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Synthesis, Characterization, Antimicrobial and Antifungal Screening of Some Novel Benzene Sulfonamide Derivatives

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ABSTRACT

The present work reports the possible utility of the synthesis of some novel 4-(2-amino-3-cyano-4-(substituted-aryl)-5- oxo-5,6,7,8-tetrahydroquinolin-1(4H)-yl)benzene sulfonamide (1a–1u) starting with 4-(3-oxo-cyclohex- 1-enylamino)benzenesulfonamide and 4-(cyclohexenylamino) benzenesulfonamide in the synthesis of some novel 4-(quinolin-1-yl) benzenesulfonamide derivatives. The structures of the synthesized compounds were confirmed by IR, ^{1}H NMR, ^{13}C NMR and mass spectral data. Some of the newly synthesized compounds were evaluated for their in vitro antibacterial and antifungal activity.

KEYWORDS

Synthesis, sulfonamide, cyclohexanone 1, 3 dione, antibacterial, antifungal.

INTRODUCTION

Sulfonamides form a significant class of compounds in medicinal and pharmaceutical chemistry with several biological applications. The sulfonamides were the first effective chemotherapeutic agents to be available in safe therapeutic dosage ranges. The sulfonamide drugs were the first effective chemotherapeutic agents to be employed systemically for the prevention and cure of bacterial infection in human beings. Sulfonamides posses many types of biological activities and representatives of this class of pharmacological agents are widely used as antibacterial[1,2,3], antifungal[2,3] ,anticancer [4,5,6], antioxidant[7], anti-inflammatory[7,8] antimalarial [9], anti-HIV integrase[10], and anti-carbonic anhydrase activity [11] among others. Herein we disclose the screening results of their antibacterial and antifungal activity of some of the compounds.

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RESULTS AND DISCUSSION

Chemistry

The present work reports the possible utility of 4-(3-oxocyclohex-1-enylamino) benzenesulfonamide in the synthesis of 4-(quinolin-1-yl) benzenesulfonamide derivatives 1a-1u. Enaminone C was obtained by condensation of cyclohexan-1,3-dione. Compounds 1a–1u were synthesized by the one-pot condensation of the aldehyde, malononitrile and enaminone 3 in a molar ratio of (1:1:1) in refluxing ethanol containing triethylamine as catalyst.

Biological Screening

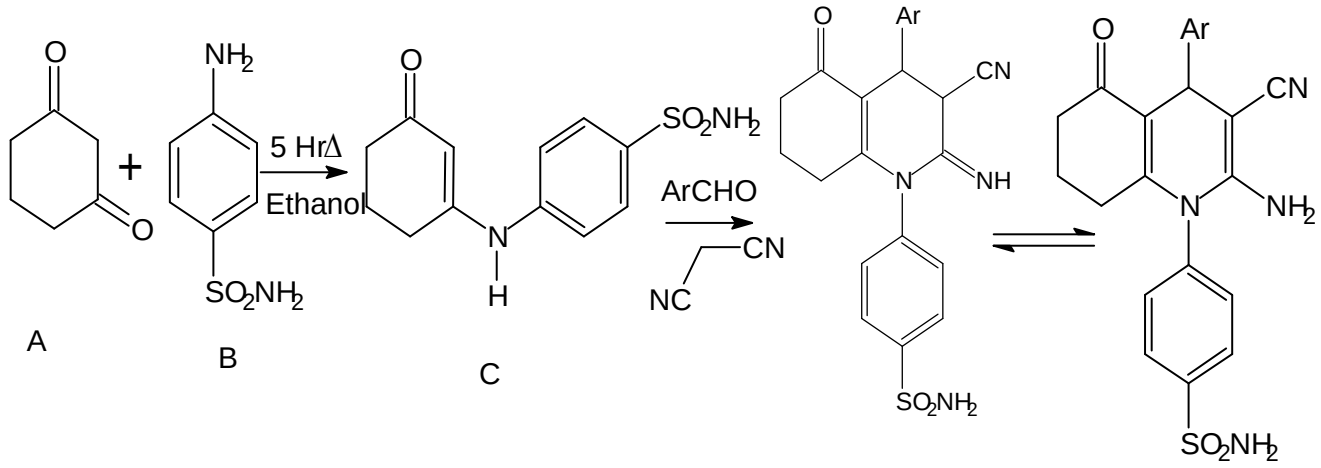
In-vitro Antibacterial Screening of Synthesized Compounds

