SYNTHESIS OF SOME NEW IMIDAZO[1,2-*c*]PYRIMIDO-[4',5':6,5]PYRANO[3,2-*h*]QUINOLINE DERIVATIVES

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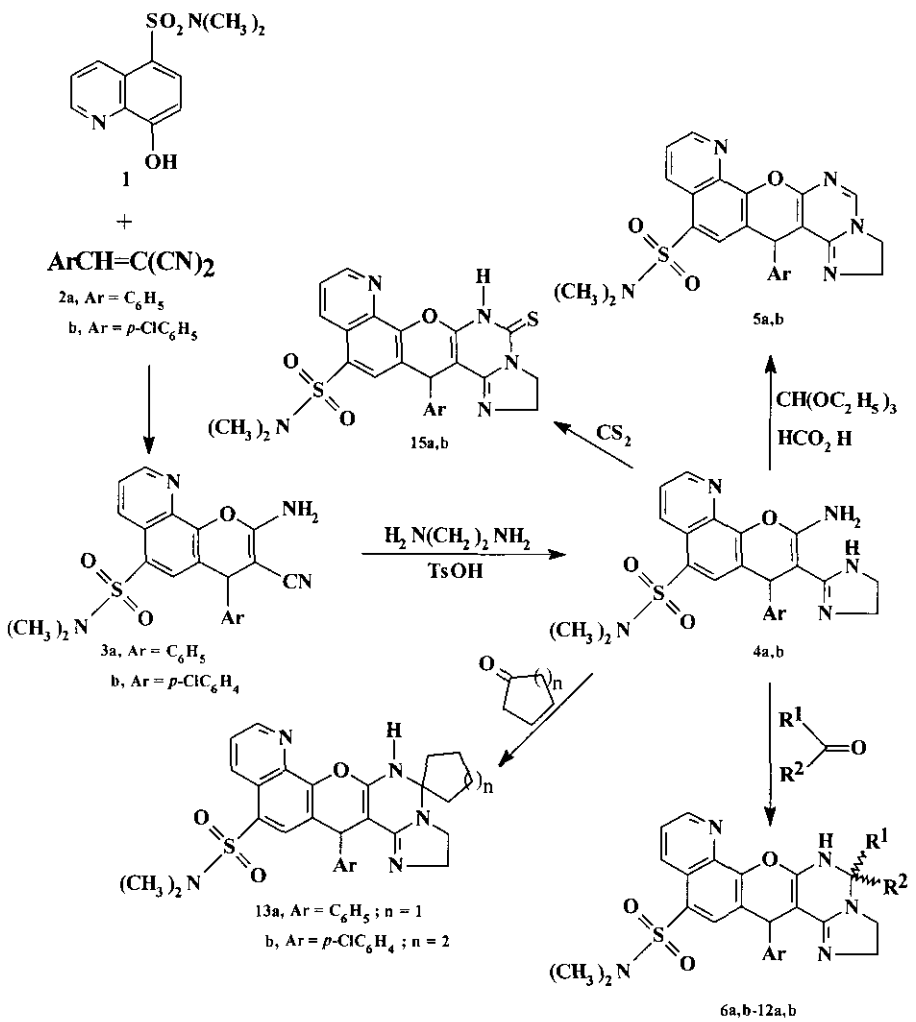
Abstract- 5-Dimethylaminosulfonyl-8-quinolinol **(1)** was reacted with cinnamonitriles **(2a,b)** to give the corresponding pyranoquinolines **(3a,b)**. Reaction of **3a,b** with ethylenediamine yielded 2-amino-4-aryl-3-(4,5-dihydro-1*H*-imidazol-2-yl)pyrano[3,2-*h*]quinolines **(4a,b)**. Compounds **(4a,b)** were reacted with triethyl orthoformate, aldehyde, ketone and carbon disulfide to give the corresponding imidazo[1,2-*c*]pyrimido[4',5':6,5]pyrano[3,2-*h*]quinoline derivatives **(5a,b-15a,b)**.

