Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 32s (2025)
https://www.jneonatalsurg.com

Evaluation Of Phytoconstituent And Pharmacological Properties Of Coriandrum Sativum (LINN)

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.Cite this paper as: Tanya Sharma, Shailja Chaudhary, Pawan Jalwal, (2025) Evaluation Of Phytoconstituent And Pharmacological Properties Of Coriandrum Sativum (LINN). *Journal of Neonatal Surgery*, 14 (32s), 1083-1093.

ABSTRACT

Coriandrum sativum (L.), commonly known as coriander, is a widely used herb with significant culinary and medicinal applications. This study aimed to comprehensively evaluate the phytoconstituents and pharmacological properties of C. sativum. Various parts of the plant, including leaves, seeds, and roots, were subjected to phytochemical screening and extraction processes. The major bioactive compounds identified included flavonoids, phenolic acids, and essential oils. Pharmacological investigations revealed a broad spectrum of therapeutic potential, including antioxidant, anti-inflammatory, antimicrobial, and hepatoprotective activities. The antioxidant properties were attributed to the presence of polyphenols and flavonoids, while the antimicrobial effects were linked to the essential oil components. Additionally, the study explored the plant's potential in managing diabetes and cardiovascular disorders. The findings suggest that C. sativum possesses diverse pharmacological properties, supporting its traditional medicinal uses and highlighting its potential for developing novel therapeutic agents. Further research is warranted to elucidate the mechanisms of action and to explore the clinical applications of these bioactive compounds.

Keywords: *Coriandrum sativum (Linn), Pharmacological properties of CS . , CS. seeds , therapeutic properties of CS, Antioxidant properties,Anti-Inflammatory.*

1. INTRODUCTION

Coriandrum sativum (Linn), commonly referred to as coriander or cilantro, is an annual herbaceous plant belonging to the Apiaceae family (*Al-Snafi et al. 2015)*. This multifaceted species is extensively cultivated for its aromatic foliage and seeds, which are utilized in culinary applications and traditional medicinal practices. Indigenous to the Mediterranean and Middle Eastern regions, C. sativum has been under cultivation for millennia and is now globally propagated. The plant typically attains a height of 30-50 cm and is characterized by delicate, pinnate leaves and small, white or pale pink inflorescences arranged in umbels. Coriander seeds contain essential oils, predominantly linalool, which contribute to their distinctive organoleptic properties. The foliage, rich in vitamins A and C, is frequently utilized fresh in diverse cuisines worldwide. Beyond its culinary applications, C. sativum has been the subject of scientific investigation for its potential properties.

Coriander thrives in well-drained soil and full sunlight, making it adaptable to various temperate climates worldwide. Its cultivation has spread globally, with major production centers in India, Russia, Morocco, and Mexico. The plant's ability to grow in diverse environments has contributed to its widespread use in numerous cuisines and traditional medicine systems across different cultures.

Historically, coriander has been utilized for both culinary and medicinal purposes, with its use dating back to ancient civilizations. Archaeological evidence suggests that coriander was cultivated in Egypt as early as the second millennium BCE, and it was mentioned in Sanskrit texts from around 1500 BCE. The ancient Greeks and Romans also valued coriander for its aromatic and medicinal properties, often using it in cooking and as a preservative.

In culinary applications, coriander is prized for its distinctive flavor profile. The fresh leaves, known as cilantro in many parts of the world, have a bright, citrusy taste with a hint of pepper. They are widely used in Mexican, Southeast Asian, and

Indian cuisines, among others. The dried seeds, on the other hand, have a warm, nutty, and slightly citrusy flavor, making them a popular spice in various dishes and as a key ingredient in many spice blends.

Traditional medicine systems, including Ayurveda, Traditional Chinese Medicine, and various folk remedies, have long employed coriander for its purported health benefits. It has been used to address digestive issues, reduce inflammation, alleviate anxiety, and manage diabetes. The plant's potential to treat various ailments has been attributed to its rich phytochemical composition, including essential oils, flavonoids, and phenolic compounds.

