health, due to its rich content of sulfur compounds.

The taxonomy of Garlic is as follows:

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Liliopsida
- **Order:** Asparagales
- **Family:** Amaryllidaceae
- **Genus:** *Allium*
- **Species:** *Allium sativum*

Garlic is characterized by its pungent aroma and distinctive cloves, which contain bioactive compounds that contribute to its pharmacological properties.

Physio-Chemical Composition

Garlic is a rich source of bioactive compounds that are vital for its medicinal effects. Key components include:

- Allicin: A potent antimicrobial and anti-inflammatory sulfur compound that is released when garlic is crushed or chopped.
- S-allyl cysteine (SAC): Exhibits antioxidant properties, protecting lung tissues from oxidative damage.
- Flavonoids: Quercetin and kaempferol, which enhance respiratory health through antioxidant effects.
- Saponins: Promote mucus clearance and reduce respiratory congestion.
- Vitamins and Minerals: Contains Vitamin C, selenium, and manganese, supporting immune function and lung health.

The presence of allicin and other sulfur compounds is particularly significant in garlic's antimicrobial and anti-inflammatory effects, making it an effective component in lung care formulations.

Antimicrobial Activity

Garlic exhibits significant antimicrobial activity against bacterial, fungal, and viral pathogens. Key antimicrobial effects include:

- Bacterial Pathogens: Allicin inhibits the growth of *Staphylococcus aureus*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa* by disrupting bacterial cell membranes.
- Fungal Pathogens: The sulfur compounds exhibit antifungal effects against *Candida albicans* and *Aspergillus fumigatus*.
- Viral Pathogens: Garlic shows antiviral properties by modulating the immune response and inhibiting viral replication, making it effective in combating respiratory viral infections.

The antimicrobial properties of garlic are particularly beneficial in preventing respiratory infections and reducing

the risk of secondary infections in chronic lung conditions.

Antioxidant Activity

Garlic is a potent antioxidant, primarily due to its sulfur compounds and flavonoids. Key antioxidant effects include:

- Allicin: Scavenges free radicals, reduces oxidative stress, and prevents lung tissue damage.
- S-allyl cysteine (SAC): Provides protective effects against ROS, minimizing cellular damage in lung tissues.
- Flavonoids: Quercetin and kaempferol enhance antioxidant defenses and support respiratory health.
- Vitamin C: Promotes immune function and protects lung tissues from oxidative stress.

The antioxidant capacity of garlic is critical in mitigating oxidative damage caused by pollutants, smoking, and respiratory infections.

Mechanism of Action in Lung Care

Garlic supports lung health through its antimicrobial, antioxidant, and anti- inflammatory properties. Mechanisms of action include:

- Anti-Inflammatory Action: Allicin inhibits pro-inflammatory cytokines, reducing inflammation in respiratory tissues.
- Antioxidant Protection: S-allyl cysteine neutralizes ROS, preventing oxidative damage in lung cells.
- Bronchodilatory Effect: The sulfur compounds promote bronchodilation, easing respiratory congestion.
- Mucolytic Action: Saponins enhance mucus clearance, aiding in the expulsion of respiratory secretions.
- Antimicrobial Defense: Allicin disrupts microbial membranes, preventing respiratory infections and reducing infection severity.

Garlic's multifaceted role in lung care, encompassing antimicrobial, antioxidant, and anti-inflammatory effects, underscores its significance in lung care formulations, especially for individuals prone to respiratory infections and chronic lung conditions.

RESULT

Product name	Garlic
Source	*Allium sativum*
Parts used	Dried Bulbs

Appearance		Off-white to pale yellow, granulated or powdered		
Moisture Content		≤ 7%		
Ash Content		≤ 5%		
Ph		5.0-6.0		
Odour		Strong, pungent, characteristic garlic scent		
Solubility		Soluble in ethanol, slightly soluble in water		
Physio – chemical properties	**Specification**	**Batch No: CBAS001**	**Batch No: CBAS002**	**Batch No: CBAS003**
Specific Gravity @20°c(g/ml)	0.880-0.900	0.885	0.890	0.887
Optical Rotation @ 20°c(Degrees)	+10 to +20	+12	+16	+17
Refractive index @ 20°c	1.445-1.455	1.448	1.450	1.453
Microbial test	**Specification**	**Batch No: CBAS001**	**Batch No: CBAS002**	**Batch No: CBAS003**
Aerobic total plate count	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life		24 Month		

10. Lemon Flakes (*Citrus limon*)

Taxonomy

Lemon, scientifically known as *Citrus limon*, is a small evergreen tree belonging to the Rutaceae family. It is widely cultivated in tropical and subtropical regions and is well-known for its high vitamin C content and potent antioxidant properties.

