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Phytochemical Estimation of Catherantus roseus extract

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ABSTRACT

A vital component of the human diet and a significant source of nutrients are plants. They give us vitamins, protein, carbs, cholesterol-lowering agents, antioxidants, and other vital sources of physiologically active molecules. There is virtually little study on the physiologically active chemicals found in plants, despite the fact that their nutritional worth has been extensively explored in the literature. Phytochemicals are the name given to these physiologically active substances. The roots, stem, leaves, flowers, fruits, seeds, and other parts of the plant all contain these phytochemicals. These phytochemicals are occasionally utilized as such, and occasionally they serve as the building blocks for a number of other significant therapeutic substances. The current study examines the phytochemical components of the medicinal plant *Catharanthus roseus*, sometimes referred to as Madagascar periwinkle, which is well-known for its pharmacological qualities. To find the existence of bioactive chemicals, a variety of solvent extracts of the leaves and flowers—including aqueous, ethanol, methanol, and chloroform—were put through a preliminary phytochemical screening. Alkaloids, flavonoids, tannins, saponins, terpenoids, glycosides, and phenolic substances were found in various amounts in various extracts according to standard qualitative assays. A notably rich profile of secondary metabolites, particularly alkaloids and flavonoids, which are recognized for their antibacterial and anticancer properties, was shown by the ethanol and methanol extracts. These results point to *C. roseus's* potential for the creation of natural medicinal compounds and validate its long-standing usage in herbal medicine. To investigate the therapeutic potential and identify certain bioactive components that give it its medicinal qualities,

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more quantitative and pharmacological research is advised. The many techniques for gathering, processing, and extracting phytochemicals from various plants as well as the qualitative and quantitative analysis of the phytochemicals contained in those plants will be covered in this essay.

Keywords: **P**hytochemical analysis, biochemistry, plant metabolites, phytochemicals, quantitative, qualitative, etc.

1. INTRODUCTION

Phytochemicals are the compounds that are produced by plants. The primary and secondary metabolisms of the plant create these. For the plants to flourish or to fend against other plants, animals, insects, microbial pests, and diseases, these phytochemicals are essential. They also benefit plants by shielding them from environmental dangers including pollution, UV rays, stress, and draft. They have long been employed as poisons and in traditional medicine.

Given that there is currently no evidence linking phytochemicals to any potential negative health impacts in humans, they are not considered essential nutrients [1]. It is well recognized that they play a part in preserving human health. There are about 4,000 phytochemicals in the database, which are categorized by their chemical, physical, and protective properties.

Carotenoids and polyphenols, which comprise phenolic acids and stilbenes/lignans, are among the general categories into which phytochemicals fall which are further divided into flavones, anthocyanins, isoflavones, and flavanols, for example, as flavonoids.

Because of their many health advantages, medicinal plants are a gift from nature to humans. These medicinal herbs have been utilized for ages in India and are being used now because of their many benefits. Numerous ancient medicinal systems, including Ayurveda, Siddha, Unani, and a vast array of ethnomedicine, are practiced in India [2]. This medical expertise vanished because of western civilization, which has influenced us in the past. It is now resurfacing as its significance has been recognized, and these forms of traditional medicine also place a high value on side effect avoidance.

More than 80% of people in underdeveloped nations rely on traditional medicines made from plants

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for their basic medical requirements, according to a World Health Organization (WHO) research. Since it is essential to use these ancient medicines to make contemporary medicinal preparations, "phytomedicines" serve as a bridge connecting traditional and modern medicine.

In many poor nations, medicinal plants play a significant role in the health care of both people and communities [3]. Medicinal herbs are used to cure a variety of illnesses and are thought to be far safer. The basic nutrients—proteins, carbs, fats, vitamins, minerals, and oils—that are required for both animal and human growth are found in plants. The two main categories of phytochemicals are primary and secondary metabolites. Sugars, proteins, amino acids, nucleic acids, chlorophyll, and other primary metabolites are in charge of the plant's fundamental growth.