Recent years have witnessed the synthesis and characterisation a number of nitrogen-containing heteroaromatics. In fact, the biological activities of these compounds have drawn the attention of organic chemists for a long time. The synthesis of pyrimidine derivatives has gained very important goals[1-4] to be used as antimicrobial,[5] antitumor[6] and displayed significant pesticidal activity.[7] Also imidazole derivatives showed diverse biological activities e.g. they are used as factors Xa inhibitors,[8] alpha-2-adrenoceptor agonists[9] and antithrombotics.[10] For these reasons, the preparation of imidazole derivatives has a lot attention in the last ten years.[11-19] Pyran derivatives were reported by different methods.[20-22] From all of the forgoing facts, together with the importance of quinoline derivatives[23] and as a continuation of our interest in the synthesis of heterocyclic systems,[24-32] we reported herein the synthesis of the title compounds which might show enhanced biological activity due to the presence of fused imidazo-pyrimido-pyranoquinoline.

The synthesis of the new imidazo[1,2-*c*]pyrimido[4',5':6,5]pyrano[3,2-*h*]quinolines **(5a,b-15a,b)** was carried out as shown in Scheme 1. Thus the reaction of 5-dimethylaminosulfonyl-8-quinolinol **(1)** with cinnamonitriles **(2a,b)** gave the corresponding 2-amino-4-aryl-3-cyano-6-dimethylaminosulfonyl-4*H*-pyrano[3,2-*h*]quinolines **(3a,b)**. The IR (υ, cm^{-1}) (KBr) spectra of **3a** showed characteristic absorption bands at 3400-3320 (NH), 3000 (CH arom.), 2900 (CH aliph.), 2200 (CN), 1360 (SO_2 asym.), 116 (SO_2 sym.). NMR (δ, ppm) ($CDCl_3$) of **3a** showed: 3.20 (s, 6H, $2CH_3$), 4.95 (s, 1 H, pyran), 6.60 (s, 2H, NH_2), 7.10-8.40 (m, 9H, aromatic protons). Reaction of **3a,b** with ethylenediamine and *p*-toluenesulfonic acid monohydrate

yielded 2-amino-4-aryl-3-(4,5-dihydro-1*H*-imidazol-2-yl)pyrano[3,2-*h*]quinolines **(4a,b)** which serve as intermediate for the synthesis of imidazo[1,2-*c*]pyrimido[4',5':6,5]pyrano[3,2-*h*]quinolines.



Compounds (6a,b - 12a,b)

	Ar	R^1	R^2		Ar	R^1	R^2
6a	C_6H_5	H	CH_3	**10a**	C_6H_5	CH_3	CH_3
6b	p-ClC_6H_4	H	CH_3	**10b**	p-ClC_6H_4	CH_3	CH_3
7a	C_6H_5	H	C_6H_5	**11a**	C_6H_5	CH_3	C_6H_5
7b	p-ClC_6H_4	H	C_6H_5	**11b**	p-ClC_6H_4	CH_3	C_6H_5
8a	C_6H_5	H	p-ClC_6H_4	**12a**	C_6H_5	CH_3	p-ClC_6H_4
8b	p-ClC_6H_4	H	p-ClC_6H_4	**12b**	p-ClC_6H_4	CH_3	p-ClC_6H_4
9a	C_6H_5	H	p-$NO_2C_6H_4$				
9b	p-ClC_6H_4	H	p-$NO_2C_6H_4$				

Scheme 1

Thus the reaction of compounds **(4a,b)** with triethyl orthoformate, aldehydes and ketones gave the corresponding 2,3-dihydroimidazo[1,2-*c*]pyrimido[4',5':6,5]pyrano[3,2-*h*]quinolines **(5a,b)** and 2,3,6-trihydroimidazo[1,2-*c*]pyrimido[4',5':6,5]pyrano[3,2-*h*]quinolines **(6a,b-12a,b)**, while the reaction with cyclic ketones and carbon disulfide gave spiroimidazo[1,2-*c*]pyrimido[4',5':6,5]pyrano[3,2-*h*]quinolines **(13a,b-14a,b)** and 5-thioxo-2,3-6-trihydroimidazo[1,2-*c*]pyrimido[4',5':6,7]pyrano[3,2-*h*]quinolines **(15a,b)** respectively (Table 1). All the newly synthesized compounds were tested against *Escherichia coli DSM 423* and *Staphlococcus allreus DSM 346* and the data are listed in Table 2.