The taxonomy of Lemon is as follows:

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Magnoliopsida
- **Order:** Sapindales
- **Family:** Rutaceae
- **Genus:** *Citrus*
- **Species:** *Citrus limon*

Lemon is characterized by its bright yellow fruit, rich in essential oils, flavonoids, and ascorbic acid, making it a valuable component in respiratory health formulations.

Physio-Chemical Composition

Lemon flakes are derived from the dried peels of the lemon fruit and contain various bioactive compounds, including:

- Vitamin C (Ascorbic Acid): A potent antioxidant that neutralizes free radicals and supports immune function.
- Flavonoids: Hesperidin, naringin, and diosmin, which exhibit anti- inflammatory and antioxidant effects.
- Essential Oils: Limonene and citral, known for their antimicrobial and bronchodilatory properties.
- Pectin: A polysaccharide that soothes respiratory mucosa and aids in mucus clearance.
- Minerals: Calcium,magnesium, and potassium, supporting overall respiratory health.

The high vitamin C content and essential oils in lemon flakes make them particularly effective in enhancing immune response and reducing respiratory inflammation.

Antimicrobial Activity

Lemon flakes exhibit significant antimicrobial activity against bacterial, fungal, and viral pathogens. Key antimicrobial effects include:

- Bacterial Pathogens: The essential oils, particularly limonene, exhibit antibacterial effects against *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*.
- Fungal Pathogens: The phenolic compounds inhibit fungal growth, particularly *Candida albicans* and *Aspergillus niger*.
- Viral Pathogens: Ascorbic acid and flavonoids enhance immune function and inhibit viral replication, making them beneficial in combating respiratory viral infections.

The antimicrobial effects of lemon flakes are particularly relevant in preventing respiratory infections, reducing the risk of secondary bacterial infections.

Antioxidant Activity

Lemon flakes are a potent source of antioxidants, primarily due to their high vitamin C and flavonoid content. Key antioxidant effects include:

- Vitamin C: Scavenges free radicals, reduces oxidative stress, and protects lung tissues from damage.
- Flavonoids: Hesperidin and naringin mitigate oxidative damage and enhance lung tissue repair.
- Essential Oils: Limonene and citral provide additional antioxidant protection by neutralizing reactive oxygen species (ROS).

The antioxidant capacity of lemon flakes is crucial in mitigating oxidative stress caused by environmental pollutants, smoking, and chronic lung conditions.

Mechanism of Action in Lung Care

Lemon flakes support lung health through their antioxidant, antimicrobial, and mucolytic properties. Mechanisms of action include:

- Antioxidant Protection: Vitamin C neutralizes ROS, preventing oxidative damage in lung tissues.
- Anti-Inflammatory Action: Flavonoids inhibit pro-inflammatory cytokines, reducing respiratory inflammation.
- Bronchodilatory Effect: Limonene relaxes bronchial smooth muscles, promoting easier breathing.
- Mucolytic Action: Pectin soothes respiratory mucosa and facilitates mucus clearance.
- Antimicrobial Defense: Essential oils disrupt microbial membranes, preventing respiratory infections and reducing infection severity.

Lemon flakes' multifaceted role in lung care, encompassing antioxidant, anti- inflammatory, and antimicrobial effects, underscores their importance in lung care formulations, particularly in respiratory infections and chronic obstructive pulmonary diseases (COPD).

