IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals
ISSN 2349-7203
HUMAN

Human Journals
Research Article
April 2016 Vol.:6, Issue:1

Synthesis (Microwave-Assisted) and Characterization of Some Heterocyclic Sulphonamide Derivatives

IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals
ISSN 2349-7203
HUMAN

V.Niraimathi★, K.B.Durgadevi

Department of Pharmaceutical Chemistry, College of Pharmacy, Madurai Medical College, Madurai-20, India.

Submission: 28 March 2016
Accepted: 5 April 2016
Published: 25 April 2016

Keywords: Isatin, sulphanilamide, ammonium acetate, Microwave synthesis

ABSTRACT

In the present study, some heterocyclic sulphonamide derivatives were synthesized by using condensation reaction. Compounds were synthesized by reacting Isatin with benzaldehyde in the presence of acetic acid and ammonium acetate to form 2-phenyl-1,4-dihydroimidazo[4,5 b]indole. The indole derivatives were reacted with substituted aromatic aldehyde and sulphanilamide to form 4-((phenyl(2-phenylimidazo[4,5-b]indol-3(4H)-yl)methyl)amino) benzenesulfonamides derivatives. All the synthesized compounds were characterized by UV, IR, ^{1}H NMR, and mass spectroscopy.

INTRODUCTION

Antibacterial sulphonamides are first the effective chemotherapeutic agents used for bacterial infection in humans. Sulphonamides are used in the treatment of tonsillitis, septicemia, meningococcal meningitis, bacillary dysentery and number of infections of urinary tract.

The imidazole nucleus is an important synthetic strategy in drug discovery. Imidazole is a planar five-member ring system with nitrogen atom in 1 and 3 positions. It is the constituent of several natural compounds like histamine, histidine, biotin, alkaloids and nucleic acid and a very important class among the medicinal compounds. Since many imidazoline derivatives possess antidiabetic, antihypertensive, and anti-inflammatory activity. [1]

Indole is non-basic nitrogenous compound in which a benzene ring and a pyrrole nucleus are fused in 2, 3 positions of the pyrrole ring. The indole nucleus is an important element of many natural and synthetic molecules with significant biological activity. Indole derivatives derived from animals are serotonins (5-HT) and melatonin. Some widely used derivatives are ondansetron for the suppression of nausea and alosetron for treatment of irritable bowel syndrome.[3][4]

The need for structurally diverse compound libraries for screening in lead discovery has driven the development of new strategies for the preparation of organic molecules in neat conditions. One of those high-speed techniques is microwave mediated synthesis, which has emerged as a new tool in organic synthesis.[2]

MATERIALS AND METHODS

Microwave irradiation was carried out in a microwave oven (MS-2029UW) with power output of 60W. IR Spectra were recorded on Shimadzu FTIR spectrophotometer in KBr disc. The ^{1}HNMR spectra were recorded on Brucker Avance III HD spectrometer using TMS as internal standard (chemical shifts in δ ppm). Mass spectra were recorded on JEOL GC MATE-II HR mass spectrometer. The reactions were monitored by thin layer chromatography on silica gel-G coated plates using hexane:ethyl acetate (6:4) solvent system.

Synthetic procedure:

