Available online at www.ijpsdr.com

International Journal of Pharmaceutical Sciences and Drug Research
2018; 10(4): 293-296


Research Article

ISSN: 0975-248X
CODEN (USA): IJPSPP



# Microwave Assisted Synthesis and Characterization of Schiff Base of 2-Amino Benzimidazole

**Garima Shrivastava*, Manjul Shrivastava**

*Department of Chemistry Government M. H. College of Home Science and Science for Women, Jabalpur- 482002, Madhya Pradesh, India*



**ABSTRACT**

New Schiff base (2-[(1H-benzimidazol-2-ylimino) methyl]-4,6- diiodophenol) was synthesized by the condensation of aryl/hetero aromatic aldehyde (3,5diiodosalicylaldehyde) with 2- amino benzimidazole under conventional and microwave conditions and characterized through IR, HNMR and Mass spectral data and CHN analysis.

**Keywords:** Microwave assisted synthesis, Conventional, Diiodosalicyldehyde, Benzimidazoles.

**DOI: 10.25004/IJPSDR.2018.100414** **Int. J. Pharm. Sci. Drug Res. 2018; 10(4): 293-296**

***Corresponding author**: Ms. Garima Shrivastava
**Address**: Department of Chemistry Government M. H. College of Home Science and Science for Women, Jabalpur- 482002, Madhya Pradesh, India
**E-mail** ✉: soumyagarima168@gmail.com
**Relevant conflicts of interest/financial disclosures:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
**Received:** 28 May, 2018; **Revised:** 10 June, 2018; **Accepted**: 14 June, 2018; **Published:** 20 July, 2018

## INTRODUCTION

In the recent year microwave assisted organic reaction has emerged as new tool in organic synthesis. The reactions are very fast and are completed within short times and purity enhanced as compared with conventional heating methods. [1-3] Among others, microwave (MW)-assisted methodology has matured and can be used safely to substitute for conventional laboratory heating techniques; a number of chemical transformations have been achieved thereby improving many existing protocols with superior results when compared to reactions performed under conventional heating conditions. Benzimidazoles derivative are related numerous varieties of pharmacokinetic and pharmacodynamics properties. Specifically, this nucleus is a constituent of vitamin $B_{12}$. The medicinal activities of the Benzimidazoles containing moiety have been well documented Albendazole, Mebendazole. [4-5] Benzimidazoles nucleus is one of the bioactive heterocyclic compounds that exhibit a wide range of biological activities. These biological activities include anti-cancer [6-7], bactericidal [8], fungicidal [9- 11], analgesic [12-13] and anti-viral properties. [14-16] Some have Anti-hypertensive activity [17] while some derivatives have

been synthesized and evaluated for inhibition of HIV-1 infectivity. [18-19]

Compounds containing azomethine group (-HC=N-) referred to as schiff base. They are condensation product of ketones or aldehydes with primary amines and were initial reportable by Victor Hugo Schiff in 1864. [20] Schiff bases are biological active compounds they possess lots of biological activities like anticancer [21], plant growth inhibitors [22] insecticidal [23], antidepressant [24], antibacterial [25], anti-inflammatory [26], anti-tuberculosis [27], antimicrobial [28] and anticonvulsant drug activity. [29]

Schiff bases have sort of applications viz., synthetic use, identification, detection and determination of aldehydes or ketones, purification of carbonyl or amino compounds, or protection of these groups throughout sophisticated or sensitive reactions. [30]

In present investigation, we synthesized Schiff base from 2-amino benzimidazoles and 3,5 diiodosalicyldehyde in the presence of acetic acid as catalyst in ethanol medium under microwave irradiation. We aimed to the synthesis of new Schiff bases using microwave irradiation due to easy to workup, improved better yield as well as completion of the reaction time is less.

