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An one-Spot Synthesis of 1, 3, 4-Thiadiazole Derivative by Conventional and Modern Technique

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ABSTRACT

An efficient and one-pot synthesis is described for the 1, 3,4-thiadiazole derivatives by a conventional and modern technologies such as microwave irradiation. The reaction of chloro and fluoro substituted aromatic carboxylic acid with thiosemicarbazide carried in the presence of phosphorus oxychloride heating at 110 0C and . The synthesized compounds were characterized by 1H NMR, IR, and mass spectroscopic techniques. The present approach offers the advantages such as simplicity of the workup procedure, low cost and mild reaction condition.

Keywords: One pot, 1,3,4-thiadiazole, thiosemicarbazide, modern technique.

I. INTRODUCTION

1,3,4-thiadiazoles is important and well-known heterocyclic compounds containing nitrogen and sulphurexhibit a wide variety of biological activities[1-4].

Thiadiazole is a 5-membered ring system containing a hydrogen-binding domain, sulphur atom, and two-electron donor nitrogen system. It has various applications in agriculture, drugs, dyes and photographic materials and was further developed by Busch and his co-workers. Also, it has producing useful intermediates in several organic preparations [5]. 1, 3, 4-Thiadiazoles derivatives ring represents an interesting class of hetero compounds with a wide spectrum of pharmacological activities which include antimicrobial [7], antibacterial [8], anticancer [9], anti-inflammatory [10], anti-proliferative activity [11], anti-oxidant [12], and antiviral [13].It also displays the diagnostic section exhibits a complete investigation of the isomeric form and the anticancer activity of bio caster 1, 3, 4-thiadiazoles due to therapeutic potential [14].

II. EXPERIMENTAL

Experimental: General: All the chemical and reagents used were of analytical grade and the completion of reaction and purity of the synthesized compounds were checked by TLC (0.5 mm thickness) using silica

gel-G coated Aluminium plates (Merck). Melting points of the compounds were determined in open capillary tube by digital Melting Point Apparatus and were uncorrected.

General procedure for one spot Synthesis of 5-phenyl substituted 1,3,4-thiadiazol-2-amine. The mixture of chloro and fluro aromatic substituted carboxylic acid (0.01mole), thiosemicarbazide (0.01mole), and 4 ml of phosphorus oxychloride were added and heat at 105^{0}C for 5-6 Hrs. Progress the reaction was monitored on TLC. After completion of reaction the reaction mixture was cool to room temperature and poured in ice-cold water, neutralized by saturated KOH. Then filter, dried and recrystallized from methanol.

Synthesis of 5-phenyl substituted 1, 3,4-thiadiazol-2-amine 3(a-d) under microwave .

The mixture of substituted aromatic carboxylic acid (0.01mole), thiosemicarbazide (0.01mole), and 4 ml of phosphorus oxychloride were added. The mixture was irradiated under microwave irradiation at 120^{0}C for 15 min. The completion of the reaction was checked by TLC. After completion of the reaction the RBF was removed from the oven. The reaction mixture was poured on to crushed ice drop wise with continuous stirring, neutralized by saturated KOH. Then filter, dried and recrystallised from methanol.

			Microwave Irradiation		Conventional method		
Entry	Compound	Ar	Reaction Time (min)	Yield (%)	Reaction Time (h)	Yield (%)	M.P.(^{0}C)
1	3b	2-F, 3-Cl	15	87	5	68	151
2	3a	2-F, 4-F	15	82	4	76	216
3	3c	2-F	15	88	4	74	165
4	3d	4-F	15	86	4	79	235

III. RESULT AND DISCUSSION

A simple and efficient procedure is describedfor the synthesis of the 1,3,4-thiadiazole derivative using the one-pot reaction of aromatic carboxylic acid and thiosemicarbazide in the presence of phosphorus oxychloride as a catalyst by conventional and Microwave irradiation techniques. The structural elucidation of the synthesized compound 3a is based on its IR, ^{1}H NMR, and mass spectral studies.The IR absorption band around 703 cm^{-1} could be attributed to the –C–S–C functional group. IR spectrum of **3a**showed absorption bands at 3385,1487, 1607, 1596, 1009 cm^{-1} indicating the presence of NH_2, C=C, C=N, C-F groups respectively. ^{1}H NMR spectrum peaks due to NH_2 protons appeared at δ:7.40. Peaks for three aromatic protonsappearedbetween 7.52-8.16. Further, LC mass spectrum showed a molecular ion peak at m/z 236 which conformsto the molecular structure of **3a.**