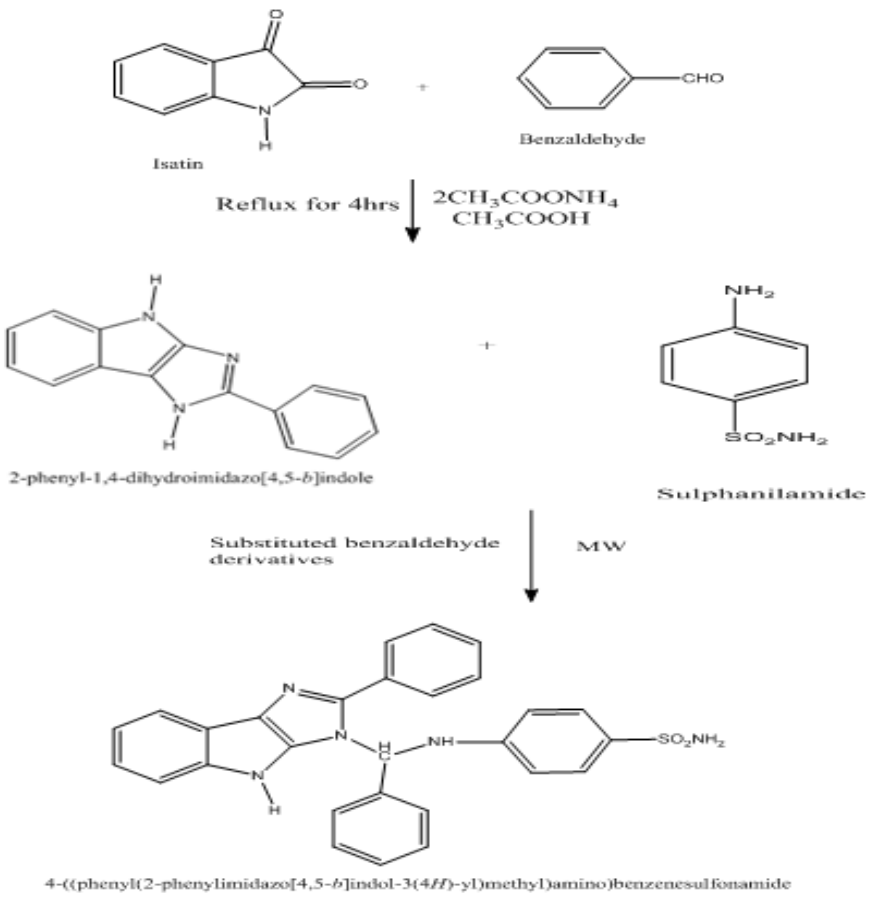
Step 1: Synthesis of 2-phenyl-1,4-dihydroimidazo[4,5-b] indole

Isatin (4mmol) and benzaldehyde (5mmol) were refluxed with ammonium acetate (40mmol) and glacial acetic acid (5ml) for four hours. After refluxing the reaction mixture was left overnight and filtered. The filtrate was neutralized with ammonium hydroxide. The product obtained was a yellow colored liquid.

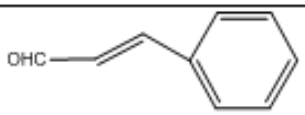
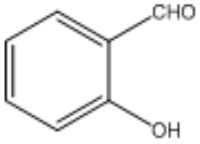
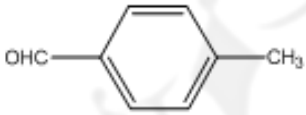
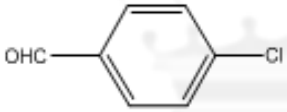
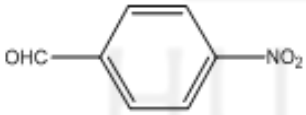
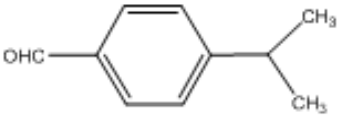
Step 2: Synthesis of 4-((phenyl(2-phenyl imidazo[4,5-b] indol-3(4H)-yl)methyl)amino)benzenesulfonamides derivatives.

2-phenyl-1,4-dihydroimidazo[4,5-b]indole derivatives (5ml) was dissolved in methanol and subjected to condensation reaction with sulphanilamide (4mmol) and different substituted benzaldehydes (1mmol) under microwave irradiation at 60 watts for 3mins. The mixture was kept at ice cool temperature. Finally recrystallised from ethanol.[5]

Scheme of reaction:



Physicochemical parameters of sulphonamide derivatives

Compound Code	Aromatic aldehyde	M.P. (˚C)s	Yield %	Mol. formula	Rf value
DD1		225	72.72	$C_{29}H_{25}N_5O_3S$	0.95
DD2		223	77.27	$C_{30}H_{25}N_5O_2S$	0.7
DD3		225	72	$C_{28}H_{23}N_5O_3S$	0.67
DD4		240	67.44	$C_{29}H_{25}N_5O_2S$	0.83
DD5		210	60	$C_{28}H_{22}ClN_5O_2S$	0.9
DD6		220	71.58	$C_{28}H_{22}N_6O_4S$	0.85
DD7		230	60.86	$C_{30}H_{28}N_6O_2S$	0.95

RESULTS AND DISCUSSION

All the newly synthesized compounds were analysed by ^{1}H NMR, FTIR, NMR and Mass spectral analysis. The purity of the synthesized compounds was ascertained by performing thin layer chromatography and determining melting points.

