World Journal of Pharmaceutical Science and Research
www.wjpsronline.com
Research Article

ISSN: 2583-6579
SJIF Impact Factor: 6.916
Year - 2026
Volume: 5; Issue: 7
Page: 395-412

TO SYNTHESIZED AND EVALUATE CINNAMYL SCHIFF BASE FROM CINNAMALDEHYDE

Abhishek, Anjali Dixit*, Ashima Chandel

Department of Pharmaceutics, CT College of Pharmacy, CT Group of Institutions, UE-II to Partappura Road, Shahpur, Jalandhar, 144020, Punjab, India.

Article Received: 22 May 2026 | | Article Revised: 12 June 2026 | | Article Accepted: 03 July 2026

***Corresponding Author: Anjali Dixit**
Department of Pharmaceutics, CT College of Pharmacy, CT Group of Institutions, UE-II to Partappura Road, Shahpur, Jalandhar, 144020, Punjab, India. **DOI:** https://doi.org/10.5281/zenodo.21370503

How to cite this Article: Abhishek, Anjali Dixit, Ashima Chandel (2026) TO SYNTHESIZED AND EVALUATE CINNAMYL SCHIFF BASE FROM CINNAMALDEHYDE. World Journal of Pharmaceutical Science and Research, 5(7), 395-412.

ABSTRACT

Cinnamomum zeylanicum most commonly known as Cinnamon is a widely used aromatic condiment and a spice obtained from the bark of cinnamon tree. Cinnamaldehyde is an aromatic compound found in cinnamon bark. The primary aim of this study is to obtain cinnamaldehyde from *Cinnamomum zeylanicum*. This was achieved by using Soxhlet extraction process. The results obtained from the schiff's test, tollen's test, solubility etc. indicated that the product extracted was Cinnamaldehyde. Schiff bases, known for their diverse pharmacological activities, have garnered considerable attention in medicinal chemistry. In this study, we present the synthesis and evaluation of a cinnamyl Schiff base derived from cinnamaldehyde. The synthesis involved the reaction between cinnamaldehyde and an appropriate amine. Characterization studies, including Tollen's test, Schiff test, Ninhydrin test, Mayer's test & Bromine water test confirmed the formation of the target compound.

KEYWORDS: Cinnamon, Extraction, Cinnamaldehyde, Soxhlet, Cinnamyl Schiff Base.

1. INTRODUCTION

SCHIFF BASE

A Schiff base is a compound with the general structure **R_2C=NR** and is considered as a subclass of imines, (imines are the compounds consisting of carbon-nitrogen double bond) being either secondary aldehydes or secondary ketimines depending on their structure. The imine is commonly used as a synonym for azomethine (which refers to secondary aldimines).

These compounds are named after the Italian chemist Hugo Schiff. Many systems exist for the nomenclature of these compounds.

Schiff's bases are aldehyde- or ketone compounds where the carbonyl group is replaced by an azomethine or imine group. These are commonly used for industrial purposes and also exhibit a wide range of biological activities. These are the most widely used organic compounds which are used as intermediates in organic synthesis, catalysts, pigments and dyes, polymer stabilizers, etc.[1]

Schiff bases are synthetically accessible and structurally diverse compounds, typically obtained by facile condensation between an aldehyde, or a ketone with primary amines. Schiff bases contain an azomethine (-C = N-) linkage that stitches together two or more biologically active aromatic/heterocyclic scaffolds to form various molecular hybrids with interesting biological properties. Schiff bases are versatile metal complexing agents and have been known to coordinate all metals to form stable metal complexes with vast therapeutic applications.

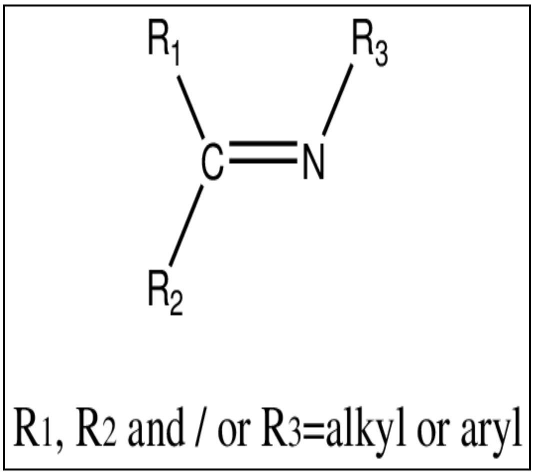

Figure 1.1: Structure of schiff base.

Schiff bases are condensation products of primary amines and carbonyl compounds and they were discovered by a German chemist, Nobel Prize winner, Hugo Schiff in 1864. Structurally, Schiff base (also known as imine or azomethine) is an analogue of a ketone or aldehyde in which the carbonyl group (C=O) has been replaced by an imine or azomethine group. Schiff base ligands are essential in the field of coordination chemistry, especially in the development of complexes of Schiff bases because these compounds are potentially capable of forming stable complexes with metal ions.[2]

PHYSICAL PROPERTIES OF SCHIFF BASES

Schiff bases are usually coloured and transparent solids. They are used in the determination of metal amounts and in the identification of carbonyl compounds due to their precise melting points. The carbon-nitrogen double bond in Schiff bases rotates more easily than the carbon-carbon double bond, which allows stereoisomers to transform into each other. The reason for this: polarization occurs in the azomethine bond due to the fact that nitrogen is more electronegative than carbon.

CHEMICAL PROPERTIES OF SCHIFF BASES

Schiff bases have many properties that vary according to the substituents attached to the azomethine group. The stability of the azomethine compound increases when there is an electronegative group attached to the nitrogen atom.