RESULT

Product name		Lemon Flakes		
Source		*Citrus limon*		
Parts used		Dried lemon peel and pulp		
Appearance		Yellow to light brown flakes		
Moisture Content		≤ 10%		
Ash Content		≤ 7%		
Ph		3.0-4.0		
Odour		Characteristic citrusy, tangy aroma		
Solubility		Soluble in water, partially soluble in alcohol		
Physio –chemical properties	**Specification**	**Batch No: CBCL001**	**Batch No: CBCL002**	**Batch No: CBCL003**
Specific Gravity @20°c(g/ml)	0.900-1.000	0.912	0.918	0.922
Optical Rotation @ 20°c(Degrees)	-5 to +5	-2	0	-1
\Refractive index @ 20°c	1.450-1.470	1.456	1.460	1.453
Microbial test	**Specification**	**Batch No: CBCL001**	**Batch No: CBCL002**	**Batch No: CBCL003**
Aerobic total plate count	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life		24 Month		

Methodology: Preactivated Vedic Methodology for Lung Care Drink

The Preactivated Vedic Methodology is a holistic approach that integrates traditional Ayurvedic principles with modern phytochemical activation techniques to maximize the therapeutic potential of medicinal plants. In this methodology, each plant component is subjected to specific activation processes to enhance its bioavailability, synergistic effects, and targeted efficacy in lung care.

1. **Selection and Sourcing of Medicinal Plants:**

o The ten selected plants – Long Pepper, Peppermint, Rosemary, Kale, Bibhitaki, Turmeric, Milk Thistle, Ginger, Garlic, and Lemon Flakes – are chosen based on their proven pharmacological activities in respiratory health, including antioxidant, antimicrobial, anti- inflammatory, and bronchodilatory properties.

o Each plant is sourced from organic, pesticide-free environments to maintain the integrity of bioactive compounds.

2. **Preactivation Process:**

o Preactivation involves treating plant materials using specific methods such as dry roasting, steam activation, or fermentation. These processes are designed to:

- Enhance the solubility and bioavailability of active compounds such as gingerol, curcumin, and silymarin.
- Reduce potential anti-nutritional factors and undesirable phytochemicals.
- Activate latent phytochemicals through enzymatic conversion and thermal modification.

3. **Extraction and Concentration:**

o Following preactivation, the plant materials undergo extraction using solvents such as ethanol, water, or supercritical CO_2, depending on the target compounds.

o Extracts are then concentrated to optimal potency levels to ensure standardized doses of key bioactive compounds, including flavonoids, alkaloids, essential oils, and phenolic compounds.

4. **Formulation and Combination:**

o The individual plant extracts are systematically combined based on their complementary actions in

lung care. For instance:

- Ginger, Garlic, and Lemon Flakes are combined to enhance antimicrobial defense and mucus clearance.

- Turmeric and Milk Thistle are paired to provide robust antioxidant and anti-inflammatory effects.
- Long Pepper and Bibhitaki are blended to promote bronchodilation and respiratory function.

o The formulation is adjusted to achieve optimal ratios, ensuring synergistic effects while minimizing potential adverse interactions.

5. **Final Processing and Packaging:**

o The formulated extract blend is subjected to low-temperature drying or lyophilization to preserve phytochemicals and prevent oxidative degradation.

o The powdered formulation is then encapsulated or converted into a soluble tea formulation, ensuring ease of administration and optimal absorption in the gastrointestinal tract.

6. **Validation and Testing:**

o The final product undergoes rigorous testing to assess its phytochemical content, antimicrobial efficacy, antioxidant capacity, and lung-protective effects.

o Analytical techniques such as HPLC, GC-MS, and spectrophotometry are employed to quantify active compounds and ensure consistency across batches.

The Preactivated Vedic Methodology thus combines traditional Ayurvedic principles with modern scientific processing to produce a potent lung care drink that addresses multiple aspects of respiratory health, including infection prevention, inflammation reduction, and lung tissue repair.

TEST AND RESULT

The physical analysis of the Lung care drink has shown the following properties:

Product name		Lung care herbal drink		
Source		Long Pepper, Peppermint, Rosemary, Kale, Bibhitaki, Turmeric, Milk Thistle, Ginger, Garlic, Lemon Flakes		
Methodology		Preactive Vedic Treatment		
Appearance		Fine yellowish-brown herbal powder		
Moisture Content		≤ 10%		
Ash Content		≤ 10%		
Ph		5.0 - 6.8		
Odour		Herbal, spicy, citrusy and pungent		
Solubility		Soluble in water		
Physio – chemical properties	**Specification**	**Batch No: CBLCD001**	**Batch No: CBTLCD002**	**Batch No: CBLCD003**
Specific Gravity @20°c(g/ml)	0.850-0.900	0.874	0.879	0.876
Optical Rotation @ 20°c(Degrees)	+5 to +20	+10	+12	+11
Refractive index @ 20°c	1.450-1.470	1.458	1.460	1.459
Microbial test	**Specification**	**Batch No: CBLCD001**	**Batch No: CBLCD002**	**Batch No: CBLCD003**
Aerobic total plate count	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative

Shelf life	24 Month

This Data represents the properties of the combined formulation of the Lung care drink using the Preactivated Vedic Methodology.

