IJPHT Journal
Papers Having Good Impact

International Journal of Pharmacy and Herbal Technology (Online)

Home Page: https://www.ijprdjournal.com/

Synthesis of Schiff Base from O-Vanillin and Phenyl Urea by Using Catalyst Chloroacetic Acid

Swapnil Waghmare, * Shrinivas Mane, Sanjay K. Bais

Fabtech College of Pharmacy, Sangola

Tal-Sangola, Dist.-Solapur

Maharashtra -413307

ABSTRACT

The synthesis of Schiff bases represents a cornerstone in organic chemistry due to their wide array of applications in medicinal chemistry, material science, and catalysis. This study focuses on the synthesis of a o-vanillin and phenyl urea were the sources of the Schiff base. Utilizing chloroacetic acid as a catalyst. The reaction proceeds through the condensation of o-vanillin, an aromatic aldehyde, and phenyl urea, an amine derivative, under mild conditions. Chloroacetic acid acts as an efficient catalyst, promoting the formation of the imine linkage by facilitating the nucleophilic attack of the amine on the carbonyl group. The use of chloroacetic acid as a catalyst in this synthesis offers a novel approach that enhances reaction efficiency and yields, while operating under relatively mild conditions. This methodology provides a valuable contribution to the field of Schiff base synthesis, offering potential pathways for development new substance containing significant industrial and medicinal uses.

Keywords: *o-vanillin, phenyl urea, chloroacetic acid, catalyst.*

*Corresponding Author Email: - swapnilwaghmare1210@gmail.com
Received on 10 July, 2024, Accepted 20 July, 2024

Please cite this article as: Swapnil Waghmare et.al Synthesis of Schiff Base from O-Vanillin and Phenyl Urea by Using Catalyst Chloroacetic Acid
International Journal of Pharmacy and Herbal Technology 2024.

INTRODUCTION

Schiff bases, characterized by the imine or azomethine functional group (-C=N-), are pivotal in the realm of organic chemistry due to their versatile applications across various fields, including medicinal chemistry, material science, and catalysis. [1]

Due to their numerous biological actions, including antibacterial, antifungal, and anticancer qualities, these substances are important for pharmaceutical research.[2]

The classical method for synthesizing Schiff bases involves the primary amine condensation with carbonyl substances. This process typically requires acidic or basic conditions to drive the reaction to completion. [3]

However, the use of catalysts can enhance reaction rates and yields while operating under milder conditions. Chloroacetic acid, a chlorinated carboxylic acid, has emerged as an efficient catalyst for such transformations due to its ability to activate carbonyl groups towards nucleophilic attack.[4]

Study in which, we explore the blending of a o vanillin and phenyl urea were the sources of Schiff base, utilizing chloroacetic acid as a catalyst. o-Vanillin, an aromatic aldehyde, is chosen for its electron-rich aromatic ring and reactive aldehyde group, which facilitate imine formation.[5]

Phenyl urea, an aromatic amine derivative, serves as the nucleophilic counterpart in the reaction. The catalytic role of chloroacetic acid is crucial in promoting the condensation reaction, ensuring high yield and efficiency under mild conditions.[6]

The aim of this formation of a straightforward and efficient synthetic route for the preparation of Schiff bases, leveraging the catalytic properties of chloroacetic acid. [7]

By offering a dependable and scalable method for upcoming applications in numerous scientific and industrial sectors, this methodology seeks to further the field of Schiff base synthesis.[8]

Principle

In order to create Schiff bases, a condensation reaction must occur between an aldehyde and an amine, resulting in the formation of an imine (Schiff base) characterized by a C=N double bond.[9]

In this specific synthesis, o-vanillin serves as the aldehyde, and phenyl urea serves as the amine. The reaction is catalyzed by chloroacetic acid, which enhances the reaction efficiency and yield.[10]

Reaction Mechanism

Activation of Aldehyde

Chloroacetic acid acts as a catalyst by protonating the carbonyl group of o-vanillin, increasing its electrophilicity and making it stronger Defence against the amine group's nucleophilic assault.[11]

Nucleophilic Attack

The amine group of phenyl urea attacks the carbonyl carbon of the activated o-vanillin, ultimately resulting in the creation of a intermediate tetrahedral.[12]

Dehydration

The intermediate undergoes a dehydration step, facilitated by the acidic environment provided by chloroacetic acid, leading to the imine bond's creation and the removal of a water molecule(C=N).[13]

Formation of Schiff Base

The final product is a Schiff base, characterized by a C=N bond, formed between the o-vanillin and phenyl urea.[14]