The best example of this is that oximes carrying hydroxyl groups on the nitrogen atom along with phenylhydrazone and semi carbazones carrying ▬NH groups are much more stable to hydrolysis than Schiff bases carrying alkyl or aryl substituents on the nitrogen atom. Although Schiff bases are stable against alkalies, they are separated into amine and carbonyl compounds by hydrolysis in acidic environment. The Schiff base formation reaction is reversible. As a result of the reaction, one mole of water is formed and the water in the environment shifts the direction of the reaction to the left. Therefore, the reaction is usually carried out in solvents where water can be removed from the environment by distillation, forming an azeotrope. If the reaction is carried out using amines containing an electronegative atom with unpaired electrons in the nitrogen atom, the reaction is completed and since hydrolysis will not occur, Schiff bases can be isolated with high efficiency.

PROPERTIES OF SCHIFF BASE

1. **Anti- malarial activity**

5-nitroisoquinoline derivatives.

2. **Anti-bacterial activity**

N-(salicylidene)-2-hydroxyaniline.

3. **Anti-fungal activity**

2,4-dichloro-5-fluorophenyl group.

4. **Anti-viral activity**

Isatin (1H-indole-2,3-dione).[3]

CINNAMON

Cinnamon is a spice obtained from the inner bark of several tree species from the genus *Cinnamomum*. Cinnamon is used mainly as an aromatic condiment and flavouring additive in a wide variety of cuisines, sweet and savoury dishes, breakfast cereals, snack foods, bagels, teas, hot chocolate and traditional foods. The aroma and flavour of cinnamon derive from its essential oil and principal component, cinnamaldehyde, as well as numerous other constituents including eugenol. Cinnamon bark is one of the most important and widely used species worldwide in cooking as well as for traditional medicinal purposes. Nearly 250 different species of cinnamon have been identified till date. The molecular formula of Cinnamaldehyde is C_9H_8O and it has a molecular weight of 132.16 g/mol.

It is an oily fluid of yellow color and can result in skin irritation when exposed at high concentration. It is a well-known fungicide and is typically applied to the root systems of plants. Also, it is used as a corrosion inhibitor for various alloys in corrosive fluids.

The most important components which contribute to the fragrance of cinnamon are cinnamaldehyde and trans cinnamaldehyde. It has been indicated in a study conducted on Cinnamomum osophloeum that essential oil obtained from cinnamon contains a high content of cinnamaldehyde.[4]

Figure 1.2: Cinnamon.

Synonyms: Dalchini, Ceylon Cinnamon, Cinnamon bark.

Biological source

Cinnamon consists of dried bark, freed from the outer cork and from the underlying parenchyma, from the shoots growing on the cut stumps of ***Cinnamomum Zeylanicum Nees***.

Family*:* *Lauraceae**.***

Geographical source

Srilanka, Malabar Coast of India, Jamaica and Brazil.

Description

Cinnamon Bark

- **Colour:** Externally dull yellowish brown, internally dark yellowish brown
- **Odour:** Aromatic
- **Taste:** Warm and very refined (Sweetish and aromatic followed by warm sensation)
- **Fracture:** Splintery
- **Size:** Length is about 1 meter, diameter is nearly 1 cm and thickness is approximately 0.5 mm.
- **Shape:** Compound quill form.

Cinnamon Oil

- **Colour:** Yellow to reddish in colour.
- **Specific gravity:** 1.00 to 1.030.
- **Optical rotation:** 0 to − 2.
- **Refractive index:** 1.562 to 1.582.

Chemical Constituents

- Cinnamon bark contains polycyclic diterpenes and proanthocyanidin oligomers. It contains volatile oils (0.5 to 1 percent), phlobatannins (1.2 percent), mucilage, calcium oxalate, starch and mannitol (responsible for sweetish taste).

- The cinnamon oil obtained from distillation method which is light yellow in colour and upon storage changes to reddish in colour.
- The essential oil (5 to 20 ml/kg) is composed of phenylpropane derivatives. Cinnamon oil mainly contains cinnamaldehyde (60 to 70 percent), eugenol (5 to 10 percent), benzaldehyde, cumin-aldehyde and other terpenes such as phellandrene, pinene, cymene, caryophyllene.

Chemical Test

- To a drop of volatile oil add a drop of ferric chloride solution, a pale green colour develops (cinnamaldehyde produces brown colour and eugenol gives blue colour which results in the formation of pale green colour).

Cinnamon Nutrition

Cinnamon contains almost no protein or fat and won't play a big role in your overall nutrition. But a teaspoon of ground cinnamon does include these and trace amounts of many other vitamins and other nutrients:

- About 6 calories.
- About 0.1 gram of protein.
- About 0.03 grams of fat.
- About 2 grams of carbohydrates.
- About 1 gram of fibre.
- About 26 milligrams of calcium.
- About 11 milligrams of potassium.
- About 3 micrograms of beta-carotene.
- About 8 international units (IU) of vitamin A.

Uses of Cinnamon

- Anti-Bacterial activity.
- Regulating Blood Sugar Levels.
- Enhancing Cognitive Function.
- Shielding Against Heart Disease.
- Supporting Digestive Health.
- Potent Anticancer Properties.
- Enhancing Circulatory System.
- Mitigating Neurodegenerative Disorders.
- Lowering LDL Cholesterol.[5]

CINNAMALDEHYDE

Cinnamaldehyde has the formula $C_6H_5CH{=}CHCHO$ and is an organic compound. Cinnamon's flavour and odour are derived from the trans (E) isomer, which occurs naturally. It is a viscous pale-yellow liquid that can be found in the bark of cinnamon trees and other Cinnamomum plants. Cinnamaldehyde makes up about 90% of the essential oil of cinnamon bark. Also, there are many laboratory synthesis methods available, but the steam distillation of cinnamon bark oil yields the most cost-effective cinnamaldehyde. The FDA has classified cinnamaldehyde as GRAS, as has existing European legislation for products expected to come into contact with food (EU N10/2011 Regulation).