Herbal Dip Composition With Medical Benefits				
S.no	**Therpeutic Usage**	**Material Description**	**Botanical Name**	**Medical Benifits**

1	**Lung Care**	Long pepper	*Piper longum*	Cold Treatment. Allergies. Prevent Diabetes, Bacterial Infection, Nervous system, weight loss
		Pepper mint	*Mentha piperita*	Indigestion, Irritable bowel syndrome, Headaches and migraines, Relieving chemotherapy-induced vomiting.
		Rosemary	*Rosmarinu s officinalis*	Neurological protection, Protection macular degeneration, Antioxidants and anti- inflammatory compounds.
		Kale	*Brassica oleracea*	Great for digestion. High in Vitamin K. powerful antioxidants, cardiovascular support. liver health. Vitamin C.
		Bibhitaki	*Terminalia bellirica*	Cough, Sore Throat, Dental Problems, insulin sensitivity, sugar levels in the blood, excellent pain reliever.
		Turmeric	*Curcuma longa*	Lessens inflammation. Fights free radicals. antioxidant properties, Improves memory
		Milk thistle	*Silybum marianum*	Promoted as a dietary supplement for hepatitis, cirrhosis, jaundice, diabetes, indigestion.
		Ginger	*Zingiber officinale*	Pain relief. Improves blood sugar regulation. Reduces nausea, lower cholesterol. Potent
				aphrodisiac, fight cancer.
		Garlic	*Allium sativum*	Lung cancer risk, Brain cancer. Hip osteoarthritis, powerful antibiotic, risk of heart attacks. anticancer properties.
		Lemon flake	*Citrus limon*	Heart health. Prevention of kidney stones. Anemia prevention. Younger. Blood Pressure, Feel Hungry

LUNG CARE DRINK

III. CONCLUSION

The Lung Care Drink formulated through the Preactivated Vedic Methodology represents a holistic and scientifically validated approach to promoting respiratory wellness. Integrating the therapeutic properties of ten carefully chosen medicinal plants—Long Pepper, Peppermint, Rosemary, Kale, Bibhitaki, Turmeric, Milk Thistle, Ginger, Garlic, and Lemon Flakes—this drink harnesses the synergistic power of nature to address multiple dimensions of lung health.

By leveraging the principles of Ayurveda and modern phytochemical activation, this formulation targets key respiratory challenges, including oxidative stress, inflammation, microbial infections, and impaired mucus clearance. The meticulous process of preactivation, involving techniques such as dry roasting, steam activation, and fermentation, significantly enhances the bioavailability of active compounds. This method not only amplifies the plants' inherent therapeutic potential but also promotes a more profound and sustained physiological response.

The combined effects of the selected plants provide a comprehensive protective mechanism for the lungs. Long Pepper and Peppermint primarily aid in bronchodilation and mucus expulsion, helping clear the airways and enhance oxygenation. Rosemary and Kale, with their rich antioxidant profiles, protect lung tissues from oxidative damage, while Bibhitaki supports mucosal health and respiratory detoxification. Turmeric and Milk Thistle act as powerful anti- inflammatory agents, reducing lung tissue inflammation and minimizing the progression of chronic conditions such as asthma and chronic obstructive pulmonary disease (COPD). Additionally, Ginger, Garlic, and Lemon Flakes work collectively to bolster the immune response, combat respiratory pathogens, and maintain mucosal integrity.

The strategic formulation process ensures that the bioactive compounds of each ingredient work in harmony, minimizing adverse interactions and maximizing health benefits. In conclusion, the Lung Care Drink formulated via the Preactivated Vedic Methodology offers a promising alternative for maintaining respiratory health in the modern age, where pollution, lifestyle factors, and recurring respiratory infections pose significant challenges. By combining ancient herbal wisdom with cutting-edge scientific techniques, this formulation provides a natural, effective, and sustainable approach to lung care, supporting both preventive and therapeutic needs.

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