IV. SPECTRAL DATA OF COMPOUND

5-(3-Chloro-2-fluoro-phenyl)-[1, 3, 4]thiadiazol-2-ylamine (3a)

Yield 84 %, m.p.151°C; IR spectrumcm^{-1}: 703 (C-S-C stretching), 3385 (**N**H_2stretching.); 1487(C=C Ar stretching), 1607 (C=N stretching),1009 (C-F stretching),; ^{1}H NMR spectrum, δ, ppm : 7.40 (dd, J=7.96, 8.4, 1H) , 7.52(1H, d, J=7.96, 1H), 8.00(s,2H), 8.16(d, J=8.4, 1H). (MS: *m/z*: 236 (M+H)$^+$.

5-(2, 4-Difluoro-phenyl)-[1, 3, 4] thiadiazol-2-ylamine (3b)

Yield 85 % m.p.216°C; IR spectrum, ν, cm^{-1}: 682(C-S-C stretching), 3369 (NH_2 stretching.) ; 1443(C=C Ar stretching), 1596 (C=N stretching),1054 (C-F stretching),; ^{1}H NMR spectrum, δ, ppm :: 7.20 (s, 1H), 7.41(d, J=8.96, 1H), 7.46(s, 2H), 8.12(d, J=8.96, 1H), (MS: *m/z*: 214 (M+H)$^+$

V. CONCLUSION

In conclusion, the present method is very simple, mild, and efficient for the synthesis of 1,3,4-thiadiazole. This method offers several advantages,

including the short reaction time, simplicity of the workup procedure, low cost, and mild reaction condition for the synthesis of one-pot synthesis of 1,3,4-thiadiazole. These derivatives have been given a key to more modifications in pharmacophore replacements.

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VII. REFERENCES

[1]. Chandrakantha, B.; Isloor, A.M.; Shetty, P.; Fun, H.K.; Hegde, G.EuropeanJournal of Medicinal Chemistry, 2014, 71, 316–323.

[2]. Bhardwaj, V.; Noolvi, M.N.; Jonathan, S.; Patel, H.M. Journal of Saudi Chemical Society, 2016, 20, S406–S410.

[3]. aronikyan, E.G.; Akopyan, S.F.; Noravyan, A.S.; Dzhagatspanyan, I.A.; Paronikyan, R.G.; Nazaryan, I.M.; Akopyan, A.G. 2012, 46, 154–156.

[4]. Sun, J.; Yang, Y.S.; Li, W.; Zhang, Y. Bin; Wang, X.L.; Tang, J.F.; Zhu, H.L. Bioorganic and Medicinal Chemistry Letters, 2011, 21, 6116–6121

[5]. Sharma, R.; Sainy, J.; Chaturvedi, S.C. Acta Pharmaceutica, 2008, 58, 317– 326.

[6]. Rajak, H.; Deshmukh, R.; Aggarwal, N.; Kashaw, S.; Kharya, M. D.; Mishra, P. Arch. Pharm, 2009, 342, 453.

[7]. Noolvi, M.N.; Patel, H.M.; Kamboj, S. Arabian Journal of Chemistry, 2016, 9, 1283–1289.

[8]. Yousif, E.A.; Majeed, A.S.; Salih, N.A. Journal of Taibah University for Science, 2013, 8, 26–3

[9]. Kumar, D.; Maruthi Kumar, N.; Chang, K.H.; Shah, K. European Journal of 25 Belen Tejada-Romero, Jean-Michel Carter, Yuliana Mihaylova, B.N. and A.A.; Aboobaker. Developmental biology, 2015, 14, 1–29

[10]. Maddila, S.; Gorle, S.; Sampath, C.; Lavanya, P. Journal of Saudi Chemical Society, 2016, 20, S306–S312.

[11]. Altintop, M.D.; Can, Ö.D.; Özkay, Ü.D.; Kaplancikl, Z.A. Molecules, 2016, 21, 1–10.

[12]. Ridha Ben Mansour*, Mohamed Ouzzane, Z.A. International Journal of Refrigeration, 2014, 43, 36–49.

[13]. Rzeski, W.; Matysiak, J.; Kandefer-Szerszeń, M. Bioorganic and Medicinal Chemistry, 2007, 15, 3201–3207.

[14]. Matysiak, J.; Nasulewicz, A.; Pelczynska, M.; Switalska, M.; Jaroszewicz, I.; Opolski, A. Eur. J. Med. Chem. 2006, 41, 475