Cinnamaldehyde's antimicrobial activity has been linked to a variety of mechanisms, some of which overlap. The mechanism of cinnamaldehyde's bactericidal action against L. monocytogenes and E. coli has been studied, and it appears that interaction with the cell mem--brane causes a rapid inhibition of energy metabolism. The disruption of proton motive forces causes leakage of small ions without leakage of larger components like ATP, as well as inhibition of ATP production and membrane-bound adenosine triphosphatase (ATPase) activity. Nowotarska, Nowotarski, Friedman, and Situ (2014) describe the formation of quantitative parameters using model membranes that suggest antimicrobial compounds like Cinnamaldehyde may change the lipid monolayer structure by forming antimicrobial and lipid aggregates. After incubation at 37°C for 2 hours, Cinnamon oil and Cinnamaldehyde reduced the intracellular ATP concentration of Mycobacterium avium subsp. paratuberculosis (Map) cells. He, Huang, Jiang, and Zhou (2019) observed that Cinnamaldehyde enhanced cell surface hydrophobicity, inhibited acid production, and improved acid tolerance in S. mutans. In the presence of Cinnamaldehyde, gene expression in biofilms was down-regulated. As a result, it showed that Cinnamaldehyde suppressed microbial activity in S. mutans biofilms by altering aggregation, hydrophobicity, acid tolerance, acid production, and virulence gene expression at sub-MIC levels.[6]

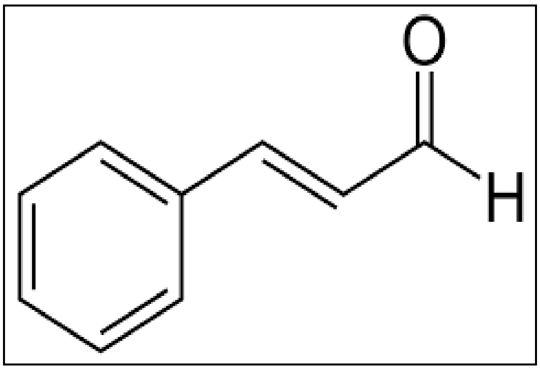

Figure 1.3: Structure of Cinnamaldehyde.

PROPERTIES OF CINNAMALDEHYDE

1. Anti-microbial activity.
2. Anti-inflammatory activity.
3. Anti-oxidant activity.
4. Anti-tumor activity.
5. Cholesterol-lowering activity.
6. Immunomodulatory activity[7].

2. REVIEW OF LITERATURE

AUTHORS NAME	YEAR	DESCRIPTION
Aruna Dhathathreyan et.al	2024	Monolayers of Schiff bases derived from ethylene diamine and o-phenylene diamine with p-nitro cinnamaldehyde, (compounds 1 and 2) at air/water interface have been studied. Photolysis of 1 in chloroform solution undergoes cis–trans isomerization on irradiation of white light while compound 2 does not undergo isomerization under photolytic conditions. The photolysis of 1 and 2 in Langmuir–Blodgett films (LB films) transferred to quartz plates form dimers. The change in product

		distribution is attributed to the influence of bridging group of the cinnamaldehyde moieties, molecular configuration and mobility of the compounds in solution, solid state and the aggregation of molecules in monolayer assemblies.[8]
Ardakan Branch et.al	2023	Schiff bases are aldehyde or ketone like compounds in which the carbonyl group is replaced by an imine or azomethine group. They are widely used for industrial purposes and also exhibit a broad range of biological activities. Schiff bases generally are bi-, tri-or tetra- dentate chelate ligands and easily react with almost all transition metal ions and form very stable complexes with them. Their chemical and physical properties in various fields such as preparative uses, identification, or protection, and determination of aldehydes or ketones, purification of carbonyl or amino compounds, or protection of these compounds in complex or sensitive reactions have been studied by various workers.[9]
Amanda A. Doyle a et.al	2023	A range of trans-cinnamaldehydes were synthesized and their antibacterial activity against S. aureus and E. coli assessed and compared to naturally occurring antibacterial trans-cinnamaldehyde. The cinnamaldehydes generated only low mM levels of activity, with the p-Br phenyl derivative showing a 4.5-fold increase in activity compared to that of the parent trans-cinnamaldehyde. However, based on the cinnamaldehyde structures evaluated in this study, a relationship could be observed between electrophilicity and bacteriostatic activity, where trans-cinnamaldehydes that are more electrophilic than TC tend to be more biologically active. Calculated electrophilicity values for the cinnamaldehyde derivatives were reported and the use of a known NMR spectroscopic assay for the identification of thiol trapping drug molecules was also described. The positive results from this assay, along with the relationship between electrophilicity and antibacterial activity.[10]
B.B. Fuchs et.al	2023	cytotoxic effects of such cinnamyl Schiff bases against human lung, kidney or red blood cells were also checked. The compounds were synthesized in a single-step, 2 min of reaction under microwave irradiation produced up to 97% yield. Six of the 23 cinnamyl Schiff bases possessed antifungal activities against strains of Candida, Aspergillus, Fonsecaea and, particularly, Cryptococcus species.[11]
Ammar Abdul Aziz Alibeg et.al	2022	Novel Schiff base-derived quinazolinone derivatives (4a and 4b) with improved antibacterial activities. Chemical procedures and spectrophotometric (IR and NMR) techniques were used to study and describe the produced compounds. Antibacterial screening tests for the target compounds were implemented against two gram-positive strains (Staphylococcus aureus, Staphylococcus faecalis) and two gram-negative strains (Escherichia coli, salmonella typhi) by scaling the diameter of the zone of bacterial inhibition. The results of these tests indicate that the synthesized Schiff bases exhibit an accepted level of biological activity against these microorganisms.[12]
Zuhair Jamain et.al	2020	A series of liquid crystal molecules with two Schiff base linking units and a cinnamaldehyde core with different terminal groups were synthesized and characterized. The intermediates of 4-heptyloxybenzaldehyde (1a) and 4-dodeyloxybenzaldehyde (1b) were synthesized through the alkylation of 4-hydroxybenzaldehyde with a series of bromoalkane. A condensation reaction of cinnamaldehyde, 1,4-phenylenediamine and a series of substituted benzaldehydes with different terminal groups such as bromo, chloro, hydroxy, cinnamaldehyde, hydrogen, methoxy, heptyloxy and dodecyloxy produced a series of new cinnamaldehyde-based compounds, 2–9, respectively. All these compounds were characterized using Fourier transform infrared (FTIR) spectroscopy, nuclear magnetic resonance (NMR) spectroscopy, and CHN elemental analysis.[13]
Hui Wang et.al	2019	Cinnamaldehyde amino acid Schiff base (CAAS) is a new class of safe, bioactive compounds which could be developed as potential antifungal