The growing interest in natural remedies and alternative medicine has sparked extensive research into the pharmacological properties of Coriandrum sativum. Scientists are now investigating the plant's bioactive compounds and their potential therapeutic applications using modern scientific methods. Studies have explored coriander's antioxidant, antimicrobial, anti-inflammatory, and hypoglycaemic properties, among others.

Recent research has focused on validating traditional uses of coriander and exploring new potential applications. For instance, studies have investigated its effects on blood sugar regulation, cholesterol levels, and cognitive function. Some research suggests that coriander may have neuroprotective properties and could potentially play a role in managing neurodegenerative diseases.

The essential oil extracted from coriander seeds has also garnered attention for its potential applications in aromatherapy and as a natural preservative in the food industry. Its antimicrobial properties make it an interesting candidate for developing natural food preservatives and eco-friendly pesticides.

As research continues, scientists are working to elucidate the mechanisms of action behind coriander's various health effects. This includes identifying specific compounds responsible for its therapeutic properties and understanding how they interact with the human body. Such scientific scrutiny is crucial for developing evidence-based natural treatments and potentially integrating coriander into modern healthcare practices.

The ongoing exploration of Coriandrum sativum's properties exemplifies the broader trend of bridging traditional knowledge with modern scientific inquiry. This approach not only validates centuries-old wisdom but also opens new avenues for drug discovery and the development of natural health products. As research progresses, coriander may play an increasingly important role in both culinary and medicinal applications, contributing to the growing field of evidence-based natural remedies. *(Sagbo et al., 2022) (Wanders et al., 2012)*

2. BOTANICAL AND CHEMICAL COMPOSITION:

Comprehensive overview of its characteristics, composition, and potential benefits. This structure is divided into three main sections, each focusing on a specific aspect of the plant:

1. Botanical Description:

This section provides a detailed account of the physical attributes and natural habitat of the plant. This includes the following information.

- The specific parts of the plant that are commonly utilized, such as seeds, leaves, roots, flowers, or bark
- The plant's geographical distribution and the types of environments where it naturally grows
- Its growth habits, including whether it's an annual, biennial, or perennial plant
- The plant's size, shape, and any distinctive features that aid in its identification
- Its taxonomic classification, including family, genus, and species

2. Phytochemical Constituents:

This section delves into the chemical composition of the plant, offering a comprehensive list of compounds found within it. These include:

- Essential oils, which are volatile aromatic compounds such as linalool and geranyl acetate
- Alkaloids, which are nitrogen-containing organic compounds often with significant physiological effects
- Flavonoids
- Tannins
- Terpenoids
- Other biologically active substances, which may include glycosides, phenolic compounds, saponins, and steroids

Since coriander seeds are a very abundant source of both essential oils and lipids, their concentrations vary greatly, ranging from roughly 0.8% to 2.1% for essential oils and from 22.9% to 33.5% for lipids, highlighting the wide range of biochemical compositions found in them. Among the different components of essential oil found in coriander seeds, linalool—specifically, the S-(+)-linalool isomer—is the most prevalent and abundant component, with concentrations as high as 87.5%. Other significant compounds like α-pinene, phellandrene, and γ-terpinene are also present, and together they contribute to the seeds' overall aromatic qualities. Regarding lipid composition, the important contribution of coriander seeds to nutritional biochemistry is mainly due to their high content of unsaturated free fatty acids and polyunsaturated free fatty acids, which include vital fatty acids like petroselinic acid, oleic acid, α-linolenic acid, and linoleic acid, highlighting their importance in dietary and health-related frameworks. *(Jacek., et al 2022)*

3. Nutritional Value:

This section explores the potential health benefits and nutritional content of the plant.