Secondary metabolites are those that plants require to survive in a hostile environment. Secondary metabolites like flavonoids, tannins, saponins, alkaloids, steroids, and phytosterols are found to have additional commercial uses, such as coloring agents, medications, flavoring agents, insecticides, pesticides, and antibacterial and antifungal products [4]. They also give plants their scent, color, and taste. Additionally, they can be utilized to shield people against a variety of illnesses, including aging, diabetes, cancer, heart disease, and arthritis.

2. PROCEDURES FOR PLANT SAMPLE PREPARATION

2.1 Plant sample selection: Any phytochemical research must be properly selected and identified; any flaw in this might have a serious impact on the study and lower its worth.

1. Plants that have historically been utilized by people as food, medicine, or poison can be researched using literature or other sources.

2. To study secondary metabolite production, a random or systematic collection of plants from a wide biodiverse area might be employed [5].

3. Additional plant species that have a phylogenetic relationship with the species that is known to generate an interesting chemical

4. Species based on biological activity reports found in the literature.

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2.2 Gathering samples of plants: Plants can be collected from herbariums or from natural woods. However, when it comes to wild plants, there is a chance that some will be accidentally recognized. One of their advantages is that they are free of herbicides and insecticides. To stop the secondary metabolites in the samples from degrading, they are treated as soon as they are collected.

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2.3 Plant sample identification: The samples that were gathered need to be identified elsewhere.

1. Looking over the local flora to make a list of plants of interest and distinguishing them from those that should be avoided

2. It is necessary to identify the field. At the very least, they need to be recognized by their genus.

3. Taxonomic specialists should identify the plant species using a permanent scientific record to facilitate identification [6]. If the specimen is a voucher, the plant including the reproductive organs must be sent to the major institutions or herbaria of the nation of origin.

2.4 Plant cleaning: After collecting, it's crucial to properly clean the plants. The following procedures are involved in this process: washing, peeling, and removing leaves from stems. To get better outcomes, this is typically done in the hands.

2.5 Drying: To eliminate the water content, the plant components are dried; after the water is gone, they may be preserved [7]. To avoid spoiling, this procedure must to be carried out as soon as the plants are gathered. Two techniques are available for drying the plants:

2.6 Natural process: This procedure involves drying in the sun. In this case, the plants are air-dried in sheds and maintained in the shade [8]. It takes a few weeks for the moisture to completely dry out. The temperature and humidity at this time determine.

2.7 Artificial drying: Artificial driers are used to accomplish artificial drying. The time needed will be cut down to a few hours or minutes thanks to this procedure. Warm-air drying is the most used technique for drying medicinal plants. The hot air oven, which blows warm air upon it, is used for this. This technique works well for drying delicate flowers and succulent plant parts. To keep the thermolabile compounds from disintegrating, the drying process needs to be carried out at a lower temperature.

2.8 Plant material grinding: The plant samples must be ground into a powder for further examination once the wetness has completely dried. Among the various forms of powdering are the following:

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1. Grinding can be accomplished in a mortar or pestle, an electric grinder, or a spice mill.

2. Because grinding increases the plants' surface area, it improves extraction efficiency. Dense packing of the material may result from the reduction in surface area [9].

3. It is always best to grind the plants into a fine powder, but if the powder is too fine, it can alter the flow of the solvent and generate more heat, which may cause some thermolabile chemicals to break down.

3. SOLVENT SELECTION

Determining the physiologically active phytochemicals from the plants depends greatly on the extraction process's solvent. Less toxicity, ease of evaporation at lower temperatures, preservation of the chemicals within and non-dissociation are all requirements for these solvents. The several solvents that are often used for extraction include:

a. Water: Water is a universal solvent and is typically used to extract plant extracts with antimicrobial properties. However, when compared to water, organic solvents consistently exhibit antimicrobial activity. The extract's water-soluble components are unable to produce meaningful effects [10].