		agents for fungal infections. To design new cinnamaldehyde amino acid Schiff base compounds with high bioactivity, the quantitative structure–activity relationships (QSARs) for CAAS compounds against *Aspergillus niger (A. niger)* and *Penicillium citrinum (P. citrinum)* were analysed. The QSAR models ($R2 = 0.9346$ for A. niger, $R2 = 0.9590$ for P. citrinum,) were constructed and validated. The models indicated that the molecular polarity and the Max atomic orbital electronic population had a significant effect on antifungal activity. Based on the best QSAR models, two new compounds were designed and synthesized.[14]
M. S. Mohy Eldin1 et.al	2018	Cinnamyl Schiff base was prepared by coupling chitosan with trans-Cinnamaldehyde the mean component of cinnamon oil-under acidic conditions to form cinnamyl chitosan Schiff base. Parameters affecting coupling process such as chitosan/cinnamaldehyde molar ratio, reaction time and reaction temperature were studied to optimize reaction conditions. The progress of Schiff base formation was monitored by increasing of absorption of polymer solution at certain wave length 310 nm and decline in ion exchange capacity of chitosan derivatives from 5.78 to 4.16 meq/g. The changing in chitosan chemical structure was proved by FT-IR, electronic spectra, and Scan electron microscope. Moreover, thermal characterization using TGA and DSC analysis show that the prepared derivatives exhibit more thermal stability than chitosan itself. The results show decrease of samples water uptake and solubility in aqueous acidic solution by increased substitution degree as a result of increase in hydrophobicity character by modification.[15]
L.B.F. dos Santos et.al	2017	The aim of this study was to synthesize and investigate the in vitro antifungal properties of 23 cinnamyl Schiff bases. In addition, cytotoxic effects of such cinnamyl Schiff bases against human lung, kidney or red blood cells were also checked. The compounds were synthesized in a single-step, 2 min of reaction under microwave irradiation produced up to 97% yield. Six of the 23 cinnamyl Schiff bases possessed antifungal activities against strains of *Candida*, *Aspergillus*, *Fonsecaea* and, particularly, Cryptococcus species.[16]

3. AIM & OBJECTIVES

Aim

To synthesized and evaluate Cinnamyl Schiff Base from Cinnamaldehyde.

Objectives

- To prepare cinnamaldehyde as the starting material.
- To set up the reaction conditions for the Schiff base formation, including selecting an appropriate solvent and catalyst.
- To carry out the reaction between cinnamaldehyde and an amine (e.g. aniline or a substituted aniline) to form the cinnamyl Schiff base.

4. PLAN OF WORK

- Literature survey from different online sources.
- Collection of ingredients from market and some of pharmaceutical laboratory.
- Setup Workspace.
- Weighing.
- Preparation of Cinnamon.
- Solvent Selection.
- Extraction Process.

- Soxhlet Extraction.
- Collect product.
- Purification.
- Characterization and Analysis.
- Synthesis of Schiff base.
- Evaluation parameters.
- Conclusion.

5. MATERIAL & METHOD

MATERIAL

- Cinnamaldehyde.
- Amine (such as aniline or benzylamine).
- Solvent (such as ethanol or methanol).
- Acid catalyst (such as aniline, acetic acid or hydrochloric acid).[17]

Table 5.1: Material & quantity used in preparation.

SR. NO.	MATERIAL	QUANTITY
1.	Cinnamon	100gm
2.	Ethyl acetate	250ml
3.	Aniline	20 ml
4.	NAOH	60ml
5.	Tollen's reagent	2 - 3 drops
6.	Schiff's reagent	2 - 3 drops
7.	Acetone	50ml
8.	Ninhydrin reagent	2 - 3 drops
9.	Bromine water	2 – 3 drops
10.	Mayer's reagent	2 – 3 drops

METHOD

Extraction of cinnamaldehyde from cinnamon bark by using Soxhlet apparatus.

Soxhlet extraction method

Bark of Cinnamomum zeylanicum was obtained from shops. 100g of cinnamon stick were mashed into smaller pieces and placed inside a thimble made from thick cotton cloth, which was then loaded into the main chamber of the Soxhlet extractor. The extraction solvent used was ethyl acetate. The solvent was heated to reflux at temperature above 100°C for 5 and 10 hours. After the extraction, the products were collected & stored in a volumetric flask.[18]

Figure 5.1: Extraction assembly of cinnamon.

The extraction of cinnamaldehyde from cinnamon typically involves the following method:

Preparation of Cinnamon

Cinnamon sticks or powder are often used. Grinding or crushing the cinnamon can increase the surface area for extraction.

Solvent Selection

Common solvents include ethanol, methanol, or hexane. Ethanol is often preferred due to its ability to extract cinnamaldehyde effectively.

Extraction Process

Maceration: Cinnamon is soaked in the solvent for a period of time, allowing the cinnamaldehyde to dissolve into the solvent.

Soxhlet Extraction: A Soxhlet extractor can be used for more efficient extraction, especially for solid materials like cinnamon.

Filtration

After extraction, the mixture is filtered to separate the solvent from the solid residue.

Evaporation

The solvent is evaporated from the filtrate, leaving behind a crude extract containing cinnamaldehyde.

Purification

Further purification steps may be employed to isolate cinnamaldehyde from other compounds extracted from cinnamon.

Characterization and Analysis

Finally, the purity and quality of the extracted cinnamaldehyde are determined through analytical techniques.