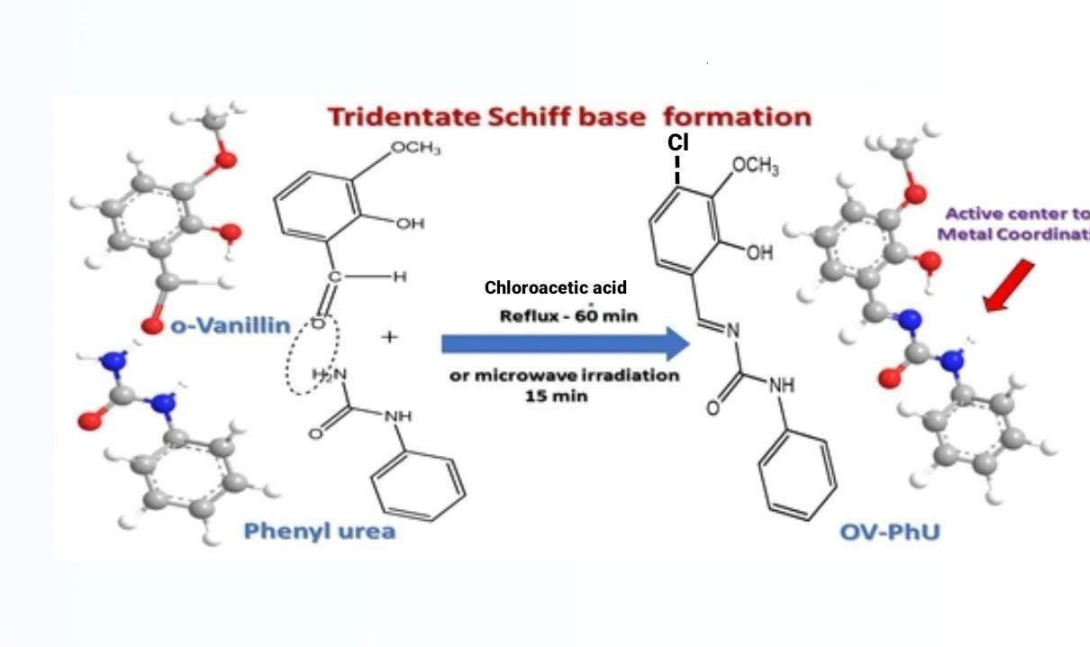

Figure No.1:1(4 chloro 2 hydroxy 3 methoxybenzylidene) 3 phenylure

Materials and Methods

Methods: -

O-vanillin and Phenyl Urea are Synthesizes Schiff Base [Microwave Oven] Procedure.

1. Equimolar (1:1) ratio of 2.5 g, 1 mmol of phenyl urea with 4 g, 1 mmol was used to prepare Schiff base in a microwave.

2. In a grinder, 2-hydroxy-3-methoxy benzaldehyde was well combined.

3. After adding 2 - 4 mL of methanol to the reaction mixture, the mixture was exposed to microwave radiation.

4. The reaction took 15 minutes at 450 watts to complete.

5. After recrystallizing the products with heated methanol, they were eventually dried in a desiccator over anhydrous Calcium chloride (CaCl2) at a lower pressure.

Calculation

O-vanillin Phenyl urea

$C_8H_8O_3$ $C_7H_8N_2O$

12 x 8 +1 x 8+16 x 3 12 x 7+1 x 8+14 x 2+16

96 + 8 + 48 84+8+28+16

152 = 136

X = 136 x 4 / 152= 3.57 g

Theoretical Yield = 3.57g

Practical Yield = 2.7 g

Percentage (%) Yield = Practical Yield / Theoretical Yield x 100 = 2.7 / 3.57 x 100 = 75.63 %

RESULT

Colour	Yellowish
Appearance	Crystallin Solid
Odour	Aromatic
State	Solid
Solubility	Soluble In Polar Solvent (Methnol)

Table No 1: - Result

Identification Test

Sr.No	Test	Observation
1	Melting point determination	The product melts at 182-185°C
2	Solubility test	The product is insoluble in water, soluble in ethanol and dichloromethane

Table No 2: - Identification Test

Limit Test

Sr.No	Limit Test	observation	Inference
1	**Chloride test:** Silver nitrate (AgNO3) solution can be used to detect the presence of chloride ions, which confirms the presence of the chloro (-Cl) group.	Formation of white precipitate (AgCl)	Positive
2	**Hydroxyl test:**- Sodium metal or sodium hydroxide (NaOH) can be used to detect the presence of the hydroxyl (-OH) group.	Formation of a white precipitate	Positive
3	**Urea test:**- Sodium hydroxide (NaOH) and hypochlorite (NaOCl) can be used to detect the presence of the urea group.	Evolution of a pungent gas (ammonia, NH3) detected by smell	Positive
4	**Aldehyde test:** Fehling's solution (CuSO4 + NaOH) or Tollens' reagent (AgNO3 + NaOH) can be used to detect the presence of the aldehyde (-CHO) group.	Formationof a brick- red precipitate	Positive

Table No 3: - Limit Test

DISCUSSION

The synthesis of Schiff base from o-vanillin and phenylurea using chloroacetic acid as a catalyst is an efficient method to form a valuable ciganic compound. The catalytic role of chloroacetic acid in promoting both the condensation and dehydration reactions underscores its significance in facilitating Schiff base formation under mild conditions. By understanding the reaction mechanism and optimizing experimental conditions, researchers can effectively synthesize and characterize Schiff bases for various applications in organic synthesis and medicinal chemistry. This method provides a versatile route to access Schiff bases, which are important intermediates in organic chemistry and have diverse biological activities.