## MATERIALS AND METHODS

All the used chemicals and solvents were of Analytical grade. All the reagents used for the preparation of the Schiff bases were obtained from Sigma Aldrich. Melting point was determined in open capillary and is uncorrected. The IR studies of the schiff were recorded with 3000 Hyperion Microscope with Vertex 80 FTIR System in KBr pellets or Nicol phase from 4000 cm $^{-1}$ to 200 cm$^{-1}$ at SAIF IIT Mumbai. Elemental analysis was carried out on Flash EA 1112 series Elemental Analyser System from IIT, Mumbai. The mass spectra of a Schiff base in this study were recorded at SAIF IIT Madras by (GC-MS Spectrometer Model Joel GC Mate. 1HNMR spectra in $CDCl_3$ were recorded on NMR spectrophotometer 500 MHz FT NMR Spectrometer at SAIF IIT Madras.

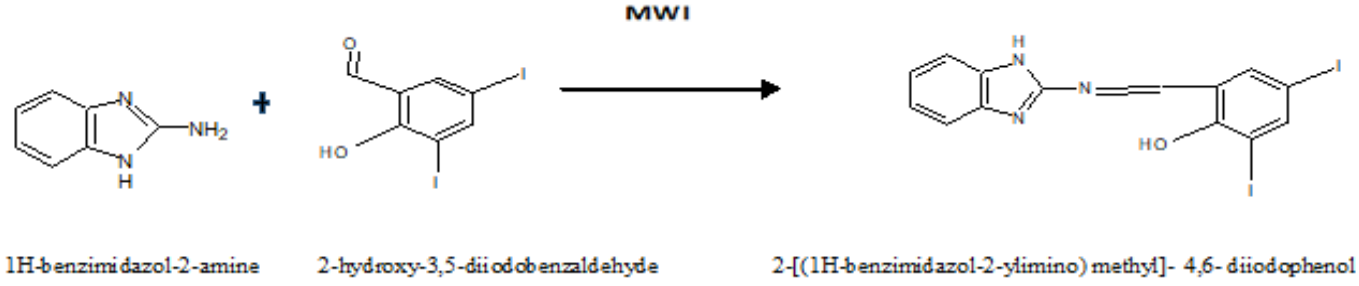
### Conventional Method for Synthesis of Schiff Base

Ethanolic solution of 3,5 diiodosalicyldehyde (0.01 mol) were added drop wise to a ethanolic solution of 2-amino benzimidazoles (0.01 mol). The mixture was refluxed on water bath for 2 hours. The product was recrystallized from ethanol. Yield: 38-45%. The Schiff base ligand exists in crystalline or amorphous form, light yellowish in colour and are stable to air and moisture.

### Microwave assisted Synthesis of schiff base

The Synthesis of Schiff base is schematically presented in (scheme 1).

2-amino Benzimidazoles (0.01 mol) and 3,5-diiodosalicyldehyde (0.01 mol), and were mixed thoroughly in ethanol and small amount of glacial acetic acid was added and were taken in Erlen Meyer flask capped with a funnel placed in a microwave oven and irradiated an interval of 1 min at 450W for about 8-10 min. After completion the reaction, the reaction mixture was allowed to attain room temperature and solid separated was filtered. The resulting yellow product was then recrystallized with ethanol, finally dried under reduced pressure over anhydrous $CaCl_2$ in a desiccator. Yield: 65-78%.




**Scheme 1**

**Table 1: The comparative results of conventional and microwave methods, analytical and physical data of the compounds**

| S. No | Compound | Reaction time CM MW | Yield % CM MW | Melting point | Elemental Analysis C% | H% | N% |
|---|---|---|---|---|---|---|---|
| 1 | BENI-S C14H9I2N3O 489.047 | 2 (10) | 38% 78% | 175 | 34.38 (34.11) | 1.85 (2.1) | N=8.59 (8.1) |

CM = Conventional method, time in hours; MW = Microwave method, time in minutes

## RESULTS AND DISCUSSION

As a result of microwave assisted synthesis, it was observed that the synthesis of schiff (2-[(1H-benzimidazol-2-ylimino) methyl]-4,6- diiodophenol) was completed in a short time with higher yields as compared to the conventional method. Comparative study results obtained by microwave assisted synthesis; versus conventional heating method is that some reactions which required 2-3 h. by conventional method, was completed within 8-10 min by the microwave irradiation technique, yields have been improved from 30-46 to 76-80%.