The *in vitro* antimicrobial activity of the newly synthesized benzenesulfonamide derivatives was tested against B. subtilis, E. coli, S.typhi and S.aureus using nutrient agar medium. The antifungal activity of synthesized Benzene sulfonamide derivatives was tested against *Aspergillus flavus* and *Aspergillus niger* using Czapex Dox Agar Medium by using disc diffusion method and candida albicans using Yeast extract malt extract agar medium by using

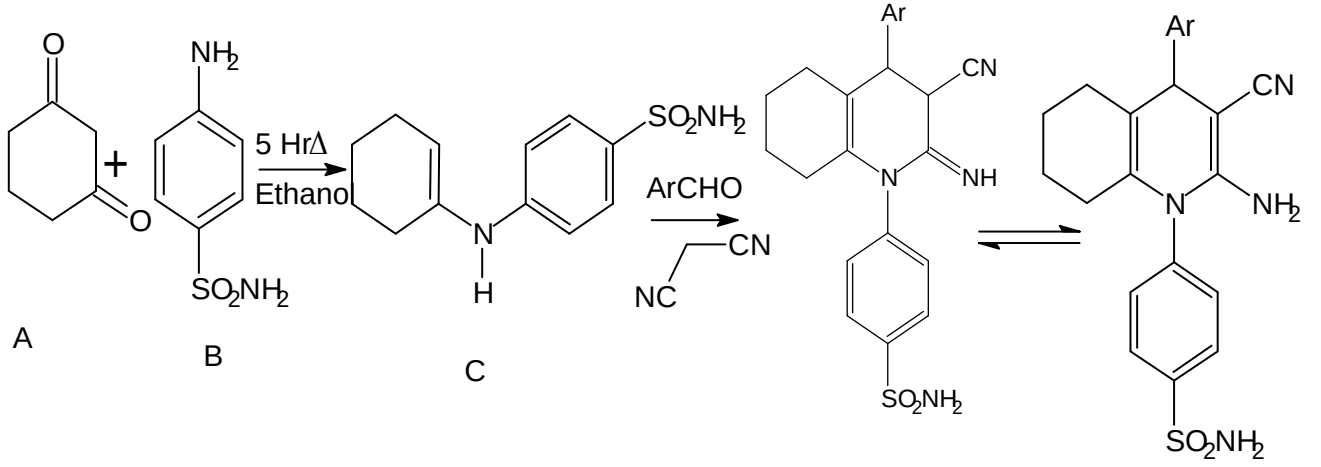
Agar plate method. The results are given in Tables as follows.

Scheme of synthesis:

Scheme 1



Scheme 2



1a, Ar = C6H4CH3-2	1h, Ar = C6H4CH3-3	1o, Ar = C6H4OH-3
1b, Ar = C6H4CH3-3	1i, Ar = C6H4CH3-4	1p, Ar = C6H4NO2-3
1c, Ar = C6H4CH3-4	1j, Ar = C6H3 (CH3)2-2, 4	1q, Ar = C6H4NO2-4
1d, Ar = C6H3(CH3)2-2,4	1k, Ar = C6H4F-2	1r, Ar = C6H4Cl-4
1e, Ar = C6H4F-2	1l, Ar = C6H4F-3	1s, Ar = C6H3Cl2-2,4
1f, Ar = C6H3F2-3,4	1m, Ar = C6H4F-4	1t, Ar = C6H3(CH3)2-3,4
1g, Ar = C6H4CH3-2	1n, Ar = C6H3F2-3,4	1u, Ar =C6H3(CH3)2-2,4

Table 1: Characterization data of synthesized novel benzensulphonamide derivatives