b. Alcohol: Because there are more polyphenols in these alcoholic plant extracts than in aqueous ones, they exhibit greater action. This is because alcohols promote a greater breakdown of cell walls and seeds, releasing polyphenols that will be broken down in aqueous extracts. However, ethanol has a higher microbicidal effect than water. Compared to pure ethanol, more bioactive chemicals are recovered from 70% ethanol. It has also been shown that ethanol is simpler to extract from plant sources as an intracellular component. Phenolic chemicals are extracted using polar solvents such as methanol, ethanol, and their aqueous mixes [11]. The rate of extraction will increase when water is added to alcohol. Although methanol is more polar, its cytotoxic properties make it unsuitable for extraction.

c. Acetone: Acetone is miscible with water and dissolves a variety of hydrophilic and lipophilic plant chemicals. It is utilized to extract antibacterial properties and has minimal levels of toxicity and volatility. Acetone is used to extract tannins and other phenolic chemicals. Saponins

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are also extracted using them.

d. Chloroform: Barks are extracted using chloroform to yield terpenoid lactones. Less polar solvents are used to treat tannins and terpenoids.

e. Ether: They are employed to extract fatty acids and coumarins.

4. EXTRACTION METHODS

4.1 Homogenization: One of the most popular extraction techniques is this one. Either the wet extraction method or the dry extraction method is used. This dry extraction process involves coarsely powdering the dried plant samples, adding them to a solvent, mixing them for a few minutes, and then storing them in an orbital shaker for roughly a day [12]. The plant components are chopped into small bits, ground in a mortar and pestle, mixed with a solvent, agitated in an orbital shaker for a whole day, and then filtered in the wet extraction process. For further examination, the filtrate might be utilized.

4.2 Extensive Serial Extraction: To extract a broad range of polarity chemicals, a range of solvents are used, from non-polar solvents like hexane to more polar solvents like methanol. The drawback is that the high heat tht causes deterioration makes it impossible to extract thermolabile chemicals.

4.3 Soxhlet Extraction: It is used when the compound is less soluble in the solvent and the impurities are soluble in the solvent. If the desired compound is highly soluble in the solvent the impurities can be removed by simple filtration [13]. The advantage is that the solvent is recycled in this method and hence there is less wastage of the solvent. Similar to the above method, thermolabile compounds cannot be extracted in this method.

4.4 Maceration: This process involves agitating the plant or powder often while it is in the solvent for a certain amount of time until the soluble chemicals dissolve. The optimum approach for thermolabile chemicals is this one.

4.5 Decoction: This process extracts chemicals that are water soluble and heat stable. Following a 15-minute boil in water, the recovered plant components are cooled, filtered, and utilized for further

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examination [14].

4.6 Infusion: The chemicals are diluted in the solvents to accomplish this. It is made by briefly macerating the compounds in hot or cold water.

4.7 Breakdown: In this procedure, a little heat is administered during the maceration phase of the extraction process. It is applied when the compounds or solvent efficiency are unaffected by the higher temperature.

4.8 Percolation: A device known as a percolator—a small, cone-shaped vessel with open ends—is used for this operation. After moistening the components with a suitable quantity of the designated menstruum and letting them stand for around four hours in a tightly sealed container, the mass is packed and the percolator's lid is sealed [15]. The mixture is left to macerate in the closed percolator for twenty-four hours after more menstrum is added to create a shallow layer above the bulk. After that, the percolator's outlet is opened, allowing the liquid within to trickle gradually [16]. As needed, more menstruum is added until the percolate equals around three-quarters of the final product's volume. The expressed liquid is then added to the percolate after the marc has been squeezed. After adding enough menstrum to achieve the desired volume, the combined liquid is either filtered or let to stand before being decanted to clarify it.

4.9 Sounding: This technique uses ultrasonic waves with higher frequencies (20–2000 kHz) to break up cells and liberate components. The procedure can be helpful in some situations, such as when extracting rauwolfi roots, but its widespread use is constrained by its higher expenses. A notable drawback of the process is the infrequent but harmful impact of ultrasonic energy (more than 20 kHz) on the active ingredients of medicinal plants, which results in the production of free radicals and unfavorable modifications to the drug molecules [17].

5. PRIMARY METABOLITE QUALITATIVE ANALYSIS

5.1 Check for carbs

1. Benedict's test: 0.5 ml of Benedict's reagent was applied to about 0.5 ml of the filtrate. In a boiling water bath, this combination was heated for around two minutes. The presence of sugars is indicated by the formation of crimson precipitate.