Table 1. Physical Data of 2-Amino-4-aryl-3-(4,5-dihydro-1*H*-imidazol-2-yl)pyrano[3,2-*h*]quinolines **(4a,b)** and Imidazo[1,2-*c*]pyrimido[4',5':6,5]pyrano[3,2-*h*]quinolines **(5a,b-15a,b)**

Compd. No.	Yield (%)	mp (°C)	Molecular Formula (Solvent of Recrystallization)	IR (υ, cm^{-1}) (KBr) and MS	NMR (δ, ppm) (Solvent)	*Anal.* Calcd/(Found) % C	H	N	S	Cl
3a	60	> 310	$C_{21}H_{18}N_4O_3S$ (ethanol)	3400-3320 (NH_2), 3000 (CH arom.), 2900 (CH aliph.), 2200 (CN), 1360 (SO_2 asym.), 1160 (SO_2 sym.)	($CDCl_3$): 3.20 (6H, s), 4.95 (1H, s) 6.60 (2H, s), 7.10-8.40 (9H, m)	62.04 (62.12)	4.46 (4.43)	13.79 (13.86)	7.90 (7.94)	—
3b	69	286-288	$C_{21}H_{17}N_4O_3ClS$ (ethanol)	3400-3320 (NH_2), 3000 (CH arom.), 2900 (CH aliph.), 2200 (CN), 1360 (SO_2 asym.), 1160 (SO_2 sym.)	($CDCl_3$): 3.20 (6H, s), 5.0 (1H, s) 6.80 (2H, s), 7.20-8.10 (8H, m)	57.19 (57.27)	3.89 (3.91)	12.71 (12.67)	7.28 (7.32)	8.05 (8.01)
4a	51	256 decomp	$C_{23}H_{23}N_5O_3S$ (ethanol)	3440-3340 (NH_2), 3310 (NH), 3020 (CH arom.), 2960 (CH aliph.), 1370 (SO_2 asym.), 1165 (SO_2 sym.), m/z 449	(CF_3COOD): 2.90 (6H, s), 3.30 (2H, t, J = 6.2 Hz), 3.70 (2H, t, J = 6.2 Hz), 4.90 (1H, s), 7.30-8.60 (9H, m)	61.44 (61.51)	5.16 (5.22)	15.58 (15.61)	7.14 (7.19)	—
4b	45	274 decomp	$C_{23}H_{22}N_5O_3ClS$ (ethanol)	3450-3350 (NH_2), 3330 (NH), 3030 (CH arom.), 2970-2860 (CH, aliph.), 1370 (SO_2 asym.), 1165 (SO_2 sym.)	(CF_3COOD): 3.00 (6H, s), 3.40 (2H, t, J = 6.2 Hz), 3.80 (2H, t, J = 6.2 Hz), 5.00 (1H, s), 7.25-8.70 (8H, m)	57.07 (57.16)	4.58 (4.62)	14.47 (14.41)	6.63 (6.58)	7.33 (7.28)
5a	42	291-293	$C_{24}H_{21}N_5O_3S$ (methanol)	3020 (CH arom.), 2990-2860 (CH aliph.), 1365 (SO_2 asym.), 1160 (SO_2 sym.), m/z 459	($CDCl_3$): 2.95 (6H, s), 3.40-3.70 (4H, m) 4.95 (1H, s), 7.30-8.80 (10H, m)	62.72 (62.65)	4.61 (4.59)	15.24 (15.22)	6.98 (6.97)	—
5b	45	239 decomp	$C_{24}H_{20}N_5O_3ClS$ (methanol)	3030 (CH arom.), 2990-2870 (CH aliph.), 1370 (SO_2 asym.), 1170 (SO_2 sym.)	($CDCl_3$): 3.00 (6H, s), 3.40-3.80 (4H, m), 5.00 (1H, s), 7.20-8.50 (9H, m)	58.34 (58.29)	4.08 (4.13)	14.18 (14.18)	6.50 (6.52)	7.19 (7.22)

(Continued)

Table 1. ***(Continued)*** Physical Data of 2-Amino-4-aryl-3-(4,5-dihydro-1*H*-imidazol-2-yl)pyrano[3,2-*h*]-quinolines **(4a,b)** and Imidazo[1,2-*c*]pyrimido[4',5':6,5]pyrano[3,2-*h*]quinolines **(5a,b-15a,b)**