Comp	Molecular Formula	M.P. (°C)	Mol. Wt.	App.	R_f	Solubility	Yield (%)
1a	$C_{23}H_{22}N_4O_3S$	150-152	434.510	Brownish Yellow	0.54	Methanol DMSO	75.94
1b	$C_{23}H_{22}N_4O_3S$	158-160	434.510	Brown	0.46	Methanol DMSO	78.30
1c	$C_{23}H_{22}N_4O_3S$	162-164	434.510	Brown	0.34	Methanol DMSO	82.62
1d	$C_{24}H_{24}N_4O_3S$	170-172	448.537	Pink	0.38	Methanol DMSO	69.51
1e	$C_{22}H_{19}FN_4O_3S$	180-182	438.474	Pink	0.45	Methanol DMSO	75.43
1f	$C_{22}H_{18}F_2N_4O_3S$	152-154	456.465	Brown	0.52	Methanol DMSO	76.22
1g	$C_{23}H_{24}N_4O_2S$	152-154	420.526	Orange	0.48	Methanol DMSO	72.71
1h	$C_{23}H_{24}N_4O_2S$	150-152	420.526	Yellowish Grey	0.46	Methanol DMSO	69.42
1i	$C_{23}H_{24}N_4O_2S$	152-154	420.526	Orange	0.42	Methanol DMSO	78.80
1j	$C_{24}H_{26}N_4O_2S$	152-154	434.553	Yellowish Brown	0.35	Methanol DMSO	78.04
1k	$C_{22}H_{21}FN_4O_2S$	222-224	424.490	Brown	0.48	Methanol DMSO	72.08
1L	$C_{22}H_{21}FN_4O_2S$	154-156	424.490	Pink	0.52	Methanol DMSO	76.64
1m	$C_{22}H_{21}FN_4O_2S$	160-162	424.490	Yellowish Brown	0.50	Methanol DMSO	78.66
1n	$C_{22}H_{20}F_2N_4O_2S$	148-150	442.481	Pink	0.46	Methanol DMSO	68.26
1o	$C_{22}H_{20}N_4O_4S$	220-222	436.483	Brown	0.42	Methanol DMSO	73.24
1p	$C_{22}H_{19}N_5O_5S$	212-214	465.481	Yellowish Brown	0.45	Methanol DMSO	70.82
1q	$C_{22}H_{19}N_5O_5S$	284-286	465.481	Yellowish Brown	0.52	Methanol DMSO	76.35
1r	$C_{22}H_{19}ClN_4O_3S$	280-282	454.929	Yellowish Brown	0.38	Methanol DMSO	68.58
1s	$C_{22}H_{18}Cl_2N_4O_3S$	290-292	489.374	Brown	0.58	Methanol	67.87
1t	$C_{24}H_{24}N_4O_5S$	148-150	480.536	Yellowish Brown	0.40	Methanol DMSO	72.67
1u	$C_{24}H_{24}N_4O_5S$	174-176	480.536	Grey	0.46	Methanol DMSO	65.84

Table 2: Antibacterial activity of some synthesized benzene sulfonamide derivatives

Sr. No.	Compound Code	Zone of Inhibition in mm	
		Escherichia Coli	*Bacillus Subtilis*
1	1a	22	27
2	1e	20	24
3	1g	24	32
4	1h	15	18
5	1i	26	28
6	1j	18	24
7	1l	34	15
8	1m	38	22
9	1n	22	28
10	1q	24	30
11	1r	16	--
12	1u	--	36
13	Standard.	32	30
14	Control	06	06

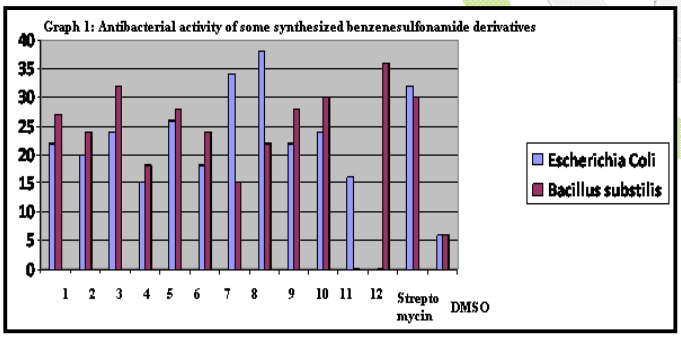


Table 3: Antibacterial Data of synthesized compounds using agar plate method.

Sr. No.	Compound Code	Zone of Inhibition in mm	
		Salmonella typhi	Staphylococcus aureus
1	1f	22	27
2	1s	20	24
3	1p	24	32
4	1t	15	18
5	1o	26	28
6	Blank	18	24
7	Penicillin	18	36

Antifungal Activity

The antifungal activity of synthesized Benzenesulfonamide derivatives was tested against *Aspergillus flavus* and *Aspergillus Niger* using Czapex Dox Agar Medium.by using disc diffusion method. Fluconazole were used as standard drug for antibacterial antifungal studies. The results of the antifungal screening for the compounds were given in Tables.

Table 4: Antifungal activity of some synthesized benzene sulfonamide derivatives.