- The mineral content, which may include elements like calcium, iron, magnesium, potassium, and zinc

- The plant's macronutrient profile, including its content of proteins, carbohydrates, and fats

- Fiber content and type (soluble or insoluble)

- The presence and levels of antioxidants, such as polyphenols, carotenoids, or other phytonutrients

- Any unique nutritional attributes that set the plant apart from others

- Potential health benefits associated with its nutritional profile, such as immune system support, improved digestion, or cardiovascular health (*Sagbo et al., 2022) (Wanders et al., 2012)*

3. PHARMACOLOGICAL PROPERTIES:

Anti-thyroid Activity:

Coriandrum sativum L., commonly known as coriander, has demonstrated potential antithyroid activity in its seed extract. Studies have shown that this extract can inhibit the function of thyroid peroxidase, a key enzyme involved in thyroid hormone synthesis. This inhibition leads to a reduction in the production of thyroid hormones, particularly thyroxine (T4) and triiodothyronine (T3). The antithyroid effects are attributed to the presence of various bioactive compounds in coriander seeds, including flavonoids, phenolic acids, and essential oils. These compounds may interfere with iodine uptake by the thyroid gland or may directly affect the thyroid hormone synthesis pathway. While these findings suggest a promising therapeutic potential for managing hyperthyroidism, further research is needed to fully elucidate the mechanisms of action and evaluate the safety and efficacy of coriander seed extract as a potential natural treatment for thyroid disorders. The potential antithyroid effects of coriander seed extract may also extend to modulating thyroid-stimulating hormone (TSH) levels, which could further contribute to its therapeutic potential. Additionally, the antioxidant properties of the bioactive compounds in coriander seeds may help protect the thyroid tissue from oxidative stress-induced damage, potentially offering a dual mechanism of action. Further investigations into the optimal dosage, treatment duration, and potential interactions with conventional thyroid medications are crucial for developing safe and effective therapeutic strategies using coriander seed extract. *(Ramadan, 2022) (Malik et al.,2023)*

Mechanism of Action: Coriandrum sativum seeds contain several phytochemicals, including flavonoids, phenolic acids, and essential oils. These compounds may exhibit antioxidant properties, which can be beneficial in managing thyroid disorders. Studies suggest that the phytochemicals in coriander seeds may inhibit the synthesis of thyroid hormones. This could be due to their effect on the enzymes involved in the production of thyroxine (T4) and triiodothyronine (T3), potentially leading to a reduction in hyperthyroid symptoms. (*Malik et al.,2023*)

Anti-Diabetic Activity:

Diabetes mellitus (DM) constitutes a category of metabolic disorders distinguished by persistent hyperglycemia and irregularities in carbohydrate, lipid, and protein metabolism, which arise from deficiencies in insulin secretion, insulin action, or a combination of both. DM accounts for a substantial portion of global health expenditures, with approximately 12% allocated to diabetes management ($ USD 673 billion). The effective regulation of diabetes while minimizing adverse effects presents a significant challenge. Researchers have indicated that phytotherapeutic agents may serve as viable alternatives in the management of DM. Coriandrum sativum (commonly known as coriander) is a botanical species that has historically been utilized in the treatment of diabetes. The objective of this investigation was to systematically review the extant literature concerning the application of coriander in the management of DM within animal subjects, utilizing a comprehensive database. The literature search was conducted via the PubMed platform. A notable interest in research pertaining to diabetes has been confirmed. Furthermore, it was observed that approximately 6.92% of the articles indexed under the term "Coriandrum sativum" pertain to diabetes research. Five studies met the predetermined inclusion criteria for analysis. In all these studies, a significant reduction in plasma glucose levels was observed in the subject's administered coriander. In conclusion, synthesizing the findings delineated in this investigation alongside the data presented in the relevant publications, it can be inferred and recommended that the incorporation of coriander may be effective in efforts to lower plasma glucose levels in diabetic animal models. *(Frederico EHFF., et al 2016)*

Numerous scholarly investigations have substantiated the efficacy of coriander in its roles as an antidiabetic, hypolipidemic, and antioxidant agent. In this body of work, Chithra and Leelamma (1999) systematically evaluated alterations in lipid metabolism among rats subjected to a high-fat diet enriched with coriander seed powder over a 75-day period There was a noticeable decrease in the levels of triglycerides and total cholesterol in the liver, heart, and serum. The incorporation of 10% coriander seed powder within a hyperlipidemic diet resulted in a marked diminution in both very low-density lipoprotein and low-density lipoprotein cholesterol concentrations, in conjunction with an elevation in high-density lipoprotein cholesterol levels. Subsequent examinations indicated a considerable decline in lipid peroxides and free fatty acids, alongside an augmentation of antioxidant enzyme activity within the hepatic and cardiac tissues of the subjects. *(Eidi, M., et al 2011), (Chithra., et al 1999)*