CONCLUSION

In this experiment, Schiff base was successfully synthesized from o-vanillin and phenyl urea using chloroacetic acid as a catalyst. The reaction proceeded via nucleophilic substitution and condensation reactions, facilitated by the catalytic action of chloroacetic acid.

Initially, o-vanillin and phenyl urea were dissolved in ethanol, and chloroacetic acid was added to the mixture. Under reflux conditions at temperature 70-75°C for 15 min, chloroacetic acid promoted the formation of an ester intermediate between o-vanillin and the acid, followed by condensation with phenyl urea to yield the Schiff base product.

After completion of the reaction, to stabilize the Schiff base product, a diluted sodium hydroxide solution was used to bring the mixture's pH to neutral. The product was then isolated by extraction with water or suitable solvent, followed by filtration and purification through re crystallization from ethanol.

The o vanillin and phenyl urea are synthesizing Schiff base using chloroacetic acid demonstrated an efficient method for the formation of organic compounds through catalytic activation. Subsequent research endeavors may investigate refining reaction parameters to augment yield and purity, as well as investigating the potential applications of Schiff bases in various chemical and biological contexts.

In conclusion, the experiment successfully o vanillin and Phenyl urea Synthesizes Schiff base highlighting the role of chloroacetic acid as a catalyst in facilitating the formation of this important class of compounds.

CONFLICTS OF INTEREST

Nil.

FUNDING

No financial interest.

Reference

1.Larhed M,Hallberg A. Microwave-Assisted High-Speed Chemistry: A New Technique in Drug Discovery,Drug Discov Today, 2001; 6(8): 406-416

2. Krstenansky JL,Cotterill I.Recent Advances in Microwave-Assisted Organic Syntheses, Curr Opin Drug DiscovDevel,2000, 3(4): 454-461

3.Montes I, Sanabria D, García M, Castro J, Fajardo J. A Greener Approach to Aspirin Synthesis Using Microwave Irradiation, J Chem Educ, 2006, 83(4): 628-631.

4.Lew A, Krutzik PO, Hart ME, Chamberlin AR. Increasing Rates of Reaction: Microwave-Assisted Organic Synthesis for Combinatorial Chemistry, J Comb Chem, 2002, 4(2): 95-105.

5.Langa F, Cruz P De La, Hoz A De La, Díaz-Ortiz A, Díez-Barra E. Microwave Irradiation: More than Just a Method for Accelerating Reactions, Contemp Org Synth, 1997, 4(5):373-386.

6.Rajak H, Mishra P. Microwave Assisted Combinatorial chemistry: The Potential Approach for Acceleration of Drug Discovery, J SciInd Res, 2004, 63(8): 641-654.

7.Bhupendra M. Mistry, Smita Jauhari "Quinoline-Based Azetidinone and Thiazolidinone Analogues as Antimicrobial and Antituberculosis Agents" Medicinal Chemistry Research,2013, 22(2): 647-665.

8.Charde M, Shukla A, Bukhariya V, Mehta J, Chakole R" A Review: Significance of Microwave Assist Technique in Green Chemistry" International Journal of Phyto pharmacy, 2012, 2 (2):39-50.

9.K.K. Rajasekhar, V. Shankar Ananth, T. S. Nithiyananthan, Gauresh, P. Naveen Kumar and R. Siva Prasada Reddy "Comparative Study of Conventional and Microwave Induced Synthesis of Selected Heterocyclic Molecules" International Journal of Chem Tech Research, 2010, 2(1): 592-597.

10.Charde M, Shukla A, Bukhariya V, Mehta J. Chakole A Review on "A Significance of Microwave Assist Technique in Green Chemistry" International Journal of Phyto pharmacy, 2012, 2 (2): 39-50.

11.Jadhav, P. M., & Patil, M. S Gene Action, Combining Ability, and Heterosis in Mung bean. Plant Breeding and Biotechnology Journal, 2014, 3(1): 15-22.

12.Srinivas R. Mane, Sanjay K Bais, Dheeraj D. Dhane Perform Quality Control Test for Container Closures and Secondary Packing Material Used in Cosmetics International Journal of Pharmacy and Herbal Technology 2023, 1(3): 196-206.

13.Shrinivas Mane, Sanjay K. Bais, Aditya V. Mali Review on Green Chemistry and Catalysis International Journal of Pharmacy and Herbal Technology,2023, 1(3): 320-329

14.Srinivas R. Mane, Sanjay K Bais, Sandesh S. Akade Preparation and Evolution of Herbal Mouthwash International Journal of Pharmacy and Herbal Technology ,2024, 2(1):518-530.