A Comperhensive study on Formulation of herbal cleaning and disinfectant spray for multipurpose use.

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Abstract

Most commercial disinfectants are made from strong chemical mixtures designed to kill germs and clean surfaces by removing dirt, stains, and odors. But using these products regularly can come with risks. Many contain harsh ingredients that canlead skin irritation, allergic reaction , and serious health conditions such as asthma and, in rare instances even cancer. For instance , phenol-based disinfectants may negatively impact the lungs and circulatory systems, whereas petroleum-derived solvents can harm the body's mucosal linings .

Conversely , herbs such as neem (Azadirachta indica), reetha (Sapindus), lemongrass (Cymbopogon), and camphor have long been valued for their natural ability to fight microbes and repel insect. Drawing from this wisdom, a polyherbal bio-disinfectant was developed by combining these ingredients into a single, effective formula.

Mixing only a small amount with water can produce an effective, fully natural floor cleaning solution that is safe to use and environmentally friendly. It is particularly beneficial inhouseholdswith young children—especially toddlers who frequently crawl or play on the floor. Free from synthetic preservatives and harsh chemicals, this affordable, plant-based disinfectant offers a healthier, more sustainable alternative to conventional cleaners.

Keywords: Bio-disinfectant, Polyherbalformulation, Natural disinfectant, Medicinal plants,Azadirachta indica (Neem),Sapindus (Reetha), Cymbopogon citrous (lemongrass), Camphor, Antimicrobial properties, Eco-friendly cleaner, Chemicaldisinfectants, Health risks, Non-toxic cleaning, Sustainable home cleaning, Child-safe disinfectant, Herbal floor cleaner, Synthetic preservative–free, Plant-based formulation.

I. INTRODUCTION

Most household floors are commonly made from durable materials such as stone, marble, granite, and ceramic tiles ,areas such as the kitchen and bathroom, particularly their floors, are exposed to heavy use and therefore require regular cleaning..Accumulation of dust and dirt can contribute to various health concerns, This is especially risky for sensitive groups like children, elderly individuals, and those with weakened immunity.

Despite the wide availability of synthetic floor cleaners, many contain strong chemicals that may cause immediate as well as long-term health effects.Such chemicals may trigger allergic reactions, skin problems, and even serious conditions like asthma or cancer. For instance, disinfectants with petroleum solvents can damage mucosal membranes, while those with phenols can disrupt the respiratory and circulatory systems.Corrosive substances can cause serious burns to the skin and eyes, and if swallowed, can severely injure the throat and

esophagus. Certain cleaners, including those that contain ammonia and chlorine bleach, these products can release irritating vapors that affect the eyes, nose, throat, and lungs, posing a higher risk for individuals with asthma or existing cardiac or respiratory conditions.

Long-term health consequences, such as cancer or hormone imbalance, can arise from even cleaners with less apparent harm.Many commercial cleaners contain compounds such as diethanolamine and triethanolamine, which can react with nitrites to form nitrosamines—substances known to penetrate the skin and exhibit carcinogenic potential. Additionally, ethylene glycol ether, which is neurotoxic, is present in several cleansers.

As an alternative, herbal formulations offer a safer, gentler option—one that avoids harmful effects altogether and is suitable for everyone, including children, adults, and the elderly. With this in mind, we set out to create a floor cleaner that taps into the incredible power of natural ingredients. These ingredients, drawn from time-honored traditions and natural healing practices, have the potential to truly changethe overall approach we use for maintaining household cleanliness.

Neem:

Azadirachta indica is a perennial tree widely distributed throughout the Indian subcontinent. It is popularly referred to as Indian neem, the Margosa tree, or Indian lilac and belongs to the Family: Meliaceae), Ayurvedic texts have valued this plant for generations due to its notable antibacterial properties.
For centuries, people have relied on neem to help treat a wide range of ailments. Thanks to its gentle, skin-friendly nature, it's also widely used in soaps, shampoos, lotions, and other personal care products. Apart from its therapeutic and cosmetic benefits, neem is recognized as an environmentally friendly species that aids in reducing soil erosionmaking it as good for the environment as it is for us. Neem leaves, especially, are known for their powerful therapeutic qualities and have long been used in India to clean and purify homes. In the past, people would even burn neem leaves to naturally fumigate their living spaces and keep pests away. Using neem in floor cleaners continues this age-old tradition, capturing its natural antibacterial and cleansing abilities to create a safer, more wholesome way to care for our homes.