Compd. No.	Yield (%)	mp (°C)	Molecular Formula (Solvent of Recrystallization)	IR (υ, cm^{-1}) (KBr) and MS	NMR (δ, ppm) (Solvent)	*Anal.* Calcd/(Found) % C	H	N	S	Cl
6a	36	> 310	$C_{25}H_{25}N_5O_3S$ (methanol)	3410 (NH), 3010 (CH arom.), 2990-2860 (CH aliph.), 1365 (SO_2 asym.), 1165 (SO_2 sym.)	(CF_3COOD): 1.55 (3H, d, *J* = 5.92 Hz), 3.00 (6H, s), 3.50-3.80 (4H, m), 4.90 (1H, s), 5.40 (1H, m), 7.10-8.70 (9H, m)	63.13 (63.20)	5.30 (5.22)	14.73 (14.81)	6.75 (6.81)	—
6b	39	251 decomp	$C_{25}H_{24}N_5O_3ClS$ (methanol)	3400 (NH), 3020 (CH arom.), 2980-2880 (CH aliph.), 1370 (SO_2 asym.), 1165 (SO_2 sym.)	($CDCl_3$): 1.55 (3H, d, *J* = 5.92 Hz), 3.00 (6H, s), 3.55-3.80 (4H, m), 5.00 (1H, s), 5.45 (1H, m), 7.20-8.60 (8H, m), 8.90 (1H, s)	58.86 (58.91)	4.74 (4.81)	13.73 (13.65)	6.29 (6.33)	6.96 (6.92)
7a	44	281 decomp	$C_{30}H_{27}N_5O_3S$ (methanol)	3415 (NH), 3000 (CH arom.), 2970-2890 (CH aliph.), 1370 (SO_2 asym.), 1165 (SO_2 sym.)	(CF_3COOD): 3.00 (6H, s), 3.40-3.80 (4H, m), 5.00 (1H, s), 6.60-8.10 (15H, m)	67.01 (66.94)	5.06 (5.11)	13.03 (13.12)	5.97 (5.91)	—
7b	47	> 310	$C_{30}H_{26}N_5O_3ClS$ (methanol)	3420 (NH), 3020 (CH arom.), 2990-2890 (CH aliph.), 1370 (SO_2 asym.), 1170 (SO_2 sym.)	(DMSO-d_6): 2.90 (6H, s), 3.30-3.70 (4H, m), 5.20 (1H, s), 7.00-8.80 (14H, m), 10.10 (1H, s)	62.97 (62.90)	4.58 (4.63)	12.24 (12.18)	5.61 (5.55)	6.20 (6.27)
8a	34	> 310	$C_{30}H_{26}N_5O_3ClS$ (methanol)	3400 (NH), 3000 (CH arom.), 2990-2890 (CH aliph.), 1370 (SO_2 asym.), 1170 (SO_2 sym.)	(CF_3COOD): 3.00 (6H, s), 3.30-3.80 (4H, m), 5.10 (1H, s), 6.90-8.10 (14H, m)	62.97 (63.01)	4.58 (4.51)	12.24 (12.27)	5.61 (5.69)	6.20 (6.16)
8b	36	> 310	$C_{30}H_{25}N_5O_3Cl_2S$ (methanol)	3420 (NH), 3020 (CH arom.), 2990-2890 (CH aliph.), 1380 (SO_2 asym.), 1170 (SO_2 sym.)	(CF_3COOD): 3.10 (6H, s), 3.20-3.70 (4H, m), 5.00 (1H, s), 7.10-8.30 (13H, m)	59.39 (59.47)	4.15 (4.19)	11.55 (11.59)	5.29 (5.31)	11.70 (11.66)
9a	35	298 decomp	$C_{30}H_{26}N_6O_5S$ (methanol)	3400 (NH), 3030 (CH arom.), 2990-2890 (CH aliph.), 1360 (SO_2 asym.), 1160 (SO_2 sym.), m/z 582	($CDCl_3$): 2.95 (6H, s), 3.10-3.65 (4H, m), 5.10 (1H, s), 7.10-8.70 (14H, m), 10.00 (1H, s)	61.83 (61.89)	4.50 (4.47)	14.43 (14.48)	5.51 (5.59)	—
9b	39	> 310	$C_{30}H_{25}N_6O_5ClS$ (methanol)	3420 (NH),3030 (CH arom.), 2990-2890 (CH aliph.), 1365 (SO_2 asym.), 1165 (SO_2 sym.)	($CDCl_3$): 3.00 (6H, s), 3.20-3.70 (4H, m), 5.00 (1H, s), 7.20-8.50 (13H, m), 10.10 (1H, s)	58.38 (58.41)	4.08 (4.13)	13.62 (13.58)	5.20 (5.17)	5.75 (5.81)