**Table 2: Observed IR bands (cm-1) of Schiff base ligands.**

| Compound | V,(O-H) | V,(C=N) | Cyclic(C=N) | V,(C-O) |
|---|---|---|---|---|
| BENI-S | 3574 | 1679 | 1595 | 1276 |

## Physical properties

The details of physical properties of the schiff base are tabulated in Table 1. Table 1 showed the comparative results of conventional and microwave methods, analytical and physical data of the compounds

## IR Spectral Studies

Disappearances of carbonyl and amine group peaks from IR spectrum indicated formation of schiff base. In the schiff base strong peaks of carbonyl near 1723 nm and amine near 3315 nm were observed. Both of these peaks were absent in the IR spectra of schiff base. [31] In addition to that another peak was observed near 1679 nm which is an indication of azomethine (CH=N). This reflects that amino acid and aldehydes which are the substrate for synthesis have been converted into schiff base i.e. 2-amino Benzimidazoles and 3,5 diiodosalicyldehyde. In addition, the ligand exhibits a band at 1595 $cm^{-1}$ due to v cyclic (C=N) of the imidazole nitrogen. [32] The phenolic C-O stretch band is observed at 1276 $cm^{-1}$ in the free ligand. [33] The data of the IR spectra of investigated Schiff base are listed in Table 2.

## $^1$HNMR Spectral Studies

The 1H-NMR Spectra of schiff base are given some signals which are summarised in Table 3.

The NMR spectra of Schiff bases were recorded in $CDCl_3$ solution, using tetramethylsilane (TMS) as internal standard. The H-NMR spectrum for schiff base showed a peak at 7.4 ppm (s, 1H, –OH), a peak at 9.4 ppm (s, 1H, N=CH), a peak at 9.7 ppm (Benzimidazoles ring N-H) The multi signals within the 8.2-7.0 ppm range are assigned to the aromatic protons of both rings. The free NH2 protons usually show a broad singlet peak in a region at 4-6 ppm. This $NH_2$ signal is absent in the observed spectra of Schiff base which indicates the formation of the Schiff base. [34]

## Mass Spectral studies

The mass spectrum of the Schiff base (2-[(1H-benzimidazol-2-ylimino) methyl]-4,6- diiodophenol) shows a molecular ion peak (m+.) at m/z 489.04 that corresponds to the molecular weight of the Schiff base. Besides this peak, the Schiff base showed a fragment ion peak at m/z 373 that corresponds to ($C_7H_4I_2O_2$) +., one part of the ligand (i. e .3,5-diiodosalicyldehyde).

**Table 3: Observed $^1$HNMR Peaks (ppm) of schiff base.**

| S. No | Compound | H for from azomethine group | H from aromatic group | H from Phenolic proton | H from benzimidazole N-H |
|---|---|---|---|---|---|
| 1 | BENI-S | 9.4 | 8.2-7.0 | 7.4 | 9.7 |

In this report, we described new Schiff base which have been synthesized using condensation of 2-amino Benzimidazoles and 3,5 diiodosalicyldehyde efficiently in an alcoholic medium using acetic acid with excellent yields under microwaves irradiation and characterized by various physicochemical and spectral analyses. In the result of microwave assisted synthesis of schiff base(2-[(1H-benzimidazol-2-ylimino) methyl]-4,6-diiodophenol), it has been observed that the reaction time decreased from hours to minutes and availability of the product within better yields compared.

## ACKONWLEDEGMENT

Authors are thankful to Govt. M. H. College of Home Science and Science for Women Autonomous Jabalpur Madhya Pradesh India for providing necessary support for this research work. The authors are thankful to IIT Bombay and SAIF IIT Madras for providing spectral data of the compounds.