Sr. No.	Compound Code	Zone of Inhibition in mm	
		Aspergillus Flavus	*Aspergillus Niger*
1	1a	22	40
2	1e	26	25
3	1g	10	18
4	1h	32	24
5	1i	30	22
6	1j	25	30
7	1l	28	--
8	1m	24	27
9	1n	--	12
10	1q	25	30
11	1r	--	21
12	1u	30	36
13	(Fluconazole)	28	26
14	(DMSO)	06	06

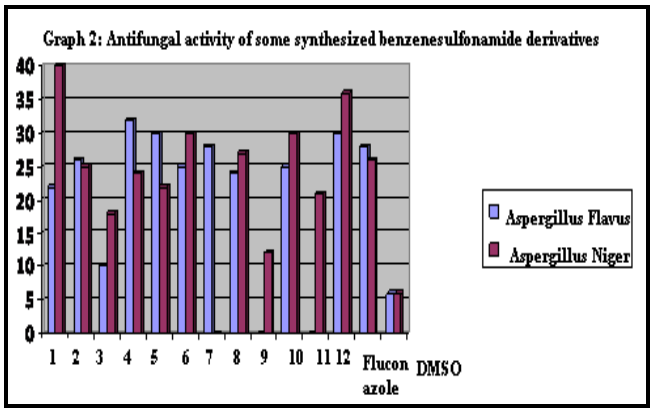


Table 5: Anti-fungal data of synthesized compounds for candida albicans.

Sr No.	Compound code	Candida Albicans (Zone of Inhibition in mm)
1	1a	--
2	1b	15
3	1c	--
4	1d	16
5	1u	13
6	Blank (DMSO)	--
7	Standard (Fluconazole)	46

The synthesized benzensulphonamide derivatives were evaluated for their *in vitro* antibacterial and antifungal potential. The antibacterial activity of synthesized compounds was evaluated against *E. coli* and *B. subtilis* using disc diffusion method and results are presented as zone of inhibition (mm) in table 2. The streptomycin was used as a control. All compounds have shown positive antibacterial activity against *E. coli* and *B. subtilis*. The compound 1m (38 mm) showed greatest activity among the all synthesized compounds against *E. coli*, while the compounds 1u (36 mm) showed stronger activity than the standard against *B. subtilis*. The compound 1h (15 mm) showed the weakest activity among the synthesized compounds against *E. coli*, while the compounds 1L (15 mm) showed the weakest activities against *B. subtilis*. The antibacterial activity of five synthesized compound was carried out by using Agar Cup Method against penicillin as a standard and results are presented as zone of inhibition (mm) in table 3. The compound 1o (26 mm) showed greatest activity among the all synthesized compounds against *Salmonella typhi*, while the compounds 1p (32mm) showed stronger activity than the standard against *Staphylococcus aureus*. The compound 1t (15 mm) showed the weakest activity among the synthesized compounds against *Salmonella typhi*, while the compounds 1t (18 mm) showed the less significant activity against *Staphylococcus aureus*.

The antifungal activity of synthesized compounds was evaluated against *A. niger* and *A. flavous* using disc diffusion method and results are presented as zone of inhibition (mm) in table 4. The Fluconazole was used as a standard and results are presented as zone of inhibition (mm) in table 4. All compounds have shown positive antifungal activity against *A. niger*. The compound 1h (32 mm) showed greater activity than the standard Fluconazole (28mm) against *A. flavous* while the compounds 1a (40 mm) showed higher activity than the standard Fluconazole (26mm) against *A. niger*. The compounds 1g (10 mm) showed the weakest activity among the synthesized compounds against *A. flavous* while the compound 1n (12mm) showed the weakest activities against *A.niger*. The five synthesized compound were screened for the antifungal activity against fungal species for candida albicans and results are presented as zone of inhibition (mm) in table 5. Compounds 1b (15mm), 1d (16mm), and 1u (13mm) showed the moderate antifungal activities among the selected five synthesized compounds.

EXPERIMENTAL

Chemistry

Melting points (˚C , uncorrected) were determined in open capillaries on a Gallenkamp melting point apparatus (Sanyo Gallenkamp, Southborough, UK). Precoated silica gel plates (silica gel 0.25 mm, 60G F254; Merck, Germany) were used for thin layer chromatography, dichloromethane/methanol (9.5:0.5) mixture was used as a developing

solvent system and the spots were visualized by ultraviolet light and/or iodine. **IR** Spectra were recorded in KBr disk on "Shimandzu FTIR model no. I.R.Affinity 1" and are reported in cm^{-1}. **^{1}HNMR** and **^{13}C NMR** spectral were recorded using NMR Spectrometer. Varian Inc, Mercury Plus 300 MHz NMR Spectrometer with tetramethylsilane (TMS) as the internal standard in $CDCl_3$. and peak multiplicities are designed as follows: s, singlet; d, doublet; t, triplet; m, multiplet. Mass spectra were reported at "Indian Institute of Technology, Bombay" with Mass spectrometer, Make: Varian Inc. USA; Model: 410 prostar Binary LC with 500 MS IT PDA Detectors. Chemicals and solvents were purchased from corresponding companies (SDFCL, Merk Pvt.Ltd.) and were used in the experimentation without further purification.