Studies on free radical scavenging:

The hydro-alcoholic extract of Coriandrum sativum L. was systematically assessed for its antioxidant properties through various in vitro methodologies at a concentration of 1 mg/ml. The flavonoid and phenolic content were quantified at 44.5 µg and 133.74 µg gallic acid equivalents per mg extract, respectively, while the leaf extracts exhibited varying IC50 values for metal chelation and radical scavenging activities compared to standard antioxidants. This research highlights the extract's potential as a natural antioxidant source, with implications for its application in the food industry to combat oxidative stress. *(Harsha S.N. et al., 2014)*

Antimicrobial Activity:

The antimicrobial effectiveness of Chief Essential Oil (CEO) was assessed against various bacterial strains, including Gram-positive Bacillus subtilis and Staphylococcus aureus, along with Gram-negative Escherichia coli and Klebsiella pneumonia. Furthermore, the fungal strain Candida albicans was cultivated, and subsequent antibacterial and antifungal assays were performed utilizing the agar-well diffusion method on Mueller-Hinton and Sabouraud-dextrose agar, respectively. (*Alkahtani et al. 2020)*

In this experimental protocol, molten agar was cooled, poured into a petri dish, and inoculated with 0.1 mL of test microorganisms before solidification. A sterile cork-borer created a 6-mm well, which was filled with 100 µL of 5% (w/v) CEO in DMSO, followed by refrigeration to enhance oil diffusion, subsequently incubated at 37°C for 24 hours. The diameter of the inhibition zone surrounding the well was measured, revealing the antimicrobial efficacy of CEO at 5%, leading to further determination of its minimum inhibitory concentration (MIC) through serial dilutions. To assess the bactericidal action of CEO, a time-kill assay was conducted, quantifying colony-forming units (CFU) at specific intervals following treatment with various dilutions of CEO. *(Ahmed I. Foudah., et al 2021)*

Anxiolytic Activity:

The principal application of sedative-hypnotic and anxiolytic pharmacological agents is to facilitate tranquility (anxiolytics or sedatives) or to induce sleep (sedative-hypnotics). Individuals experience varying degrees of emotional stress, often mild and short-lived, which do not necessitate medication.

However, anxiety can sometimes escalate, hindering optimal functioning. It commonly coexists with various medical conditions and psychiatric disorders, necessitating pharmacological intervention when symptoms worsen.

CNS depressants can alleviate anxiety, yet most require significant sedation for efficacy. Sedative and anxiolytic medications are among the most prescribed, raising questions about the frequency of such prescriptions. Insomnia includes various sleep disturbances, and sedative-hypnotics are one approach to treatment. Approaches can consist of avoiding energizing substances, sustaining a wholesome meal plan, participating in workouts, and coping with stress levels. Most anxiolytics and sedative-hypnotics suppress CNS activity in a dose-dependent manner. An optimal anxiolytic should ensure calmness without excessive sedation or dependence, while an ideal hypnotic should enable quick sleep onset and quality rest. Both medication types should be minimally toxic and safe in combination with other drugs. (*Pathan A.R., et al 2011)*

Mechanism of Action:

The benzodiazepines exhibit a robust binding affinity to distinct macromolecules located within the central nervous system. These binding sites specific to benzodiazepines, referred to as receptors, are intricately linked with GABA receptors. Benzodiazepines enhance GABAergic neurotransmission across virtually all domains of the central nervous system. This augmentation is posited to transpire indirectly at the postsynaptic GABAA receptor complex. The functional relevance of this drug-receptor interaction lies in the receptor complex's capacity to modulate the influx of chloride ions into the postsynaptic neurons. The elevation in chloride conductance, facilitated by GABA, is further amplified by the presence of benzodiazepines. This enhancement of GABA-mediated chloride conductance culminates in a pronounced hyperpolarization of these neurons, consequently resulting in reduced synaptic transmission. In contrast, another category of sedative-hypnotic agents, the barbiturates, also interact with receptors associated with the GABA-chloride ionophore; however, these substances appear to extend rather than intensify the effects of GABA. *(Pathan A.R., et al 2011)*