Analytical data

4-(((4-methoxy phenyl)(2-phenyllimidazo[4,5-b]indol-3(4H)-yl)methyl)amino)benzene sulfonamide(DD1).

UV: The ethanolic solution of the compound exhibited maxima of 282.40nm when examined in the range of 200nm to 400nm

IR:(KBrυcm^{-1}): 3421.72(N-HStr), 2958.80(ali-C-HStr), 3066.62(aro-C-H Str),1571.99(aroC=C Str), 1467.83(C=N Str), 1093.64(C-N Str), 1028.06(C-N-C Str), 1330.8(SO_2 Str),1269.16(aro OCH_3 Str).

^{1}HNMR: δppm (DMSO): 2.5 (S,1H,CH protons), 6.51(S,2H,NH protons), 7.5-8.4 (aromatic and Hetero aromatic protons), 3.52(S,1H,OCH_3).
MASS : (m/z value): 523.1500 M^+ ion peak.

4-((3-phenyl-1-(2-phenyllimidazo[4,5-b]indol-3(4H)-yl)allyl)amino)benzene sulfonamide (DD2).

UV: The ethanolic solution of the compound exhibited maxima of 276.00nm.

when examined in the range of 200nm to 400nm.

IR:(KBr υ cm-1):3309.85(N-H Str), 2920.23(Ali-C-H Str), 3309.85(Aro-C-H Str), 1579.70(Aro-C=C Str),1450.47(C=N Str), 1093.64(C-N Str), 1072.42(C-N-C Str),,1332.81(SO2 Str), 1269.16(Aro-OCH3 Str).

^{1}H NMR: δppm (DMSO): 2.6 (S,1H,CH), 6.5(S,2H,NH Protons), 7.7-8.3 (aromatic and Hetero aromatic protons), 2.7(S,2H,CH=CH).
MASS: (m/z value): 519.6200 (M^++1) ion peak

4-(((2-hydroxyphenyl)(2-phenyllimidazo[4,5-b]indol-3(4H)-yl)methyl)amino)benzene sulfonamide (DD3).

UV: The ethanolic solution of the compound exhibited maxima of 273.00nm when examined in the range of 200nm to 400nm.

IR:(KBr υ cm-1): 3340.71(N-H Str),2918.30(Ali-C-H Str), 3057.17(Aro-C-H Str),

1483.26(Aro-C=C Str), 1450.47(C=N Str), 1093.64(CN Str), 1029.99(C-N-C Str), 1332.81(SO2 Str), 3633.89(Aro-OH Str).

^{1}H NMR: δppm (DMSO) :6.5 (S,1H,NHprotons), 8.13-8.26 (aromatic and Hetero aromatic protons), 2.5 (S,1H,Aliphatic H),9.58(S,1H,OH).

MASS: (m/z): 509.5400 M^+ ion peak.

4-(((2-phenyllimidazo[4,5-b]indol-3(4H)-yl)(p-tolyl)methyl)amino)benzene sulfonamide (DD4).

UV: The ethanolic solution of the compound exhibited maxima of 268.00nm when examined in the range of 200nm to 400nm.

IR:(KBr υ cm-1): 3385.07(N-H Str),2916.37(Ali-C-H Str), 3032.17(Aro-C-H Str),1585.49(Aro-C=C Str), 1440.83(C=N Str), 1093.64(CN Str), 1016.49(C-N-C Str), 1332.81(SO2 Str), 1381.03 (aro-CH_3 Str).

^{1}H NMR: δppm (DMSO): 6.5 (S,1H,NHprotons), 7.5-8(aromatic and Hetero aromatic protons), 2.5 (S,1H,Aliphatic H), 2.7(S,3H,CH_3).

MASS: (m/z value): 507.6100 (M^+ +1) ion peak .

4-(((4-chlorophenyl)(2-phenyllimidazp[4,5-b]indol-3(4H)-yl)methyl)amino)benzene sulfonamide (DD5).

UV: The ethanolic solution of the compound exhibited maxima of 269.00nm when examined in the range of 200nm to 400nm.

IR:(KBr υ cm-1): 3346.79(N-H Str), 2922.16(ali-C-H Str), 3012.81(aro-C-H Str), 1583.56(aro-C=CStr), 1460.11(C=NStr),1091.71(C-N Str),1010.70(C-N-C Str), 1334.74(SO_2Str), 761.88(aro-Cl Str).