The methodology involves optimizing parameters such as solvent type, extraction time, temperature, and the ratio of cinnamon to solvent to maximize the yield of cinnamaldehyde. Additionally, ensuring proper safety measures and equipment sterilization are crucial throughout the extraction process.[19]

6. PREPARATION OF SCHIFF BASE

The first imines were synthesized in the nineteenth century by Hugo Schiff in 1864. Since then, a variety of methods have been developed for the synthesis of imines. The classical synthesis involves the condensation of a carbonyl compound with an amine under azeotropic distillation reported by Schiff. Water formed in the system was completely removed by using a molecular sieve[20]. An in-situ method for water elimination was developed using dehydrating solvents such as tetramethyl orthosilicate or trimethyl orthoformate in the 1990s demonstrated that the efficiency of these methods is dependent on the use of highly electrophilic carbonyl compounds and strongly nucleophilic amines.[21]

Schiff bases are often polydentate in coordinating ability, because of synthetic flexibility, the special property of C=N group and the relative ease of preparation, especially when —SH or —OH are present close to the azomethine group which can form a five or six membered ring with the metal ion.[22]

METHODOLOGY

- Start with cinnamaldehyde as the starting material.
- Dissolve cinnamaldehyde in a suitable solvent, such as ethanol or methanol.
- Add an amine compound, such as aniline, to the solution.
- Stir the mixture at room temperature or slightly elevated temperature (around 40-50°C) for several hours.
- Once the reaction is complete, isolate the cinnamyl Schiff base product by filtration or extraction.[23]

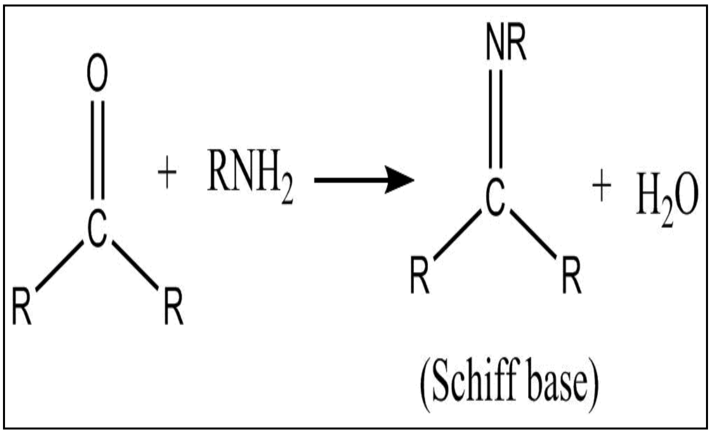

Figure 6.1: Structure of schiff base.

Figure 6.2: Preparation of cinnamyl schiff base.

7. EVALUATION PARAMETERS

TEST FOR CINNAMALDEHYDE

❖ **Schiff's test**

Schiff's reagent is used as a qualitative test for aldehydes. It consists of an indicator dye, fuchsin hydrochloride, in a saturated solution of Sulphur dioxide. Sulphur dioxide decomposes the dye. When an aldehyde is added Schiff's Reagent, it reacts with the – SO_2 and thus restores the deep reddish-purple color of the dye.[24]

❖ **Tollen's Test**

Tollen's test has been used in this process to determine the compound obtained. Two important things occur when an aldehyde is introduced to the Tollens reagent. Tollen's reagent oxidizes the aldehyde and results in the formation of carboxylic acid. The silver ions present in the Tollens reagent are reduced into metallic silver. Usually, test is carried out in clean test tubes made of glass. This is because the reduction of the silver ions into metallic silver forms a silver mirror on the test tube. Tollen’s test is commonly referred to as the silver Mirror test due to the formation of this layer of metallic silver on the test tube.[25]

❖ **Solubility test**

Cinnamaldehyde is popularly known to be insoluble in water and soluble in oils and alcohols.

❖ **pH test**

- Ensure that the pH meter is calibrated according to the manufacturer's instructions.
- If the cinnamaldehyde suspension/emulsion is too concentrated, dilute it with distilled water to a manageable level for pH testing.
- Place the pH meter probe into the suspension/emulsion, ensuring that it's fully immersed and not touching the container's walls or bottom.
- Stir the suspension/emulsion gently to ensure uniform mixing.
- Allow a few seconds for the pH reading to stabilize on the meter display.
- Record the pH value displayed on the meter.
- Rinse the pH meter probe with distilled water between measurements to prevent cross-contamination.
- Repeat the measurement if necessary for accuracy, especially if the suspension/emulsion is not homogeneous.[26]

TEST FOR CINNAMYL SCHIFF BASE

❖ **Schiff test**

This test involves the reaction of the schiff base with Schiff's reagent (potassium bisulfite and basic fuchsin). It forms a purple coloration indicating the presence of the Schiff base.[27]

Procedure

Add few drops of sample (cinnamyl schiff base) in the test tube with the help of dropper & add few drops of Schiff’s reagent in the sample.

❖ **Bromine test**

Cinnamyl schiff base can react with bromine water, causing decolorization of the bromine water due to the addition reaction between bromine and the carbon-carbon double bond present in the cinnamyl group.[28]

Procedure

Add few drops of sample in the test tube & add few drops of bromine water in the same test tube in which sample is presented.

❖ **Ninhydrin test**

This test is commonly used for detecting primary and secondary amines. Cinnamyl schiff base contains an imine group, which can react with ninhydrin to form a coloured product.[29]

Procedure

Add few drops of sample in the test tube with the help of dropper & add few drops of ninhydrin solution in the same test tube in which sample is presented.

❖ **Tollen's test**

Cinnamyl schiff base can undergo oxidation in the presence of Tollens' reagent (ammoniacal silver nitrate), forming a silver mirror on the inner surface of the reaction vessel.[30]

Procedure

Add few drops of sample in test tube then add few drops of tollen's reagent in the same test tube in which sample is present & allow to heat for few minutes, then observe the colour.