## REFERENCES

1. Ravichandran S, Karthikeyan E. Microwave Synthesis - A Potential Tool for Green Chemistry. International Journal of ChemTech Research. 2011; 3(1): 466-470.
2. Zahmatkesh S, Hajipour AR. Microwave-assisted synthesis and characterization of some optically active poly (ester-imide) thermoplastic elastomers. e-polymers. 2009a; 068.
3. Zahmatkesh S, Hajipour AR. Microwave-assisted synthesis and characterization of optically active poly (ester-imide) s incorporating L-alanine. Amino Acids. 2010; 38:1253–1260.
4. Amari M, Fodili M, Nedjar- Kolli B, Hoffmann AP, PÉriÉ J. Reactivity studies on 4- aminopyrones: Access to benzimidazole and benzimidazolone derivatives. J. Heterocycl. Chem. 2002; 39(4): 811-816.
5. Neil O, Smith MJ, Heckelman M. The Merck Index, 13th ed. Merck & Co Inc., pp. 1785, 10074.
6. Refaat HM. Synthesis and anticancer activity of some novel 2-substituted benzimidazole derivatives. European Journal of Medicinal Chemistry. 2010; 45(7): 2949-2956.
7. Błaszczak-Świątkiewicz K, Mikiciuk-Olasik E. Biological Evaluation of the Activity of Some Benzimidazole-4,7-dione Derivatives. Molecules. 2014; 19(10): 15361-15373.
8. Salahuddin, Shaharyar M, Mazumder A, Abdullah MM. Synthesis, characterization and antimicrobial activity of 1,3,4-oxadiazole bearing 1H-benzimidazole derivatives. Arabian Journal of Chemistry. 2017; 10(1): S503-S508.
9. Suresh S, Karthikeyan S, Saravanan P, Jayamoorthy K, Dhanalekshmi KI. Comparison of antibacterial and antifungal activity of 5-amino-2- mercapto benzimidazole and functionalized $Ag_3O_4$ nanoparticles, Karbala International Journal of Modern Science. 2016; 2(2): 129-137.
10. Padalkar VS, Borse BN, Gupta VD, Phatangare KR, Patil VS, Umape PG, Sekar UN, Synthesis and antimicrobial activity of novel 2-substituted benzimidazole, benzoxazole and benzothiazole derivatives. Arabian Journal of Chemistry. 2016; 9(2): S1125-S1130.
11. Khabnadideh S, Rezaei Z, Pakshir K, Zomorodian K, Ghafari N. Synthesis and antifungal activity of benzimidazole, benzotriazole and aminothiazole derivatives. Res Pharm Sci. 2012; 7(2): 65–72.
12. Mariappan G, Hazarika R, Alam F, Karki R, Patangia U, Nath S. Synthesis and biological evaluation of 2-substituted benzimidazole derivatives. Arabian Journal of Chemistry. 2015; 8(5): 715–719.
13. Shaharyar M, Mazumder A, Salahuddin, Garg R, Pandey RD. Synthesis, characterization and pharmacological screening of novel benzimidazole derivatives, Arabian Journal of Chemistry. 2016; 9(1): S342–S347.