^{1}H NMR: δppm (DMSO): 6.5 (S,1H,NHprotons),7.5-8 (aromatic and Hetero aromatic protons), 2.5(S,1H, aliCH).

MASS: (m/z value): 528.0300 M^+ ion peak.

4-(((4-nitrophenyl)(2-phenyllimidazo[4,5-b]indol-3(4H)-yl)methyl)amino)benzene sulfonamide (DD6).

UV: The ethanolic solution of the compound exhibited maxima of 263.00nm when examined in the range of 200nm to 400nm.

IR:(KBr υ cm-1): 3462.22(N-H Str), 2920.23(ali-C-H Str), 3246.20(aro-C-H Str), 1597.06(aro-C =C Str), 1408.04(C=N Str), 1095.57(C-N Str),1008.77(C-N-C Str),1344.38(SO_2 Str), 3633.89(a ro-NO_2 Str).

^{1}H NMR: δppm (DMSO): 6.5 (S,1H,NHprotons), 7.5-8 (aromatic and Hetero aromatic protons) 2.5(S,1H, Aliphatic CH).

MASS: (m/z value): 538.5800 (M^++1) ion peak

4-(((4-dimethylamino)(2-phenylimidazo[4,5-b]indol-3(4H)-yl)methyl)amino)benzene sulfonamide (DD7).

UV: The ethanolic solution of the compound exhibit maxima of 344.80nm when examined in the range of 200nm to 400nm.

IR:(KBr υ cm-1): 3410.15(N-H Str), 2918.30(ali-C-H Str), 3244.27(aro-C-H Str), 1548.84(aro-C=C Str), 1440.83(C=N Str), 1440.83(C-N Str),1064.71(C-N-C Str), 1325.10(SO_2Str).

^{1}H NMR: δppm (DMSO): 6.5 (S,1H,NHprotons),7.5-8 (aromatic and Hetero aromatic protons) 2.5 (S,1H,aliphatic H).3.03(S,6H,N(CH_3)$_2$.

MASS: (m/z value):536.6500 (M^++1)ion peak.[6][7][8]

CONCLUSION

In the current study, some heterocyclic sulphonamide derivatives were synthesized by conventional method assisted by microwave technique. The yields of all the synthesized compounds were found be in the range of 60-77%. The title compounds were characterized by physicochemical parameters like melting point and R_f value. Structures of all the synthesized compounds were confirmed by FTIR,^{1}HNMR and Mass spectral analysis.

ACKNOWLEDGMENT

The authors are thankful to Mr. Murugesh, Indian Institute of Technology, Chennai, Madurai Kamaraj University and Department of Pharmaceutical chemistry, Madurai Medical College, Madurai for providing the facilities to carry out this study.

REFERENCES

1. Anshul Chawla, Ashu Sharma and Anil kumar Sharma, Review: A convenient approach for the synthesis of imidazole derivatives using microwaves. *Der Pharma Chemica*, 2012, 4 (1):116-140.
2. M. Srinivas, d. Swapna, k. Haritha ,vpvs. Koteswara rao, *An International Journal of Advances in Pharmaceutical Science:*2013,vol.4,issue 6,pg 1219-1228.
3. Nagendra Kumar Kaushik,Neha Kaushik, Akhilesh Kumar Verma,Eun Ha Choi,Pankaj Attri,Naresh Kumar and Chung Hyeok Kim.*Biomedical importances of indole*,Molecules 2013,18, 6620-6662.
4. Rakesh Jalandra and Gunjan Jadon.A review article on indole,*International Journal of Advanced Research in Pharmaceutical and Bio-sciences:*2014,4(1),1-5.
5. N.Umarani, K.Ilango,Gyanesh Garg,Bompada K.Srinivas and V.Hemalatha.Exploring the effects of newer three component aminobenzylated reactions of triphenyl imidazole motif as potent anti-microbial and anti-inflammatory agents,*International Journal of Pharmacy and Pharmaceutical sciences:*2011,Vol 3,issue 2.
6. RobertM.Silverstein and Francis X.Webster.,(2001). Spectrometric identification of organic compounds,2nd Edition,72-135.
7. Sharma Y.R.Elementry Organic Spectroscopy,Principles And Chemical Applications, 4th Edition,2007,90-200.
8. Kaur.H.,Instrumental methods of chemical analysis 9th edition 364-456.