Order	**Rutales**
Suborder	**Rutinae**
Family	**Meliceae**
Subfamily	**Melioideae**
Tribe	**Meliae**
Genus	**Azadirachta**
Species	**Indica**

Phytochemicals and Biological activity of Neem plant

Neem is recognized as a rice source of diverse phytochemicals. Studies have identified more than 300 bioactive compounds in neem tree. These compounds are generally grouped into two major categories : isoprenoids and non-isoprenoids.

Neem contains a diverse collectionof natural compounds that areresponsible for many of its healing and cleansing effects.Its isoprenoid group which includes diterpenoids, triterpenoids, and steroidal compounds such as protomeliacins, a variety of limonoids, azadirone, azadiradione, gedunin, and related derivatives. It also contains C-secomeliacins like azadirachtin, nimbin, salanin, and their derivatives, all known for their strong biological activity.

Beyond these, neem also contains many non-isoprenoid compounds; these include proteins, different carbohydrates and polysaccharides, multiple glycosides, flavonoids, coumarins, tannins, chalcones, various polyphenolic substances, sulfur-containing compounds, and several aliphatic molecules.

Investigations have shown that the phytochemical profile varies across different parts of the neem plant, such as:

- **Leaves:**The leaves contain compounds such as azadirachtin, meliantriol, salannin, nimbidin, nimbanene, several triterpenes, along with cyclic di- and tetrasulfides and beta-sitosterol**.**.
- **Seeds:**seeds are rich inlimonoids like azadirachtin, meliantrol, and nimbidene,.
- **Seed oil**:seed oil mainly consists of constituents such as nimbolide, nimbosterol, and myricetin.

Biological activity of the Neem plant

Leaves of the neem plant have long been used in Indian tribal households as a natural remedy for minor skin problems like cuts and wounds.Neem seeds contain nimbin, a triterpenoid compound responsible for their strong biological activity.Studies show that neem provides numerous health benefits, including antibacterial, antiviral, antifungal, anti-inflammatory, and antiseptic properties. It’s also known to have antipyretic (fever-reducing), antiplasmodial (malaria-fighting), anti-ulcer, and anti-diabetic effects. In addition, neem’s famous reputation as an insect repellent is largely due to azadirachtin, a powerful natural insecticide found in its seeds.

Reetha:

Sapindus, commonly known as soapnut or soapberry, is also referred to by regional names such as washmut, ritha, reetha, aritha, doda, and dodahi. The genus name “Sapindus” derives from the Latin words *sapo* (soap) and *indicus* (from India), reflecting its long-standing use as a natural cleanser.

This plant is especially rich in triterpenoid saponins, which are found in various parts of the plant including the fruits, galls, and roots.These saponins are secondary plant metabolites with strong surfactant properties that support the traditional use of Sapindus as a natural cleaning agent., underpinning the traditional use of Sapindus as

a natural detergent and its documented insecticidal activity. The pericarp of the fruit contains especially high levels of saponins, typically around 10–12% of the fruit weight, and this saponin-rich portion is often selected for preparing cleansing and insecticidal formulations.

Lemongrass:

Cymbopogon, a genus in the grass family Poaceae, includes around 120 species that thrive in tropical and subtropical climates across the world. Many types of lemongrasses originate from South and Southeast Asia as well as Australia, which is why the plant is often referred to as East Indian lemongrass.

Lemongrass is well known for its fresh, citrus-like flavor due to its high citral content. Its essential oil has shown strong antimicrobial effects, and the plant is commonly grown around homes because of its natural insect-repelling qualities.

The essential oil of Cymbopogon species contains a rich mixture of monoterpenesand related compounds such as limonene, citral, elemol, citronellol, linalool, geraniol, methylheptenone, β-caryophyllene, and various esters including geranyl acetate. Research reports that lemongrass oil consists of 13 primary chemical constituents.

Studies show that lemongrass essential oil is made up of several key compounds, Studies indicate that citral (18.7%), geranyl acetate (12.4%), and geraniol (12.3%) are among the major compounds, with neral (24.6%) and limonene (7.5%) being dominant components.. Research over the years has consistently demonstrated that lemongrass essential oil has strong insecticidal and insect-repelling properties.

Camphor: An Overview

Camphor is derived from the wood of Cinnamomum camphora and other species belonging to the Lauraceae family.It is typically obtained by steam distillation of the wood and bark, followed by purification or sublimation. Camphor oil contains several bioactive constituents, including camphor itself, linalool, borneol, camphene, dipentene, terpinenes, safrole, and cineole.

Among these, linalool is particularly notable. It has been shown to have strong insecticidal effects against various stored-product pests, and it also possesses antifungal and antimicrobial properties.