Anti-mutagenic activity:

4-nitro-o-phenylenediamine (NOP) is a well-known example of how different biological systems metabolically activate aromatic amines into mutagens. Research using the Ames reversion mutagenicity experiment showed that coriander juice has no harmful effects but dramatically lessens the mutagenic effects of a number of aromatic amines, namely 2-aminofluorene, m-phenylenediamine, and NOP. Given that chlorophyll concentration and antimutagenic effectiveness are positively correlated, more investigation into the processes behind these effects may provide important new information about coriander's potential as a mutagenicity-preventive drug. *(Pathak Nimish L., et al 2011)*

Cholesterol lowering effect:

Coriander seeds were administered to rats on a high-fat cholesterol diet to evaluate their dietary impact. The seeds demonstrated a notable hypolipidemic effect. The experimental rats exhibited significantly elevated triglyceride and total cholesterol levels. Enhanced activity of plasma lecithin cholesterol acyl transferase and b-hydroxy, b-methyl glutaryl CoA reductase was also observed. This hypocholesterolemic effect is linked to the increased plasma LCAT activity, improved cholesterol degradation to fecal bile acids, and neutral sterol production. (*Dhanapakiam P., et al 2008)*

Anticancer effect:

The results reveal a substantial decrease in cholesterol levels and the cholesterol to phospholipid ratio, alongside an increase in phospholipid concentrations in the DMH control group compared to the spice-treated group. Additionally, the coriander-treated group showed significant elevations in faecal dry weight, neutral sterols, and bile acids relative to the DMH group. Thus, coriander demonstrates a protective role against adverse lipid metabolism effects in experimental colon cancer. This protective effect may serve as a potential mechanism by which coriander inhibits colon tumorigenesis. *(Chithra V., et al 2000)*

Antidepressant effect:

The extract derived from the seeds has been found to exhibit a significantly more pronounced antidepressant effect when compared to the aqueous extract of the same seeds. This advanced power can be credited to the extract's capacity to engage with various neurotransmitter systems, particularly the adrenergic, dopamine-ergic, and GABA-ergic systems. Such interactions permit the modulation and governance of key neurotransmitters implicated in the pathophysiology of depression, ultimately resulting in the observed antidepressant effect. (*Sudha K., et al 2011).*

Methods and methodology:

Coriandrum sativum linn. Seeds were bought from the market of Gangrar, Rajasthan. The seeds were washed to remove dust particles by using distilled water. The seeds were dried under shade, and they were stored to be used as samples for the extraction. The seeds were sent and authenticated by Herberium & angiosperm taxonomy of Safia science college, Bhopal.

The Extraction preparation:

50 g of the Coriandrum sativum seeds was extracted with 500 millilitres of methanol using Soxhlet apparatus. The extraction was carried out for 8 hrs and the extract was collected the excess methanol was removed by using water bath, the work was carried out at the department of pharmaceutical sciences, Mewar university, Gangrar, Rajasthan.

Procedure for the Phytochemicals Test:

The comprehensive examination of various phytochemical constituents, specifically focusing on the identification and quantification of flavonoids, terpenoids, quinones, anthocyanins, sterols, phenolic compounds, carbohydrates, tannins, lactones, and saponins, was meticulously conducted in accordance with the procedural methodologies that are delineated in the subsequent sections of this document. *(R. Sasi Kumar et al 2014)*