❖ **Mayer's test**

This test involves the reaction of the schiff base with Mayer's reagent (potassium mercuric iodide). Formation of yellow precipitate indicates the presence of the Schiff base.[31]

Procedure

Add few drops of sample in the test tube, then add few drops of Mayer's reagent in the same test tube in which sample (cinnamyl schiff base) is present & observing the colour.

These tests can help confirm the presence of cinnamyl schiff base in a given sample.

8. RESULTS AND DISCUSSION

Conformational tests were carried out for the product obtained after extraction. As mentioned above, Tollen's test, Schiff's test, Solubility & pH test have been carried out and the results are discussed below.

When the extract was added to the tollens reagent, it resulted in the formation of a silver layer on the walls of the test tube. This led to the confirmation that the extract obtained is indeed an aldehyde.

Extract + Tollen's reagent	**Silver layer was obtained in the inner layer of test tube**

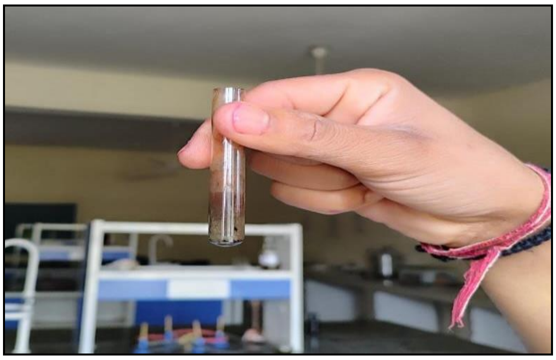

Figure 8.1: Presence of cinnamaldehyde.

The result of Schiff's test was given as below:

Extract + Schiff reagent	**Deep reddish colour obtained**

Figure 8.2: Presence of cinnamaldehyde.

The results of the solubility test are as follows:

Table 8.1: Result of solubility

Water	**Insoluble**
Acetone	**Soluble**

Figure 8.3: Figure of solubility.

The cinnamaldehyde is soluble in acetone or insoluble in water.

The pH of cinnamaldehyde is obtained to be 6.83.

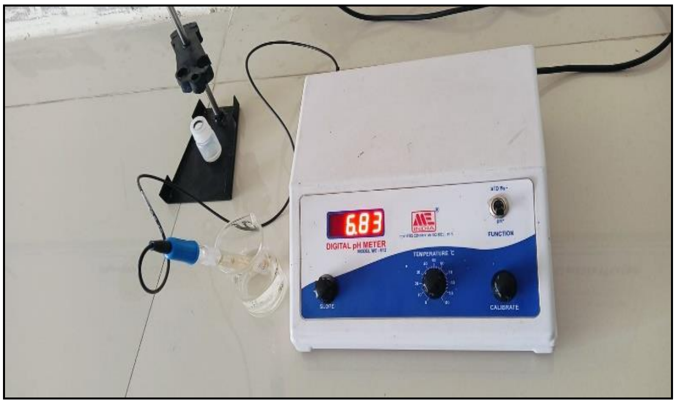

Figure 8.4: Result of pH test.

Conformational tests were carried out for the cinnamyl schiff base. As mentioned above, Schiff test, Tollen test, Bromine water test, Ninhydrin test & Mayer's test have been carried out and the results are discussed below.

❖ **Schiff test**

Purple colour is obtained due to the presence of Schiff base & this indicates the presence of Schiff base.

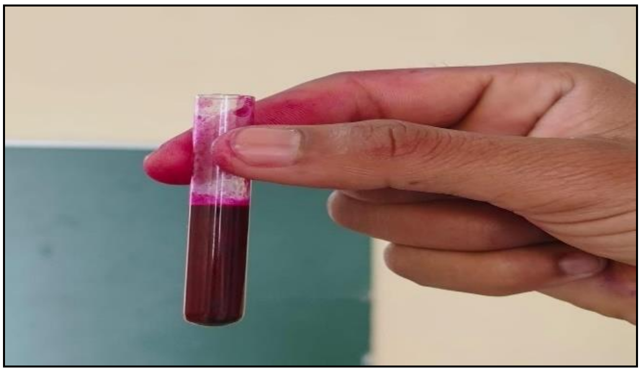

Figure 8.5: Schiff test.

❖ **Bromine test**

Discolouration of sample due to the double bond present in the cinnamyl group & this indicates the presence of Schiff base.

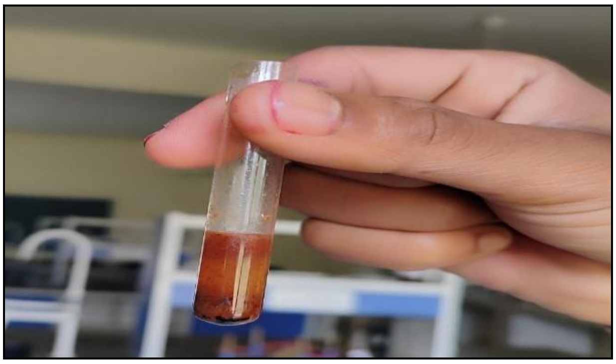

Figure 8.6: Bromine test.

❖ **Ninhydrin test**

Brown colour is obtained due to the presence of Schiff base & this indicates the presence of Schiff base.

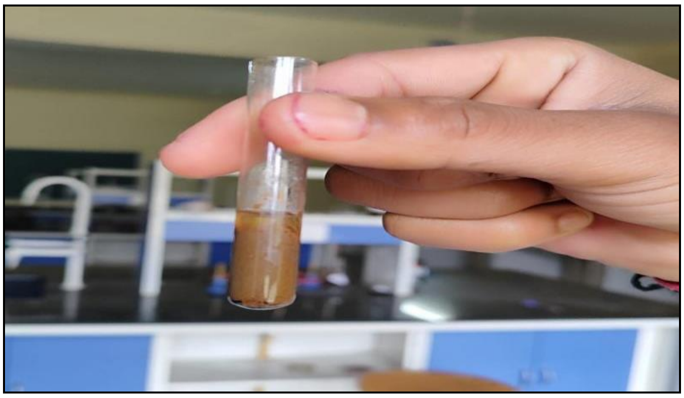

Figure 8.7: Ninhydrin test.

