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SYNTHESIS AND CHARACTERIZATION OF SULFANYL DIAZENE OXADIAZOLE DERIVATIVES

Natasha Naval Aggarwal, B.C. Revanasiddappa*

**Department of Pharmaceutical Chemistry, NGSM Institute of Pharmaceutical Sciences of Nitte -Deemed to be University, Paneer, Deralakatte, Mangalore-575 018,Karnataka, India*
Email: revan@nitte.edu.in

Abstract
In the present study, a series of new Sulfanyldiazene oxadiazole derivatives were synthesized using conventional technique. 4-(5-mercapto-1,3,4-oxadiazol-2-yl)phenol **(1)** was synthesized from of 4-hydroxy benzhydrazide and potassium hydroxide along with CS_2 . The title compounds **(2a-f)** were yielded by the condensation of diazonium salts with Compound **(1)** in DMF medium. FT-IR, ^{1}H-NMR and Mass spectral data established the structures of the newly synthesized compounds.
Keywords: Sulfanyldiazene oxadiazoles, Diazonium slats, Benzhydrazide,

Introduction

Among the class of heterocyclic compounds , nitrogen containing heterocycles with an oxygen atom are considered as an imperative class in medicinal chemistry owing to their interesting diversified biological application. There are number of five membered heterocycles containing nitrogen and oxygen atom and they have showed their potential as chemotherapeutic and pharmaco therapeutic agents. During the past years considerable evidences have also accumulated to demonstrate the efficacy of 1,3,4-oxadiazoles, since the later compounds belongs to an important class of five membered heterocyclic compounds.

In the past years considerable evidence has been accumulated to demonstrate the efficacy of substituted 1,3,4-oxadiazoles. Compounds incorporating heterocyclic ring systems continue to attract considerable interest due to the wide range of biological activities they possess. Amongst them five membered heterocyclic compounds particularly. The ability of 1, 3, 4-oxadiazole nucleus to participate in a variety of chemical reaction has made it a medicinal backbone on which number of potential molecules can be constructed.

The literature survey reveals 1, 3, 4-oxadiazoles are reported to show a broad spectrum of activities, which includes lipid peroxidation[I], insecticidal[II], antitubercular[III], antimitotic[IV], antibacterial[V], antiproliferative[VI], anticonvulsant[VII], anti-HIV[VIII], anti-inflammatory[1X], anticancer[X] etc.

A few therapeutic agents possessing of 1,3,4-oxadiazole nucleus includes, Raltegravir an antiretroviral drug, Nesapidil is categorized as a class IV antiarrhythemic drug, Furamizole ,a

nitrofuran derivative possesses a strong antibacterial activity and Tiodazocin is an antihypertensive drug.

In consideration of the above observations, it was thought of interest to synthesize some new 1, 3, 4-oxadiazole compounds and their characterization.

Experimental

All the required chemicals and solvents were procured from Himedia and Spectrochem Chemicals, Mumbai, India. Open end capillary method was employed to ascertain the Melting points which are uncorrected. Silica gel G plates were used for monitoring TLC and spots were located by UV or in iodine chamber. The IR spectrum (in KBr pellets) is recorded by using Alpha Bruker IR Spectrometer and frequencies are expressed in cm^{-1}. The ^{1}H-NMR spectra were recorded on Agilent FT-NMR Spectrometer (400 MHz, Model: 400MR DD_2) in $CDCl_3$ and DMSO with TMS as an internal standard and values are expressed in δ ppm. Waters LC-MS Mass spectrometer was used to record the mass spectra.

Synthesis of 4-(5-mercapto-1,3,4-oxadiazol-2-yl)phenol (1)

Carbon disulfide (0.01 mol) was slowly added to a solution of 4-hydroxy benzhydrazide (0.01 mol) and potassium hydroxide (1 gm) in alcohol (20ml). The reaction mixture was refluxed for 12-18 hr. The excess solvent was evaporated under vacuum. The resulting solid residue was dissolved in water and then acidified to pH 2 using HCl. The precipitated solid is filtered, followed by washing with water and recrystallization with alcohol. % Yiled -68. MP (^{O}C): 146-48.

Synthesis of substituted (5-(((3-nitrophenyl)diazenyl)thio)-1,3,4-oxadiazol-2-yl)phenol (2a-f)

Diazonium salts were prepared by the diazotization of primary amines in cold conditions of sodium nitrite and Con HCl. The cooled diazonium salts were added to the compound **(1)** (0.01 mol) in DMF (20 ml) medium. Stirring of the reaction mixture was continued for 1 hour and kept it aside for 24hrs. The solid product which is formed is filtered, washed with water, dried and recrystallized from alcohol. The physical data of the title compounds **(2a-f)** is given in table-1.

4-(5-(((4-chlorophenyl)diazenyl)thio)-1,3,4-oxadiazol-2-yl)phenol (2a): FT-IR (KBr, cm^{-1}): 3365(OH), 3010 (CH), 1605(C=N),1530(C=C), 2110 (N=N). ^{1}H-NMR (DMSO-d_6,400 MHz) δ: 6.91-8.07 (m, Ar-H, 8H), 12.79 (s, OH, 1H). MS(m/z): 332.76(M+).