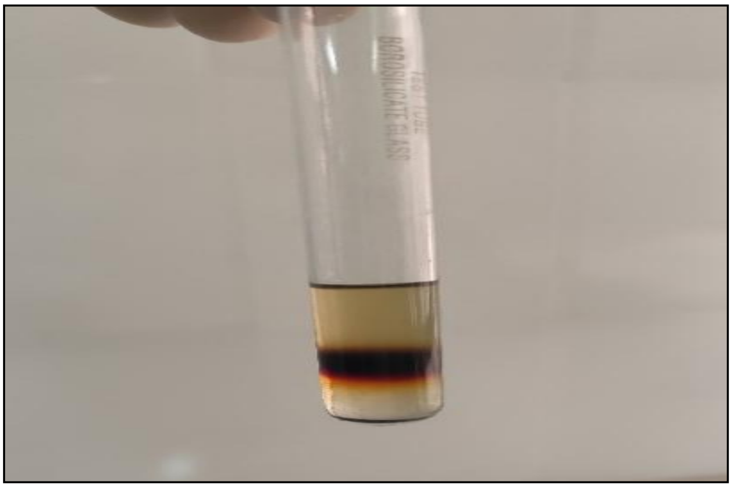
1. Test for alkaloids:

1.1 Wagner's Test:

The Wagner's reagent is introduced to 2 milliliters of extract, and the apperance of a reddish-brown precipitate suggests the presence of alkaloids.

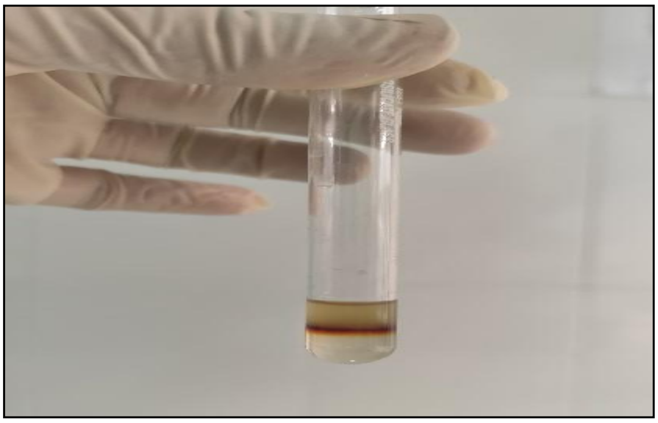
2. Test for flavonoids:

2.1. Sodium hydroxide Test A few drops of aqueous NaOH and HCl were added to 2 milliliters of extract, and the creation of a yellow-orange color shows the presence of flavonoids.



2.2. Test for H2SO4:

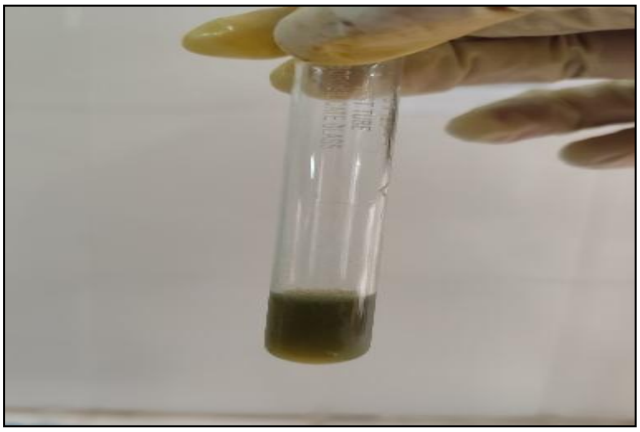
Following the meticulous treatment of a specific segment of the extract utilizing concentrated sulfuric acid, scientifically denoted as H2SO4, one observes with great scrutiny the emergence of an orange coloration, which serves as a significant indicator of the existence of flavonoids within the sample being analyzed.



3. Tannin Test:

3.1. Ferric Chloride Test:

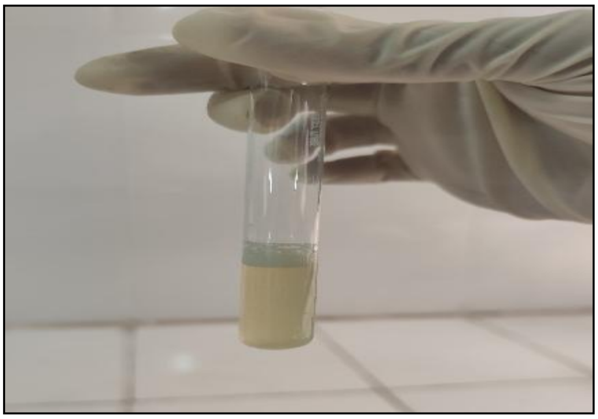
After adding a small amount of extract with alcohol and treating it with a neutral feCl3 solution, the development of blue or the presence of tannins is indicated by a greenish-colored solution.