14. Shaker YM, Omar MA, Mahmoud K, Elhallouty SM, El-Senousy WM, Ali MM, Mahmoud AE, Abdel-Halim AH, Soliman SM, El Diwani HI. Synthesis, *in vitro* and *in vivo* antitumor and antiviral activity of novel 1-substituted benzimidazole derivatives. Journal of Enzyme Inhibition and Medicinal Chemistry. 2015; 30(5):826-845.
15. Sharma D, Narasimhan B, Kumar P, Judge V, Narang R, Clercq ED, Balzarini J. Synthesis, antimicrobial and antiviral activity of substituted benzimidazoles. Journal of Enzyme Inhibition and Medicinal Chemistry. 2009; 24(5): 1161-1168.
16. Tonelli M, Paglietti G, Boido V, Sparatore F, Marongiu F, Marongiu E, La Colla P, Loddo R. Antiviral activity of benzimidazole derivatives. I. Antiviral activity of 1-substituted-2-[(benzotriazol-1/2-yl)methyl]benzimidazoles. Chem Biodivers. 2008; 5(11):2386-401.
17. Jat RK, Jat JL, Pathak DP. Synthesis of Benzimidazole Derivatives: As Anti-Hypertensive Agents. E-Journal of Chemistry. 2006; 3(4): 278-285.
18. Gardiner JM, Loyns CR, Burke A, Khan A, Mahmood N. Synthesis and HIV-1 inhibition of novel benzimidazole derivatives. Bioorganic & Medicinal Chemistry Letters. 1995; 5(12):1251-1254.
19. Evans TM, Gardiner JM, Mahmood N, Smis M. Structure-activity relationships of anti-HIV-1 *N*-alkoxy- and *N*-allyloxy-benzimidazoles, Bioorganic & Medicinal Chemistry Letters. 1997; 7(4): 409-412.
20. Yadev G, Mani JV. Green Synthesis of Schiff Bases by Using Natural Acid Catalysts. Int. J. Sci. Res. 2015; 4(2):121-127.
21. Osowole AA, Ingo O, Ogunlana OA. Synthesis, Spectroscopic, Anticancer, and Antimicrobial Properties of Some Metal(II) Complexes of (Substituted) Nitrophenol Schiff Base. Int. J. Inorg. Chem. 2012; 1-6.
22. Prakash A, Adhikari D. Application of Schiff bases and their metal complexes-A Review. Int. J. ChemTech Res. 2011; 3(4):1891-1896.
23. Kiruthikajothi K, Chandramohan G. Synthesis and evaluation of insecticide efficiency of copper complexes against eriophyid mite, Aceria guerreronis. Int. J. Curr. Microbiol. App. Sci. 2013; 2(12): 24-28.
24. Kumar J, Rai A, Raj V. A Comprehensive Review on the Pharmacological Activity of Schiff Base Containing Derivatives. Organic & Medicinal Chem IJ. 2017; 1(3): 555564.
25. Jayakumar R, Vadivel R, Ananthi N. Role of Chirality in Drugs. Organic & Medicinal Chem IJ. 2018; 5(3):555661.
26. Ankalgi AD, Ranawat MS. Synthesis and anti-inflammatory activity of substituted 2H-1,4-pyridoxazin-3(4H)-one derivatives. J. Chem. Pharma. Res. 2012; 4(2):1436-1440.
27. Pahlavani E, Kargar H, Rad NS. A Study on Antitubercular and Antimicrobial Activity of Isoniazid Derivative. Zahedan J Res Med Sci. 2015; 17(7):7-10.
28. Dave S, Bansal N. Analgesic and Anti-inflammatory Activities of Schiff Base Metal Complexes, a Review. International J. Basic. App. Chem. Sci. 2013; 3(1): 31-40.
29. Divar M, Yeganeh Y, Jamshidzadeh A, Heidari R, Khabnadideh S. Anticonvulsant activity of some semicarbazone and thiosemicarbazone derivatives of isatin on PTZ induced seizure. JIAPS. 2017; 2(3): 04-14.
30. Arulmurugan S, Kavitha HP, Venkatrama BR. Biological Activities of Schiff Base and its Complexes: A Review. Rasayan. J. Chem. 2010; 3(3):385-410.
31. Muzammil K, Trivedi P, Khetani DB. Synthesis and Characterization of Schiff base m-nitro aniline and their complexes. Research Journal of Chemical Sciences. 2015; 5(5):52-55.
32. Malik S, Singh A, Ahmed N. Spectral characterization and thermal behavior of Schiff base metal complex derived from 2-aminobenzimidazole. Advances in Applied Science Research. 2015; 6(8):199-204.
33. Meek DW, Drago RS, Piper TS. Spectrochemical Studies of Dimethyl Sulfoxide, Tetramethylene Sulfoxide, and Pyridine N-Oxide as Ligands with Nickel(II), Chromium(III), and Cobalt(II). Inorg. Chem. 1962; 1:285-289.
34. Pavia DL, Lampman GM, Kris GS. Introduction to Spectroscopy. Saunders Golden-Sunburst Series, USA. Harcourt Brace College Publishers, America (1996).

**HOW TO CITE THIS ARTICLE:** Shrivastava G, Shrivastava M. Microwave Assisted Synthesis and Characterization of Schiff Base of 2-Amino Benzimidazole. Int. J. Pharm. Sci. Drug Res. 2018; 10(4): 293-296. **DOI: 10.25004/IJPSDR.2018.100414**