4-(5-(((2,6-dichloro-4-nitrophenyl)diazenyl)thio)-1,3,4-oxadiazol-2-yl)phenol (2b): FT-IR (KBr, cm^{-1}): 3577(OH), 3085 (CH), 1622(C=N),1588(C=C), 2110 (N=N).^{1}H-NMR (DMSO-d_6,400 MHz) δ: 7.69-8.29 (m, Ar-H, 6H), 13.57 (s, OH, 1H). MS(m/z): 401.65(M+).

4-(5-(((4-nitrophenyl)diazenyl)thio)-1,3,4-oxadiazol-2-yl)phenol (2c): FT-IR (KBr, cm^{-1}): 3337(OH), 3259 (CH), 1635(C=N),1586(C=C), 2113. (N=N). ^{1}H-NMR (DMSO-d_6,400 MHz) δ: 7.05-8.34 (m, Ar-H, 8H), 8.74 (s, OH, 1H). MS(m/z): 343.32(M+).

4-(5-(((2,4-dinitrophenyl)diazenyl)thio)-1,3,4-oxadiazol-2-yl)phenol (2d): FT-IR (KBr, cm^{-1}): 3445(OH), 3330 (CH), 1607(C=N),1582(C=C), 2123(N=N). ^{1}H-NMR (DMSO-d_6,400 MHz) δ: 7.60-8.12 (m, Ar-H, 7H), 12.88 (s, OH, 1H). MS(m/z): 388.31(M+).

4-(5-(((2-chloro-4-nitrophenyl)diazenyl)thio)-1,3,4-oxadiazol-2-yl)phenol (2e): FT-IR (KBr, cm^{-1}): 3367(OH), 3007 (CH), 1600(C=N),1525(C=C), 2110 (N=N). ^{1}H-NMR (DMSO-d_6,400 MHz) δ: 7.71-8.29 (m, Ar-H, 7H), 11.20 (s, OH, 1H). MS(m/z): 367.21(M+).

4-(5-(((3-nitrophenyl)diazenyl)thio)-1,3,4-oxadiazol-2-yl)phenol (2f): FT-IR (KBr, cm^{-1}): 3295(OH), 3007 (CH), 1608(C=N),1514(C=C), 2198 (N=N). ^{1}H-NMR (DMSO-d_6,400 MHz) δ: 6.91-7.74 (m, Ar-H, 8H), 10.32(s, OH, 1H). MS(m/z): 343.32(M+)

Results and discussion

The reaction sequence leading into the formation of title compounds is showed in **Scheme-01.** The title compounds **(2a-f)** were synthesized by reacting 4-(5-mercapto-1,3,4-oxadiazol-2-yl)

phenol **(1)** and diazonium salts in DMF medium. All the synthesized new compounds were assigned on the basis of spectral data. Purity of all the compounds was established by using TLC plates and location of the spots were located by using iodine vapours as the detecting agent. The new compounds were further recrystallized and checked for the various physicochemical properties.

In general, the IR spectrum of compound **(2b)** showed absorption band at 2950 –3100 cm^{-1} due to aliphatic C-H stretch. The absorption band for C=N was observed at 1622 cm^{-1}. The other prominent absorption band in IR spectrum were observed at 1588 (C=C) and 3477(OH) cm^{-1}. The ^{1}H-NMR spectrum of compound **(2b)** showed a singlet at δ 13.57 corresponding to OH proton. A multiplet at δ 7.69-8.29 indicated the presence of aromatic protons. Further evidence for the formation of title compounds 1,3,4-oxadiazoles was obtained by recording the mass spectrum of the compound **(2b)**. The mass spectrum of the compound showed molecular ion peak at m/z 401.65 (M+), which is in conformity with the molecular formula $C_{14}H_7N_4O_2SCl_3$. All the newly synthesized compounds were characterized by the spectral data and they were in agreement with the assigned structures.

Conclusion

In the present work, a new series of substituted (5-(((3-nitrophenyl)diazenyl)thio)-1,3,4-oxadiazol-2-yl)phenol were synthesized and characterized by the spectral data. The new compounds were yielded in good yield and purified by the recrystallization technique.

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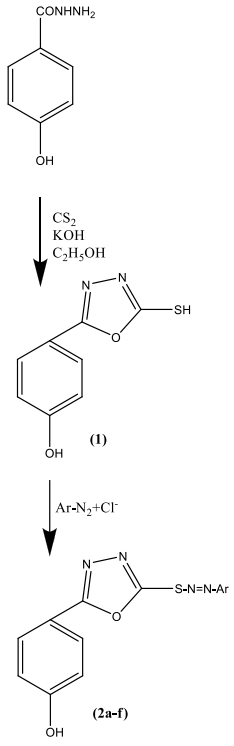
Table-1: Physical data of compounds (2a-f)

Comp	Ar-NH_2	Molecular Formula	Molecular Weight	Melting Point (^OC)
2a	4-Cl	$C_{14}H_9ClN_4O_2S$	332.76	111-13
2b	2,4,6-$(Cl_3)_3$	$C_{14}H_7Cl_3N_4O_2S$	401.65	144-46
2c	4-NO_2	$C_{14}H_9N_5O_4S$	343.32	119-21
2d	2,4-$(NO_2)_2$	$C_{14}H_8N_6O_6S$	388.31	133-35
2e	2,4- $(Cl_2)_2$	$C_{14}H_8Cl_2N_4O_2S$	367.21	150-52
2f	3-NO_2	$C_{14}H_9N_5O_4S$	343.32	178-80

Scheme-01



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