(Continued)

Table 1. ***(Continued)*** Physical Data of 2-Amino-4-aryl-3-(4,5-dihydro-1*H*-imidazol-2-yl)pyrano[3,2-*h*]-quinolines **(4a,b)** and Imidazo[1,2-*c*]pyrimido[4',5':6,5]pyrano[3,2-*h*]quinolines **(5a,b-15a,b)**

Compd. No.	Yield (%)	mp (°C)	Molecular Formula (Solvent *of* Recrystallization)	IR (υ, cm^{-1}) (KBr) and MS	NMR (δ, ppm) (Solvent)	*Anal. Calcd/(Found) %* C	H	N	S	Cl
10a	41	281 decomp	$C_{26}H_{27}N_5O_3S$ (methanol)	3420 (NH), 3040 (CH arom.), 2990-2900 (CH aliph.), 1360 (SO_2 asym.), 1160 (SO_2 sym.)	(CF_3COOD): 1.90 (6H, s), 2.90 (6H, s), 3.10-3.60 (4H, m), 5.00 (1H, s), 7.40-8.90 (9H, m)	63.78 (63.75)	5.56 (5.54)	14.31 (14.30)	6.56 (6.54)	—
10b	44	> 310	$C_{26}H_{26}N_5O_3ClS$ (methanol)	3430 (NH), 3000 (CH arom.), 2980-2890 (CH aliph.), 1370 (SO_2 asym.), 1165 (SO_2 sym.)	($CDCl_3$): 1.90 (6H, s), 2.95 (6H, s), 3.00-3.60 (4H, m), 5.00 (1H, s), 7.20-8.60 (8H, m), 10.30 (1H, s)	59.58 (59.54)	5.00 (4.96)	13.37 (13.41)	6.13 (6.08)	6.77 (6.81)
11a	53	296 decomp	$C_{31}H_{29}N_5O_3S$ (methanol)	3420 (NH), 3020 (CH arom.), 2970-2900 (CH aliph.), 1365 (SO_2 asym.), 1160 (SO_2 sym.)	(CF_3COOD): 1.95 (3H, s), 2.95 (6H, s), 3.15-3.70 (4H, m), 5.10 (1H, s), 7.50-8.40 (14H, m)	67.48 (67.50)	5.30 (5.26)	12.70 (12.65)	5.82 (5.76)	—
11b	55	> 310	$C_{31}H_{28}N_5O_3ClS$ (methanol)	3410 (NH), 3030 (CH arom.), 2980-2900 (CH aliph.), 1360 (SO_2 asym.), 1160 (SO_2 sym.)	(CF_3COOD): 2.00 (3H, s), 2.90 (6H, s), 3.00-3.60 (4H, m), 5.10 (1H, s), 7.60-8.20 (13H, m)	63.51 (63.60)	4.82 (4.79)	11.95 (11.89)	5.48 (5.50)	6.06 (6.10)
12a	45	> 310	$C_{31}H_{28}N_5O_3ClS$ (methanol)	3410 (NH), 3030 (CH arom.), 2980-2900 (CH aliph.), 1360 (SO_2 asym.), 1160 (SO_2 sym.)	(CF_3COOD): 2.00 (3H, s), 2.90 (6H, s), 3.00-3.60 (4H, m), 5.10 (1H, s), 7.50-8.30 (13H, m)	63.51 (63.47)	4.82 (4.85)	11.95 (11.99)	5.48 (5.51)	6.06 (6.04)
12b	42	292 decomp	$C_{31}H_{27}N_5O_3Cl_2S$ (methanol)	3400 (NH), 3030 (CH arom.), 2990-2900 (CH aliph.), 1370 (SO_2 asym.), 1165 (SO_2 sym.)	(CF_3COOD): 2.00 (3H, s), 2.95 (6H, s), 3.10-3.70 (4H, m), 5.10 (1H, s), 7.60-8.50 (12H, m)	59.98 (59.91)	4.39 (4.36)	11.29 (11.27)	5.17 (5.21)	11.44 (11.41)
13a	51	262-264	$C_{28}H_{29}N_5O_3S$ (methanol)	3420 (NH), 3030 (CH arom.), 2990-2900 (CH aliph.), 1370 (SO_2 asym.), 1160 (SO_2 sym.)	(CF_3COOD): 1.40-1.80 (8H, m), 2.90 (6H, s), 3.30-3.60 (4H, m), 5.10 (1H, s), 7.70-8.40 (9H, m)	65.21 (65.16)	5.67 (5.64)	13.58 (13.61)	6.23 (6.19)	—
13b	55	279 decomp	$C_{28}H_{28}N_5O_3ClS$ (methanol)	3410 (NH), 3030 (CH arom.), 2980-2900 (CH aliph.), 1360 (SO_2 asym.), 1160 (SO_2 sym.)	(CF_3COOD): 1.40-1.80 (8H, m), 2.90 (6H, s), 3.30-3.60 (4H, m), 5.20 (1H, s), 7.50-8.30 (8H, m)	61.13 (61.17)	5.13 (5.15)	12.73 (12.69)	5.84 (5.79)	6.45 (6.42)