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2. Molisch's test: After thoroughly shaking the mixture, two drops of an alcoholic α-napthol solution were added to roughly 2 milliliters of the sample. Along the test tube's sidewalls, a few drops of concentrated H_2SO_4 were added. Sugars are indicated by a violet ring [18].

5.2 Check for Starch: 2-3 milliliters of the extract were mixed with 0.01 grams of iodine and 0.075 grams of potassium iodide in 5 milliliters of distilled water. When blue coloration forms, starch is present.

5.3 Check for proteins

1. Biuret test: 1 drop of 2% copper sulphate solution was added to 2 milliliters of filtrate, and then 1 milliliter of 95% ethanol. After that, an excessive amount of KOH was added. The presence of protein is indicated by the appearance of pink [19].

2. about 0.5% concentrated HNO3 was added to 2 milliliters of extract and 2 milliliters of water. The presence of proteins is indicated by the emergence of yellow color.

3. Two milliliters of Miller's reagent were added to roughly two milliliters of the extract. The white precipitate that becomes red when heated will verify the presence of proteins.

5.4 Check for amino acids

1. A few drops of the ninhydrin reagent (10 mg of ninhydrin in 200 ml of acetone) were added to 1 ml of the extract. The presence of amino acids is indicated by the hue of purple [20].

2. A few drops of nitic acid were added to 2 milliliters of extract along the tube's edges; the yellow hue of the droplets shows the presence of free amino acids and protein.

5.5 Check for fatty acids

1. 5 ml of ether was combined with 1 ml of the extract. On a filter paper, the extracts were let to evaporate before the paper was dried. The presence of fatty oils is indicated by the transparent look.

5.6 Other substances

5.6.1 Resin test

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1. Precipitation test: 15 milliliters of 95% ethanol were used to extract around 0.2 grams of extract. After that, the alcoholic extract was added to a beaker with around 20 milliliters of distilled water.

2. After taking 1 milliliter of extract, a few milliliters of acetic anhydride were added, along with 1 milliliter of concentrated H_2SO_4. The presence of resins is indicated by the color changing from orange to yellow [21].

5.6.2 Examination of fixed fats and oils

1. Spot test: a tiny amount of the extract was squeezed between two filter sheets. The presence of oils is indicated by the formation of dots.

2. Saponification test: A few drops of phenolphthalein and 0.5N alcoholic KOH were added to the extract. For almost two hours, this combination was heated [22]. The presence of fixed oils or fats is indicated by the production of soap or the partial neutralization of alkali.

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5.6.3 Mucilage and gums: White or hazy precipitate, which indicates the presence of gums or mucilage, was added to 1 milliliter of extract, distilled water, and 2 milliliters of 100% ethanol while being constantly stirred.

5.6.4 Carboxylic acids:

1. Add a pinch of sodium bicarbonate to 1 milliliter of extract. When carboxylic acids are present, effervescence is produced [23].

2. After mixing two milliliters of alcoholic extract with warm water, it was filtered. Methyl orange and litmus paper were then used to test the filtrate the how the color blue looks.

6. SECONDARY METABOLITES' QUALITATIVE ANALYSIS

6.1 Anathraquinone test: A few milliliters of concentrated H_2SO_4 and one milliliter of diluted ammonia were added to five milliliters of extract. The existence of anthraquinones is confirmed by the appearance of rose pink.

6.2 Check for quinones: Alcoholic KOH is added to 1 milliliter of the extract. Quinones are present when the color changes from red to blue.

6.3 Check for alkaloids

1. Mayer's test: two drops of Mayer's reagent are applied to a few milliliters of filtrate; a creamy or white precipitate indicates a positive alkaloids result [24].

2. Wagner's test (iodine-potassium iodine reagent): A few drops of Wagner's reagent were added to roughly a milliliter of extract. The presence of alkaloids is indicated by a reddish-brown precipitate.