❖ **Tollen's test**

Silver colour is obtained due to the presence of Schiff base & this indicates the presence of Schiff base.

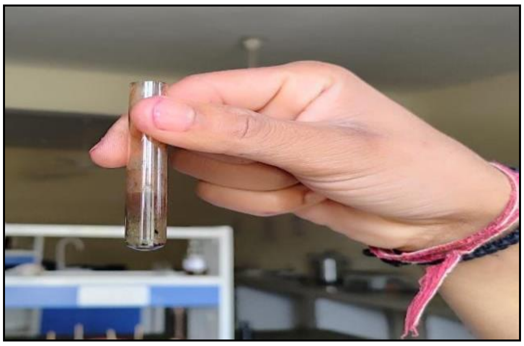

Figure 8.8: Tollen's test.

❖ **Mayer's test**

Yellow precipitates are obtained due to the presence of Schiff base & this indicates the presence of Schiff base.

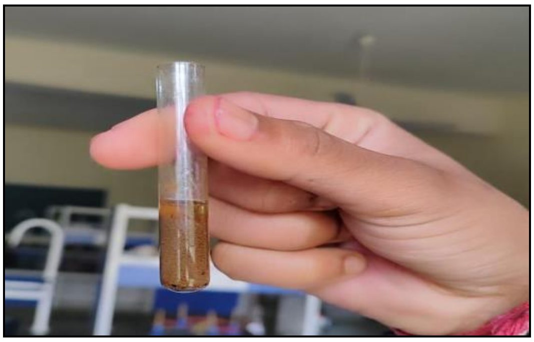

Figure 8.9: Mayer's test.

Table 8.2: Table of Results.

Schiff test	**Positive**
Tollen’s test	**Positive**
Bromine water test	**Positive**
Ninhydrin test	**Positive**
Mayer’s test	**Positive**

9. CONCLUSION & SUMMARY

Cinnamomum Zeylanicum most commonly known as Cinnamon is a widely used aromatic condiment and a spice obtained from the bark of cinnamon tree. Cinnamaldehyde is an aromatic compound found in cinnamon bark. The primary aim of this study is to obtain cinnamaldehyde from *Cinnamomum Zeylanicum*. Cinnamaldehyde, the main component of cinnamon essential oils, can be found in nature in the bark and leaves of cinnamon plants.

In conclusion, the synthesis and evaluation of cinnamyl Schiff base from cinnamaldehyde have been successfully accomplished. Through the outlined synthetic pathway, cinnamaldehyde reacted with an amine compound under suitable conditions to yield the desired Schiff base. Characterization studies, including Tollen’s test, Schiff test, Ninhydrin test, Mayer’s test & Bromine water test confirmed the formation of the target compound.

In summary, cinnamyl Schiff bases hold promises in various applications, including antifungal activity and chemical derivatization. Their unique structural features make them intriguing subjects for further investigation.

10. REFERENCES

1. Peralta-Domínguez D, Rodríguez M, Ramos-Ortíz G, Maldonado JL, Meneses-Nava MA, Barbosa-García O, Santillan R, Farfán N. A Schiff base derivative from cinnamaldehyde for colorimetric detection of Ni2+ in water. Sensors and Actuators B: Chemical, 2015 Feb 1; 207: 511-7.
2. Magalhães TF, Da Silva CM, Dos Santos LB, Santos DA, Silva LM, Fuchs BB, Mylonakis E, Martins CV, de Resende-Stoianoff MA, De Fátima Â. Cinnamyl Schiff bases: Synthesis, cytotoxic effects and antifungal activity of clinical interest. Letters in Applied Microbiology, 2020 Nov 1; 71(5): 490-7.
3. Wang H, Jiang M, Li S, Hse CY, Jin C, Sun F, Li Z. Design of cinnamaldehyde amino acid Schiff base compounds based on the quantitative structure–activity relationship. Royal Society Open Science, 2017 Sep 6; 4(9): 170516.
4. Doyle AA, Stephens JC. A review of cinnamaldehyde and its derivatives as antibacterial agents. Fitoterapia, 2019 Nov 1; 139: 104405.
5. Zhang R, Chen H, Yu Q, Zhang Y, Liu F, Wang F, Chen X, Liu Y. Extraction of bioactive compounds from cinnamon residues with deep eutectic solvents and its molecular mechanism. Chemical Engineering Science, 2023 Jun 5; 273: 118630.
6. Boulechfar C, Ferkous H, Delimi A, Djedouani A, Kahlouche A, Boublia A, Darwish AS, Lemaoui T, Verma R, Benguerba Y. Schiff bases and their metal Complexes: A review on the history, synthesis, and applications. Inorganic Chemistry Communications, 2023 Apr 1; 150: 110451.
7. Juyal VK, Pathak A, Panwar M, Thakuri SC, Prakash O, Agrwal A, Nand V. Schiff base metal complexes as a versatile catalyst: A review. Journal of Organometallic Chemistry, 2023 Jul 23: 122825.
8. Lucas-Gonzalez R, Yilmaz B, Khaneghah AM, Hano C, Shariati MA, Bangar SP, Goksen G, Dhama K, Lorenzo JM. Cinnamon: An antimicrobial ingredient for active packaging. Food Packaging and Shelf Life, 2023 Mar 1; 35: 101026.
9. Zhang W, Ezati P, Khan A, Assadpour E, Rhim JW, Jafari SM. Encapsulation and delivery systems of cinnamon essential oil for food preservation applications. Advances in Colloid and Interface Science, 2023 Jul 17: 102965.
10. Ran R, Zheng T, Tang P, Xiong Y, Yang C, Gu M, Li G. Antioxidant and antimicrobial collagen films incorporating Pickering emulsions of cinnamon essential oil for pork preservation. Food Chemistry, 2023 Sep 15; 420: 136108.
11. Usai F, Di Sotto A. Trans-cinnamaldehyde as a novel candidate to overcome bacterial resistance: An overview of in vitro studies. Antibiotics, 2023 Jan 27; 12(2): 254.
12. Muhoza B, Qi B, Harindintwali JD, Koko MY, Zhang S, Li Y. Encapsulation of cinnamaldehyde: An insight on delivery systems and food applications. Critical reviews in food science and nutrition, 2023 Jun 11; 63(15): 2521-43.
13. Pan C, Yang K, Erhunmwunsee F, Li YX, Liu M, Pan S, Yang D, Lu G, Ma D, Tian J. Inhibitory effect of cinnamaldehyde on Fusarium solani and its application in postharvest preservation of sweet potato. Food Chemistry, 2023 May 15; 408: 135213.
14. Zhang X, Hu L, Liu HW, Song DW, Shen YF, Liu L, Hu Y, Chen J. Cinnamaldehyde, a major component of Cinnamomum cassia Presl ethanol extract, has the potential to unlock the outbreak of WSSV. Aquaculture, 2023 Oct 15; 575: 739761.
15. Feng J, Sun L, Zhai T, Liang Q, Jiang T, Chen Z. Preparation of cinnamaldehyde nanoemulsions: Formula optimization, antifungal activity, leaf adhesion, and safety assessment. Industrial Crops and Products, 2023 Sep 15; 200: 116825.