4-(3-Oxo-cyclohex-1-enylamino) benzenesulfonamide (C):

A mixture of cyclohexane-1,3-dione or Cyclohexanone (A) (1.12 g, 0.01 mol) and sulfanilamide (B) (1.72 g, 0.01 mol) in ethanol (30 mL) was refluxed for 3 h. The reaction mixturewas cooled and then poured onto cold water the obtained solid was crystallized from ethanol to give 3.Yield, 80%; m.p. 232–234.

4-[2-Amino-3-cyano-4-(substituted-aryl)-5-oxo-5, 6, 7, 8- tetrahydroquinolin-1(4H)-yl]benzenesulfonamide (1a–1u) :

A solution of enaminone (C) (2.66 g, 0.01 mol), the appropriate aldehyde (0.01 mol) and malononitrile (0.66 g, 0.01 mol) in absolute ethanol (30 mL) containing 3 drops of triethylamine, was refluxed for 5 h. The solid obtained after concentration and cooling, was filtered and crystallized from dioxane to give 1a–1u, respectively.

1. 4-(2-amino-3-cyano-4 (2-methylphenyl)-5-oxo-5, 6, 7, 8-tetrahydroquinolin-1(4H)-yl) benzene sulfonamide, **1a**.Yield 75.94% ; mp 150-152˚C;**IR** (KBr,cm^{-1}) : 3182, 3265, 3356,3469 (NH_2, stretching), 2281, 2339, (C≡N, stretching), 1141,1184,1247,1317 (SO_2, stretching), 3035, 3062 (Ar-CH), 2949 (aliphatic- CH),1614 (C = O).Anal.Calcd.For $C_{23}H_{22}N_4O_3S$: C,63.58; H, 5.10; N,12.89; O,11.05; S,7.38.

2. 4-**(**2-amino-3-cyano-4-(3 methylphenyl)-5-oxo-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzenesulfonamide, 1b. Yield 78.30 % ; mp 158-160 ˚C IR (KBr,cm-1) : 3211, 3280,3356 (NH2, stretching), 2117,2167,2293 (C≡N, stretching), 1136,1149,1165,1193,1259,1284,1301 (SO2, stretching), 3028, 3045 (Ar-CH) , 2954 (aliphatic- CH),1587,1614,1633,1643 (C= O). Anal.Calcd.For C23H22N4O3S: C,63.58; H, 5.10; N,12.89; O,11.05; S,7.38.

3. 4-(2-amino-3-cyano-4-(4-methylphenyl)-5-oxo-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzenesulfonamide **1c.** Yield 82.62 % ; mp 162-164 ˚C **IR** (KBr,cm^{-1}) : 3186,3265,3356 (NH_2, stretching), 2189 (C≡N, stretching), 1141,1184, 1247,1317 (SO_2, stretching), 3034, 3061 (Ar-CH) , 2949 (aliphatic- CH),1573,1612 (C= O). Anal.Calcd.For $C_{23}H_{22}N_4O_3S$: C,63.58; H, 5.10; N,12.89; O,11.05; S,7.38.

4. 4-(2-amino-3-cyano-4-(2,4-dimethylphenyl)-5-oxo-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzenesulfonamide **1d.** Yield 69.51 %; mp 170-172 ˚C **IR** (KBr,cm^{-1}) : 3372, 3358 (NH_2, stretching), 2222, 2191, 2169, (C≡N, stretching), 1157 ,1182,1251,11296,1309 (SO_2, stretching), 3039, 3084 (Ar-CH), 2962,2981 (aliphatic- CH),1612 (C= O). Anal.Calcd.For $C_{24}H_{24}N_4O_3S$: C, 60.26; H, 4.37; F, 4.33; N, 12.78; O, 10.95; S, 7.31.

5. 4-(2-amino-3-cyano-4-(2-fluorophenyl)-5-oxo-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzenesulfonamide **1e.** Yield 75.43 %; mp 180-182 ˚C **IR** (KBr, cm^{-1}) : 3356 (NH_2, stretching), 2220, (C≡N, stretching), 1184 ,1247,1317, (SO_2, stretching), 3034, 3062 (Ar-CH), 2949, (aliphatic- CH),1612,1687 (C= O). Anal.Calcd.For $C_{22}H_{19}FN_4O_3S$: C, 64.27; H, 5.39; N, 12.49; O, 10.70; S, 7.15.