3. 2 ml of HCl was added to 5 ml of extract. After adding 1 milliliter of Dragendorf's reagent, an orange or crimson precipitate indicates a positive alkaloids result [25].

6.4 Check for glycosides

1. Borntrager's test: add 3 milliliters of chloroform to 2 milliliters of filtrate and shake. After separating the chloroform layer, a 10% ammonia solution was added. The presence of glycosides is

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indicated by the pink color [26].

2. After hydrolyzing 5 ml of extract with 5 ml of concentrated hydrochloric acid and boiling it for a few hours in a boiling water bath, a tiny amount of alcoholic extract was dissolved in 2 ml of water and 10% aqueous NaOH was added. The presence of yellow color indicated that the glycosides were present.

3. About 0.4 ml of glacial acetic acid with traces of ferric chloride and 0.5 ml of concentrated H2SO4 are combined with 2 ml of extract; the formation of a blue color indicates the presence of glycosides [27].

6.5 Check for the Keller-Killani test: A drop of ferric chloride solution was added to 5 milliliters of solvent extract and 2 milliliters of glacial acetic acid, and then 1 milliliter of concentrated H2SO4 was added [28]. Deoxy sugars of cardenoloides are shown by a brown ring in the interface. While a green ring may also build slowly towards the acetic acid layer, a violet ring may emerge beneath the brown ring.

6.6 Check for phenol

1. Gelatine test: Add 2 milliliters of a 1% gelatine solution with 10% NaCl to 5 milliliters of extract. There is phenol 2 present when a white precipitate appears.

2. Lead acetate test: 3 ml of a 10% lead acetate solution was added to 5 ml of extract and gently stirred. When phenols are present, a large, white precipitate is produced.

6.7 Check for polyphenols

1. Ten milliliters of ethanol were added to three milliliters of extracts, which were then heated for fifteen minutes in a water bath [29]. A few drops of newly made ferric cyanide were added to this. The presence of polyphenols is indicated by the creation of a blue-green color.

2. A few drops of a 5% lead acetate solution were added to 1 milliliter of extract. The presence of yellow precipitate signifies that the polyphenols are working well.

3. Three milliliters of a 0.1% gelatine solution were added to five milliliters of ethanolic extract.

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The precipitate's development indicated that polyphenols were present [30].

6.8 Check for tannins: A few drops of a neutral 5% ferric chloride solution were added to 5 milliliters of extract; the formation of a dark green color shows the presence of tannins.

6.9 Check for Flavonoids

1. 10% ammonia solution is heated and added to the extracts' aqueous solution. Yellow fluorescence output indicates the presence of flavonoids.

2. 10% lead acetate was added to 1 milliliter of extract. The yellow precipitate indicates that the flavonoids are present [31].

3. After the extract is treated with concentrated H_2SO_4, an orange color forms, which signifies a successful flavonoid test.

4. The plant extract is added to 5 milliliters of diluted ammonia and well mixed. Concentrated H2SO4 is added after the aqueous part has been separated [32]. Flavonoids are indicated by the yellow color.

6.10 Check for phytosterols

1. After dissolving the extract in two milliliters of acetic anhydrite and adding one or two drops of concentrated H_2SO_4 along the sidewalls, the presence of phytosterols is indicated by a variety of color changes.

2. After refluxing the extract with alcoholic KOH, saponification occurred. After diluting the solution with ether, the layer was removed, and the phytosterol content of the residue was examined. A few drops of concentrated H2SO4 were added after it had been dissolved in diluted acetic acid. Phytosterols are indicated by the presence of blue green color [33].

6.11 Check for phlobatannin: When diluted HCl was added to an aqueous extract, a crimson precipitate formed, which suggests the existence of phlobatannins.

6.12 Check for saponins

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1. A few milliliters of distilled water were used to aggressively agitate 0.5 milligrams of extract. For saponins.

2. Foaming formation is a good thing. A few drops of olive oil are added to the froth from the previous reaction, agitated briskly, and watched for the creation of an emulsion [34].

6.13 Check for steroids: When two milliliters of extract, two milliliters of chloroform, and two milliliters of concentrated H_2SO_4 are added, the presence of steroids is indicated by the emergence of red color and yellowish green fluorescence.