16. Kang H, Wang Q, Yu H, Guo Q, Weber L, Wu W, Lepp D, Cui SW, Diarra MS, Liu H, Shao S. Validating the use of a newly developed cinnamaldehyde product in commercial broiler production. Poultry Science, 2024 May 1; 103(5): 103625.
17. Hendriana A, Setiawati M, Jusadi D, Suprayudi MA, Ekasari J, Wahjuningrum D. Dietary evaluation of cinnamaldehyde supplementation with different protein energy levels and ratios in Pacific whitleg Shrimp Litopenaeus vannamei. Jurnal Akuakultur Indonesia, 2024 Feb 13; 23(1): 79-91.
18. Hendriana A, Setiawati M, Jusadi D, Suprayudi MA, Ekasari J, Wahjuningrum D. Evaluation of the administration of cinnamaldehyde to feed on the growth performance and carbohydrate metabolism of Pacific whiteleg shrimp (Litopenaeus vannamei). Aquaculture, Aquarium, Conservation & Legislation, 2023 Oct 1; 16(5): 2660-70.
19. Solanki P, Parangi T, Chauhan ML. Novel Schiff's base Liquid Crystalline Trifluoromethoxy aniline derivatives of Cinnamoyl Ester. Journal of Molecular Structure, 2024 Apr 9: 138292.
20. Eldin MM, Hashem AI, Omer AM, Tamer TM. Preparation, characterization and antimicrobial evaluation of novel cinnamyl chitosan Schiff base. International Journal of Advanced Research, 2015; 3(3): 741-55.
21. Wang H, Jiang M, Li S, Hse CY, Jin C, Sun F, Li Z. Design of cinnamaldehyde amino acid Schiff base compounds based on the quantitative structure–activity relationship. Royal Society Open Science, 2017 Sep 6; 4(9): 170516.
22. Manivannan S, Prabhakaran R, Balasubramanian KP, Dhanabal V, Karvembu R, Chinnusamy V, Natarajan K. Synthesis, spectral, electrochemical and catalytic studies of new Ru (III) tetradentate Schiff base complexes. Applied Organometallic Chemistry, 2007 Nov; 21(11): 952-7.
23. Tamer TM, Valachová K, Mohyeldin MS, Soltes L. Free radical scavenger activity of cinnamyl chitosan schiff base. Journal of Applied Pharmaceutical Science, 2016 Jan 26; 6(1): 130-6.
24. Fan Z, Zhang H, Wang H, Han S, Zhang Y, Wu X, Sun F. In-situ cinnamaldehyde modification confers bamboo long-acting mold resistance and its reaction mechanisms. Industrial Crops and Products, 2023 Feb 1; 192: 116059.
25. Doyle AA, Krämer T, Kavanagh K, Stephens JC. Cinnamaldehydes: Synthesis, antibacterial evaluation, and the effect of molecular structure on antibacterial activity. Results in Chemistry, 2019 Jan 1; 1: 100013.
26. Doyle AA, Krämer T, Kavanagh K, Stephens JC. Cinnamaldehydes: Synthesis, antibacterial evaluation, and the effect of molecular structure on antibacterial activity. Results in Chemistry, 2019 Jan 1; 1: 100013.
27. Abdulsada AH, Alibeg AA, Wannas AN. Synthesis and biological evaluation of some newly synthesized Schiff base derived quinazolinone and cinnamaldehyde. Journal of Pharmaceutical Negative Results, 2022 Sep 20; 13(3): 151-4.
28. Abdulsada AH, Alibeg AA, Wannas AN. Synthesis and biological evaluation of some newly synthesized Schiff base derived quinazolinone and cinnamaldehyde. Journal of Pharmaceutical Negative Results, 2022 Sep 20; 13(3): 151-4.
29. Magalhães TF, Da Silva CM, Dos Santos LB, Santos DA, Silva LM, Fuchs BB, Mylonakis E, Martins CV, de Resende-Stoianoff MA, De Fátima Â. Cinnamyl Schiff bases: Synthesis, cytotoxic effects and antifungal activity of clinical interest. Letters in Applied Microbiology, 2020 Nov 1; 71(5): 490-7.
30. Wang H, Jiang M, Li S, Hse CY, Jin C, Sun F, Li Z. Design of cinnamaldehyde amino acid Schiff base compounds based on the quantitative structure–activity relationship. Royal Society Open Science, 2017 Sep 6; 4(9): 170516.
31. Tamer TM, Valachová K, Mohyeldin MS, Soltes L. Free radical scavenger activity of cinnamyl chitosan schiff base. Journal of Applied Pharmaceutical Science, 2016 Jan 26; 6(1): 130-6.