6. 4-(2-amino-3-cyano-4-(3,4-difluorophenyl)-5-oxo-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzenesulfonamide **1f.** Yield 76.22 %; mp 152-

154 ˚C **IR** (KBr,cm^{-1}) : 3120, 3230,3325 (NH_2, stretching), 2127,2179,2289 (C≡N, stretching), 1141,1161,1186,1222,1257,1284, (SO_2, stretching), 3028, 3074, (Ar-CH), 2937,2947,2972 (aliphatic-CH),1573,1612,1645 (C= O). Anal. Calcd. For $C_{22}H_{18}F_2N_4O_3S$: C, 57.89; H, 3.97; F, 8.32; N, 12.27; O, 10.52; S, 7.02.

7. 4-(2-amino-3-cyano-4-(2-methylphenyl)-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzenesulfonamide **1g.** Yield 72.71%; mp 152-154 ˚C **IR** (KBr,cm^{-1}) : 3462, 3477, 3373 (NH_2, stretching), 2281, 2233, 2204 (C≡N, stretching), 1186 (SO_2, stretching), 3066, 3089 (Ar-CH), 2962 (aliphatic- CH). **MS** (m/z): 420. **^{1}H NMR:** Solvent (CD_3OD) **δ** 3.321-3.300 [s, 2H, R-NH_2], **δ** 4.846 [m, 8H, AR-NH_2], **δ** 6.710-6.662 [m, 4H, AR-H], **δ** 7.607-7.559[m, 4H, ARH]. **^{13}C NMR:** δ153.62 (C in aromatic), δ131.330 (C=C in alkenes), δ129.04(C=C in alkenes), δ 114.60 (C=C), δ 114.50 (C=C), δ 49.96 (C-C). Anal.Calcd.For $C_{23}H_{24}N_4O_2S$: C, 65.69; H, 5.75; N, 13.32; O, 7.61; S, 7.62.

8. 4-(2-amino-3-cyano-4-(3-methylphenyl)-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzenesulfonamide **1h.** Yield 69.42%; mp 150-152 ˚C **IR** (KBr,cm^{-1}): 3462, 3375 (NH_2, stretching), 2281, 2204 (C≡N, stretching), 1186, 1332 (SO_2, stretching), 3088, 3066 (CH-Aromatic), 2866, 2831 (CH-aliphatic), 900 (S-N). Anal.Calcd.For $C_{23}H_{24}N_4O_2S$: C, 65.69; H, 5.75; N, 13.32; O, 7.61; S, 7.62.

9. 4-(2-amino-3-cyano-4-(4-methylphenyl)-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzenesulfonamide **1i.** Yield 78.80%; mp 152-154˚C **IR** (KBr,cm^{-1}): 3375, 3477, 3269 (NH_2, stretching), 2281, 2231 (C≡N, stretching), 3089, 3066 (CH-aromatic), 2868, 2833 (CH-aliphatic). **MS** (m/z): 420. **^{1}H NMR:** Solvent (CD_3OD) **δ** 3.321-3.300 [s, 2H, R-NH_2], **δ** 4.827 [m, 8H, AR-NH_2], **δ** 6.714-6.666 [m, 4H, AR-H], **δ** 7.611-7.564[m, 4H, ARH]. **^{13}C NMR:** δ153.62(c in aromatic), δ131.32 (C=C in alkenes), δ129.06(C=C in alkenes), δ 114.65 (C=C), δ 114.55 (C=C), δ 49.99 (C-C). Anal.Calcd.For $C_{23}H_{24}N_4O_2S$: C, 65.69; H, 5.75; N, 13.32; O, 7.61; S, 7.62.

10. 4-(2-amino-3-cyano-4-(2,4-dimethylphenyl)-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzenesulfonamide **1j.** Yield 78.04%; mp 152-154˚C **IR** (KBr,cm^{-1}) :3383, 3477, 3323 (NH_2, stretching), 2235, 2279 (C≡N, stretching), 3055, 3068, 3041 (CH Aromatic), 2852, 2899, 2868 (CH aliphatic), 1184, 1334(SO_2). **MS** (m/z): 434. **^{1}H NMR:** Solvent (CD_3OD) **δ** 3.321-3.300 [s, 2H, R-NH_2], **δ** 4.827 [m, 8H, AR-NH_2], **δ** 6.714-6.666 [m, 4H, AR-H], **δ** 7.611-7.564[m, 4H, ARH]. **^{13}C NMR:** δ153.60(c in aromatic), δ131.33 (C=C in alkenes), δ129.06(C=C in alkenes), δ 114.66 (C=C), δ 114.55 (C=C), δ 49.73 (C-C), δ 50.01 (C-O). Anal.Calcd.For $C_{24}H_{26}N_4O_2S$: C, 66.33; H, 6.03; N, 12.89; O, 7.36; S, 7.38.