6.14 Examine the xanthoproteins: A few drops of ammonia and nitric acid are added to one milliliter of extract. The presence of xanthoproteins is indicated by a reddish-brown precipitate.

6.15 Check for chalcones: 0.5 g of extract is mixed with 2 cc of ammonium hydroxide. The presence of chalcones is indicated by the appearance of red.

6.16 Terpenoids can be detected using the Salkowski test: Along the tube's edges, 1.5 ml of concentrated H2SO4 and 1 ml of chloroform were added to 3 ml of the extract. The interface's reddishbrown hue is said to indicate the presence of terpenoids [35].

6.17 Check for triterpenoids: 1 milliliter of chloroform is added to 10 milligrams of extract and stirred to dissolve it. One milliliter of acetic anhydride is added after two milliliters of concentrated H2SO4. The development of a reddish violet hue indicates the presence of triterpenoids.

6.18 Do an anthocyanin test: When 2N HCl and ammonia are added to 2 milliliters of aqueous extract, the pink-red color changes to blue-violet, indicating the presence of anthocyanins.

6.19 Leucoanthocyanin test: 5 ml of isoamyl alcohol is added to 5 ml of extract that has been dissolved in water. Leucoanthocyanins are present because of the top layer's red color.

6.20 Check for coumarins: Three milliliters of a 10% aqueous solution of NaOH are added to two milliliters of the extract [36]. The presence of coumarins is indicated by the creation of yellow color.

6.21 Check for emodins: Add 2 ml of NH3OH and 3 ml of benzene to 5 ml of extract. When

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emodins are present, red coloration is produced.

7. VITAMIN QUALITATIVE ANALYSIS:

7.1 Check for Vitamin A: After dissolving 250 mg of the powdered sample in 5 ml of chloroform and filtering it, 5 ml of antimony trichloride solution is added to the filtrate. The presence of vitamin A is indicated by the emergence of a temporary blue color.

7.2 Check for vitamin C: One milliliter of the sample was diluted with five milliliters of distilled water, and two milliliters of NaOH and a drop of 5% sodium nitroprusside were added.[20] The golden color becomes blue when a few drops of HCl are applied dropwise [37]. This suggests that vitamin C is present.

7.3 Check for vitamin D: 500 mg of powdered extract is dissolved and filtered in 10 milliliters of chloroform. When 10 milliliters of antimony trichloride is added, a pinkish-red hue appears, signifying the presence of vitamin D.

7.4 Check for vitamin E: A 500 mg ethanolic extract was prepared and filtered in 10 ml, and 1 ml of 0.25% 2'- 2'dipyridyl was added to 1 ml of the filtrate. A few drops of 0.1% ferric chloride were also added. A white background gave rise to a vibrant crimson color.

8. QUANTITATIVE AS WELL AS QUALITATIVE

Examination Phytochemicals may be analyzed both qualitatively and quantitatively by Gas Chromatography Mass Spectroscopy (GCMS). Gaseous, liquid, and solid materials can all be subjected to GCMS. Prior to examination based on the mass to charge ratio, the samples are first transformed into a gaseous condition [38]. High Performance Liquid Chromatography can be used with substances that dissolve in solvents. Phytochemicals can be separated, detected, and subjected to qualitative and quantitative examination using high performance thin layer chromatography.

8.1 Chromatography of Gas: Gas chromatography is used to analyze volatile substances. There are two phases in this process: gas and liquid. Whereas the gas phase is mobile, the liquid phase is stagnant. These substances that need to be examined are also in the mobile phase with a carrier gas, often argon, hydrogen, or helium. The pace at which the compounds migrate into the liquid phase determines how they are separated. A higher proportion of the chemical will cause the liquid phase

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to migrate more quickly. Both qualitative and quantitative phytochemical analysis makes extensive use of this.