4. Saponins test:

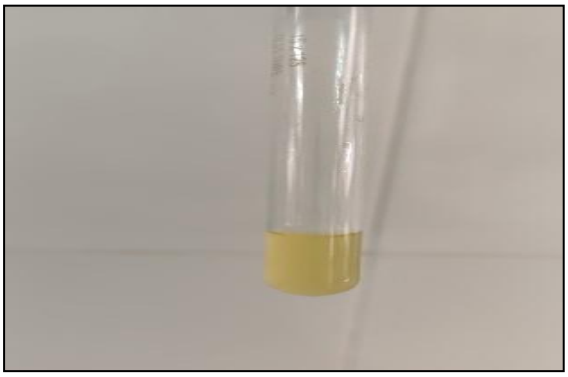
4.1. Test for Foam:

The detection of saponins within a particular extract is signified by the formation of a stable and enduring froth that occurs subsequent to the vigorous agitation of a minute quantity of the extract when it is mixed with water.



5. Test for quinones:

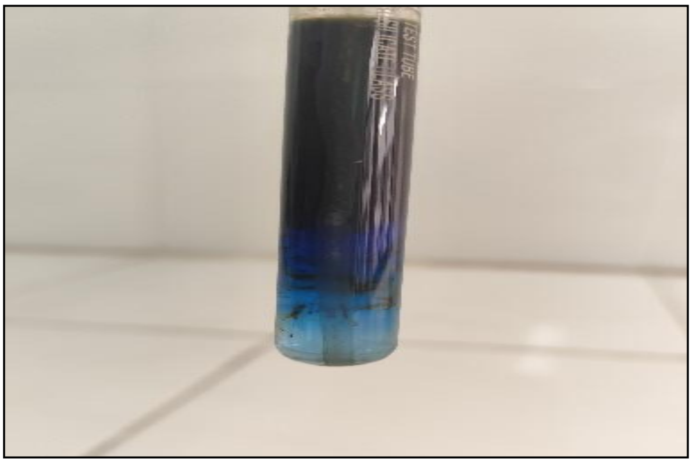
When a little quantity of the extract was treated with strong hydrochloric acid, a yellow precipitate formed, indicating the presence of quinones.



6. Test for carbohydrates:

6.1. Fehling's Test:

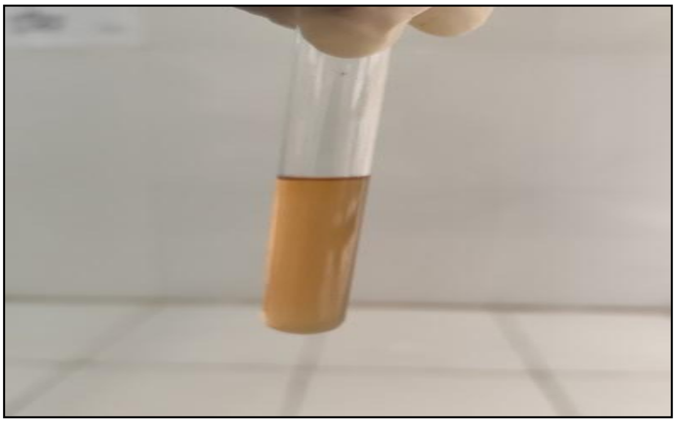
Distilled water was used to dissolve 1 milliliter of each extract, which was then filtered. Five milliliters of Fehling's solutions A and B in equal quantities were added to the filtrate to heat it. A crimson cuprous oxide precipitate forms when there is reducing sugar present, indicating the existence of carbohydrates.



7. Test for terpenoids:

7.1. Lieber-mann – Burchard Test:

One milliliter of the botanical extract in question was subjected to a treatment process involving chloroform, to which acetic anhydride was introduced in conjunction with a minimal quantity of sulfuric acid, specifically H2SO4, and subsequently, a meticulous observation was conducted which revealed the emergence of a dark green coloration, a significant indicator that suggests the potential presence of terpenoids within the extract.