11. 4-(2-amino-3-cyano-4-(2-fluorophenyl)-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzenesulfonamide **1k.** Yield 72.08%; mp 222-224˚C **IR** (KBr,cm^{-1}):3477, 3375 (NH_2, stretching), 2222, 2281 (C≡N, stretching), 1188, 1313 (SO_2, stretching), 1095 (C-F, stretching), 900.76 (S-N, stretching). Anal.Calcd.For $C_{22}H_{21}FN_4O_2S$: C, 62.25; H, 4.99; F, 4.48; N, 13.20; O, 7.54; S, 7.55.

12. 4-(2-amino-3-cyano-4-(3-fluorophenyl)-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzene Sulfonamide **1L.** Yield 76.64%; mp 154-156˚C **IR** (KBr,cm^{-1}): 3477, 3383 (NH_2, stretching), 2235 (C≡N, stretching), 1182.36 (SO_2, stretching), 1010.70 (C-F, stretching), 2831.50 (C-H, aliphatic). **MS** (m/z): 424.2. **^{1}H NMR:** Solvent (CD_3OD) **δ** 3.320-3.299 [s, 2H, R-NH_2], **δ** 4.909-4.843 [m, 8H, AR-NH_2], **δ** 6.709-6.661 [m, 4H, AR-H], **δ** 7.606-7.558 [m, 4H, AR-H]. **^{13}C NMR:** δ153.62 (C in aromatic), δ131.34 (C=C in alkenes), δ129.04(C=C in alkenes), δ 114.58 (C=C), δ 114.47 (C=C), δ 49.94 (C-C). Anal.Calcd.For $C_{22}H_{21}FN_4O_2S$: C, 62.25; H, 4.99; F, 4.48; N, 13.20; O, 7.54; S, 7.55.

13. 4-(2-amino-3-cyano-4-(4-fluorophenyl)-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzene

sulfonamide **1m.** Yield 78.66%; mp 160-162˚C **IR** (KBr,cm^{-1}): 3375, 3477 (NH_2, stretching), 2279, 2206.57 (C≡N, stretching), 1186 (SO_2, stretching), 1002 (C-F, stretching), 898 (S-N, stretching), 3066, 3039 (CH, aromatic), 2833.43 (CH aliphatic). **MS** (m/z): 424. **^{1}H NMR:** Solvent (CD_3OD) **δ** 3.321-3.300 [s, 2H, R-NH_2], **δ** 4.827 [m, 8H, AR-NH_2], **δ** 6.714-6.666 [m, 4H, AR-H], **δ** 7.611-7.564 [m, 4H, ARH]. **^{13}C NMR:** δ153.61(C in aromatic), δ131.32 (C=C, in alkenes), δ129.06(C=C in alkenes), δ 114.65 (C=C), δ 114.54 (C=C), δ 49.99 (C-C). Anal.Calcd.For $C_{22}H_{21}FN_4O_2S$: C, 62.25; H, 4.99; F, 4.48; N, 13.20; O, 7.54; S, 7.55.

14. 4-(2-amino-3-cyano-4-(3,4-difluorophenyl)-5,6,7,8-trahydroquteinolin-1(4H)-yl) benzenesulfonamide **1n.** Yield 68.26%; mp 148-150˚C **IR** (KBr,cm^{-1}): 3477, 3375 (NH_2, stretching), 2233.57 (C≡N, stretching), 1184 (SO_2, stretching), 1072 (C-F, stretching), 898 (S-N, stretching). Anal.Calcd.For $C_{22}H_{20}F_2N_4O_2S$: C, 59.72; H, 4.56; F, 8.59, N, 12.66; O, 7.23; S, 7.25.

15. 4-(2-amino-3-cyano-4-(3-hydroxyphenyl)-5-oxo-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzenesulfonamide **1o.** Yield 68.26%; mp 220-222˚C **IR** (KBr,cm^{-1}): 3265, 3358 (NH_2, stretching), 2177, 2216, (C≡N, stretching), 1149,1170,1190,1251,1278,1321,1340, (SO_2, stretching), 3464 (OH), 3091 (Ar-CH), 2953(aliphatic- CH), 1587,1612,1649 (C= O). Anal.Calcd.For $C_{22}H_{20}N_4O_4S$: C, 60.54; H, 4.62; N, 12.84; O, 14.66; S, 7.35.