Because of its characteristics, camphor can improve the cleaning and disinfecting performance of floor cleaners. It also impart a pleasant aroma and helps deodorize the space. Its strong, refreshing scent effectively masks unwanted odors, leaving the cleaned area smelling fresh. Additionally, camphor dissolves easily in many solvents, making it convenient to incorporate into cleaning product formulations.

II. MATERIALS AND METHODS:

Collection and preparation of ingredients:

Neem (Azadirachta indica) leaves and lemongrass (Cymbopogon) were collected from the VGI herbal garden, while reetha (Sapindus sp.) and raw camphor (Cinnamomum camphora) were procured from verified and trustworthy sources.

The collected leaves were air-dried for several days and then coarsely powdered. From this, Approximately 50 g of the powdered neem leaves were subjected to extraction using 250 mL of ethanol at 40–50 °C in a Soxhlet apparatusuntil the solvent ran clear. The solvent was allowed to evaporate until a dense, viscous extract was obtained.

In the case of reetha, the dried pericarp was ground with a mortar and pestle, and the alcoholic extract was obtained using the decoction technique. Lemongrass essential oil was individually extracted using the steam distillation method. Furthermore, a measured quantity of camphor was dissolved in alcohol to produce a saturated camphor solution.

All prepared extracts and ingredients were carefully preserved for subsequent incorporation into the formulation.

Herbal Disinfectant Preparation

Neem extract and lemongrass oil were mixed thoroughly with the aid of a mechanical stirrer for about 10 minutes.Subsequently, the reetha extract and camphor solution were introduced, and the total volume was adjusted using distilled water(100 ml). Because camphor and lemongrass already provide a pleasant natural aroma, no additional fragrance was required.The formulated floor disinfectant was subsequently poured into a suitable container and kept in a cool, dry environment for later evaluation.

S.no.	Ingredients	Formulation 1 (F1)	Formulation 2 (F2)
1.	Neem extract	60 ml	50 ml
2.	Reetha extract	20 ml	30 ml
3.	Lemon grass oil	10 ml	10 ml
4.	Camphor solution	10 ml	10 ml
		100 ml	100 ml

III. RESULT

Evaluation

1. **Physical Evaluation:**
   - **Appearance:**The formulation exhibited characteristics of a smooth, free-flowing liquid.
   - **Colour:**By placing a drop of the formulation on a clean white surface, it was visually identified as having a dark greenish-brown colour.
   - **Odour:** The fragrance was assessed manually by a small group of 3–4 people, and all of them described it as refreshing and aromatic.

- **pH:** Using pH paper, the formulation was found to have a pH value ranging between7–8.
- **Grittiness:**The disinfectant was gently rubbed between the fingertips to assess its texture and ease of spread , no grittiness was detected.
- **Stability Studies:** To evaluate stability, Samples of the formulations were maintained at 25°C, 35°C, and 45°C for a duration of one month."
- During the observation period, no alteration in color, odour, or phase separation was detected in the formulations.
- **Staining:** A dilution of 5 ml (about one teaspoon)The floor cleaner, when diluted appropriately with water, effective for surface cleaning and did not leave any stains or marks behind.

2. Chemical Evaluation:

- **Foaming Assessment :**
  Approximately 1 mL of the formulation was diluted with 5 mL of distilled waterand shaken strongly in a test tube for one minute.The formation of a stable layer of foam above the liquid was taken as evidence of saponins.
- **Color Examination:**
  Approximately 2 mL of the extract was mixed with a drop of 10% copper sulfate solution and 1 mL of concentrated sulfuric acid, followed by gentle heating. The development of a blue-green coloration confirmed the presence of triterpenoid compound.

S.no.	Parameters	F1	F2
1.	Appearance	A thick liquid that flows easily	A thick liquid that flows easily
2.	Color	A dark greenish-brown liquid	A dark greenish-brown liquid
3.	pH	7.5	7.8
4.	Odour	Pleasant (aromatic)	Pleasant (aromatic)
5.	Foam test	Stable	Stable
6.	Stability of formulation at 25 ℃	Stable	Stable
7.	Stability of formulation at 35 ℃	Stable	Stable
8.	Stability of formulation at 45 ℃	Stable	Stable
9.	Grittiness	Not found	Not found
10.	Staining ability (when dissolved in water)	It didn't leave any stains on the white floor.	It didn't leave any stains on the white floor.

IV. CONCLUSION

This polyherbal disinfectant is made from neem leaves, reetha, lemongrass oil, and camphor. These natural ingredients work together to make an eco-friendly and effective cleaner.It offers a safer alternative to chemical cleaners, is mild on the skin, and is suitable for use around children and pets. Additionally, it has a fresh, natural fragrance that creates a soothing atmosphere

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