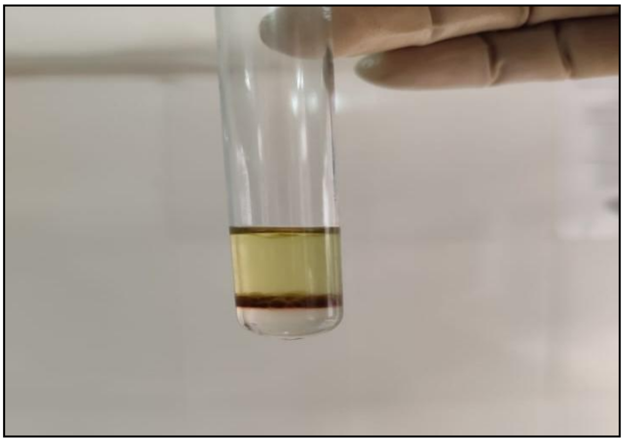
8. Test for sterols:

8.1. Burchard-Liebermann Examine:

The existence of sterols within the examined sample was conclusively demonstrated through the observable formation of a distinct dark pink or red hue, or alternatively, a reddish-brown ring, which emerged subsequent to the application of 1 millilitre of the respective extract that underwent treatment with a combination of chloroform, acetic anhydride, and a few carefully measured drops of concentrated sulfuric acid.

8.2: Test of H_2SO_4 :

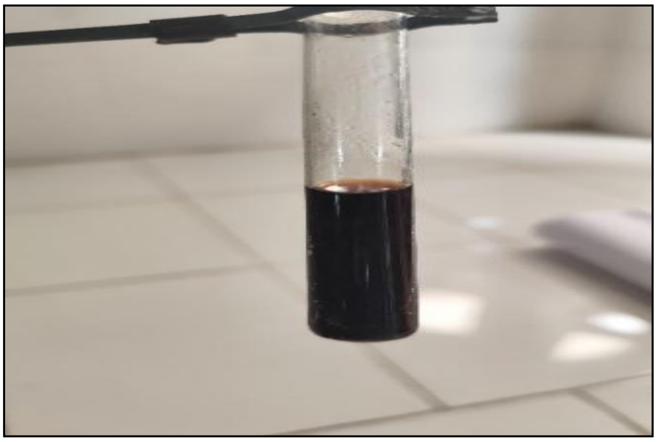
A violet or green tint was seen to appear after 1 millilitre of extract was treated with ethanol and H_2SO_4, indicating the existence for sterols.



9. Check for Phenols:

9.1. The Lieber-mann Test:

When 1 millilitre of extract was heated with $NaNO_3$, H_2SO_4, and diluted with water, a vivid red, green, or blue colour was produced, indicating the presence of phenols. Then, too much diluted NaOH was applied.



S.no.	Phytoconstituents	Tests	Result
1	Alkaloids	Wagner's Reagent	+
2	Flavonoid	NaOH Test	+
		H2SO4 Test	+
3	Tannins	Ferric Chloride Test	+
4	Saponins	Foam Test	+
5	Quinones	Quinone test	-
6	Carbohydrates	Fehling's Test	+
7	Terpenoids	Lieber-mann - Burchard Test	+
8	Sterols	Lieber-mann – Burchard Test	+
		H2SO4 Test	+
9	Phenols	Liebermann Test	+

This table 1.1 shows the presence (+) or absence (-) of various compounds in the methanol extract of Coriandrum sativum Linn seeds.

Conclusion

Among the bioactive components found in the seeds of the Coriandrum sativum plant are alkaloids, flavonoids, terpenoids, sterols, polysaccharides, saponins, and phenolic compounds. Given that this has been traditionally utilized for management various health conditions such as cancer, and skin burns, the therapeutic properties of these plants may be attributed to the presence of these bioactive substances. The current investigation elucidates that the phytochemicals found in Coriandrum seeds may significantly give to range of studies, thereby enhancing the understanding of the plant's pharmacological potential.

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