16. 4-(2-amino-3-cyano-4-(3-nitrophenyl)-5-oxo-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzene sulfonamide **1p.** Yield 70.82%; mp 212-214˚C **IR** (KBr,cm^{-1}) : 3224,3342 (NH_2, stretching), 2181, 2216,2283, (C≡N, stretching), 1165,1192,1255,1267,1348, (SO_2, stretching), 3091 (Ar-CH), 2960,2912 (aliphatic-CH),1587,1620,1649 (C= O).Anal.Calcd.For $C_{22}H_{19}N_5O_5S$: C,56.77; H,4.11; N,15.05; O,17.19; S,6.89.

17. 4-(2-amino-3-cyano-4-(4-nitrophenyl)-5-oxo-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzene sulfonamide **1q.** Yield 76.35%; mp 284-286˚C **IR** (KBr,cm^{-1}): 3223,3346 (NH_2, stretching), 2193 (C≡N, stretching), 1161,1184,1255,1288,1348,1323, (SO_2, stretching), 3078,3103 (Ar-CH), 2953,2910,2985, (aliphatic- CH),1517,1608, (C= O). Anal.Calcd.For $C_{22}H_{19}N_5O_5S$:C,56.77; H,4.11; N,15.05; O,17.19; S,6.89.

18. 4-(2-amino-3-cyano-4-(4-chlororophenyl)-5-oxo-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzenesulfonamide **1r.** Yield 68.58%; mp 280-282˚C **IR** (KBr,cm^{-1}): 3356, 3257 (NH_2, stretching), 2181, (C≡N, stretching), 1141,1184,1247,1317 (SO_2, stretching), 3035, 3043,3062 (Ar-CH), 2949 (aliphatic- CH),1612 (C= O). Anal.Calcd.For $C_{22}H_{19}ClN_4O_3S$: C, 58.08; H, 4.21; Cl, 7.79; N, 12.32; O, 10.55; S, 7.05.

19. 4-(2-amino-3-cyano-4-(2,4-dichlorophenyl)-5-oxo-5,6,7,8-tetrahydroquinolin-1(4H)-yl) benzenesulfonamide **1s.** Yield 67.87%; mp 290-292˚C **IR** (KBr,cm^{-1}) : 3219, 3296,3346 (NH_2, stretching), 2183, (C≡N, stretching), 1163,1190,1265,1315,1338 (SO_2, stretching), 3068, 3089 (Ar-CH), 2960,2953 (aliphatic-CH),1587,1612 (C= O). Anal.Calcd.For $C_{22}H_{18}Cl_2N_4O_3S$:
C, 53.99; H, 3.71; Cl, 14.49; N, 11.45; O, 9.81; S, 6.55.

20. 4-(2-amino-3-cyano-4-(3, 4-dimethoxy-phenyl)-5-oxo-5,6,7,8 tetrahydro-quinolin1 (4H)yl) benzenesulfonamide **1t.** Yield 72.67%; mp 148-150˚C **IR** (KBr,cm^{-1}) : 3240, 3257,3350 (NH_2, stretching), 2181,2125,2223 (C≡N, stretching), 1143, 1157, 1184, 1205, 1253, 1274 (SO_2, stretching), 3068, 3028,3089 (Ar-CH), 2964,2937 (aliphatic- CH),1566 (C= O). Anal.Calcd. For $C_{24}H_{24}N_4O_5S$: C, 59.99; H, 5.03; N, 11.66; O, 16.65; S, 6.67.

21. 4-(2-amino-3-cyano-4-(2,3-dimethoxy-phenyl)-5-oxo-5,6,7,8-tetrahydroquinolin-1(4H) yl) benzene sulfonamide **1u.** Yield 65.84%; mp 174-176˚C **IR** (KBr,cm^{-1}) : 3228, 3250,3350

(NH_2, stretching), 2173,2194,2218,2254 (C≡N, stretching), 1165,1186,1226,1269,1317,1338 (SO_2, stretching), 3068, 3003 (Ar-CH), 2906,2943 (aliphatic- CH),1556,1585,1614 (C= O). Anal.Calcd.For $C_{24}H_{24}N_4O_5S$: C, 59.99; H, 5.03; N, 11.66; O, 16.65; S, 6.67.

CONCLUSION

Twenty one novel benzenesulfonamide derivatives have been synthesized and some of the novel synthesized compounds are screened for antibacterial and antifungal activity. These compounds showed good to moderate activity against E. coli, B. Subtilis, S Typhi, S Aurus.Aspergillus Flavus, Aspergillus Niger and Candida albicans. The biological activity of these compounds will trigger more interest in the synthesis of such compounds from the easily available starting materials.

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