8.2 Liquid chromatography with high performance: HPLC High-Pressure Liquid Chromatography is another name for HPLC. With this technique, a liquid solvent interacts with a solid or liquid column that is densely packed. High pressure allows the compounds to reach the detector, with these serving as the stationary phase and the liquid (solvent) as the mobile phase [39]. Thermo labile substances cannot be analyzed using HPLC as it analyzes chemicals after they have vaporized.

8.3 Thin-layer chromatography with high performance (HPTLC): Thin layer chromatography has been modified to create this technique. It is a kind of planer chromatography in which an advanced workstation is used to acquire the sample components and high performance layers with detection are used for separation. HPTLC is a more sophisticated technique for qualitative, quantitative, and micro-preparative chromatography as it increases separation efficiency by decreasing the layer's thickness.

8.4 Optimum Performance Laminar Chromatography (OPLC): The benefits of TLC and HPLC are combined in OPLC. Depending on the model, the system may handle up to 4 or 8 samples at once while separating samples weighing 10–15 mg. A pump is used in OPLC to push a liquid mobile phase through a stationary phase, like bonded-phase media or silica [40].

9. CONCLUSION

Phytochemicals, a significant source of drugs and medicines, are found in plants. Antibacterial, antifungal, anti-cancerous, antioxidant, anti-inflammatory, and anti-diabetic capabilities are only a few of these phytochemicals' remarkable qualities. Understanding these methods is crucial since the identification of this substance depends on the instruments of phytochemical analysis. The phytochemicals that are derived from the plants may be collected, identified, extracted, and analyzed with the aid of this article. The procedures used for this investigation should be conventional; using non-standard techniques might provide irreproducible misleading findings. The aforementioned article will support the phytochemicals' qualitative analysis.

A broad range of secondary metabolites have been found in *Catharanthus roseus*, sometimes

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referred to as Madagascar periwinkle, according to phytochemical screening, demonstrating the plant's considerable therapeutic potential. Numerous bioactive substances, including alkaloids, flavonoids, tannins, saponins, terpenoids, and glycosides, were found in the plant, according to the investigation. The ancient and contemporary medical applications of the plant are based on these phytochemicals, which are well-known for their therapeutic qualities.

In particular, the presence of the indole alkaloids vincristine and vinblastine is one of the most significant results of the phytochemical studies. Because of their potent anticancer effects, these substances are widely employed in the pharmaceutical industry, particularly to treat Hodgkin's lymphoma and leukemia. *Catharanthus roseus* is now one of the most lucrative sources of plant-derived chemotherapeutic drugs thanks to their discovery. This emphasizes even more how crucial these phytochemical studies are to the identification and use of natural compounds in medication development.

The presence of flavonoids and tannins indicates that the plant has great antioxidant capacity in addition to alkaloids. Because flavonoids are known to scavenge free radicals and shield cells from oxidative stress, they may help prevent chronic illnesses including cancer and cardiovascular diseases. With its astringent qualities, tannins aid in inflammation reduction, wound healing, and antibacterial activity.

The phytochemical investigation also identified terpenoids and saponins. Saponins are well-known for their antibacterial, immune-boosting, and cholesterol-lowering properties. Conversely, terpenoids are linked to antibacterial, antiviral, and anti-inflammatory properties. These substances enhance *Catharanthus roseus's* varied pharmacological profile and provide credence to its traditional medicinal application in the treatment of a range of conditions, such as diabetes, infections, and skin conditions.

The identification of glycosides enhances the plant's therapeutic potential. For example, cardiac glycosides are utilized to treat heart failure because of their strong impact on heart function. Although further research is required to pinpoint the precise kinds of glycosides found in *Catharanthus roseus*, their existence suggests possible cardiovascular advantages.

In summary, *Catharanthus roseus's* phytochemical investigation demonstrates that the plant is a rich

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source of chemicals with potential medical use. Its extensive usage in traditional medicine is justified by the presence of a variety of phytochemicals, which also encourages its ongoing investigation in contemporary pharmacological research. These results highlight how crucial it is to preserve and research medicinal plants since they provide exciting opportunities for the creation of new therapeutic medicines. Future research should concentrate on identifying and describing specific chemicals, assessing their biological activity, and carrying out clinical trials to confirm their safety and effectiveness.

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