(Continued)

Table 1. ***(Continued)*** Physical Data of 2-Amino-4-aryl-3-(4,5-dihydro-1*H*-imidazol-2-yl)pyrano[3,2-*h*]-quinolines **(4a,b)** and Imidazo[1,2-*c*]pyrimido[4',5':6,5]pyrano[3,2-*h*]quinolines **(5a,b-15a,b)**

Compd. No.	Yield (%)	mp (°C)	Molecular Formula (Solvent of Recrystallization)	IR (υ, cm^{-1}) (KBr) and MS	NMR (δ, ppm) (Solvent)	*Anal.* Calcd/(Found) % C	H	N	S	Cl
14a	48	235-237	$C_{29}H_{31}N_5O_3S$ (methanol)	3400 (NH), 3030 (CH arom.), 2990-2900 (CH aliph.), 1370 (SO_2 asym.), 1165 (SO_2 sym.)	(CF_3COOD): 1.30-1.70 (10H, m), 2.80 (6H, s), 3.30-3.60 (4H, m), 5.10 (1H, s), 7.80-8.50 (9H, m)	66.75 (66.71)	5.90 (5.87)	13.23 (13.19)	6.06 (6.11)	—
14b	52	253 decomp	$C_{29}H_{30}N_5O_3ClS$ (methanol)	3420 (NH), 3030 (CH arom.), 2990-2900 (CH aliph.), 1370 (SO_2 asym.), 1160 (SO_2 sym.)	(CF_3COOD): 1.30-1.70 (10H, m), 2.90 (6H, s), 3.40-3.70 (4H, m), 5.10 (1H, s), 7.60-8.30 (8H, m)	61.73 (61.76)	5.36 (5.33)	12.42 (12.46)	5.69 (5.71)	6.29 (6.25)
15a	58	269 decomp	$C_{24}H_{21}N_5O_3S_2$ (AcOH)	3410 (NH), 3030 (CH arom.), 2980-2900 (CH aliph.), 1360 (SO_2 asym.), 1160 (SO_2 sym.)	(CF_3COOD): 2.85 (6H, s), 3.20-3.70 (4H, m), 5.20 (1H, s), 7.70-8.20 (9H, m)	58.63 (58.58)	4.31 (4.33)	14.25 (14.22)	13.06 (13.11)	—
15b	61	> 310	$C_{24}H_{20}N_5O_3ClS_2$ (AcOH)	3400 (NH), 3020 (CH arom.), 2980-2900 (CH aliph.), 1370 (SO_2 asym.), 1165 (SO_2 sym.)	(CF_3COOD): 2.90 (6H, s), 3.10-3.80 (4H, m), 5.20 (1H, s), 7.50-8.10 (8H, m)	54.78 (54.71)	3.83 (3.86)	13.31 (13.26)	12.20 (12.17)	6.75 (6.79)

Antimicrobial Activity

The antimicrobial activity of the synthesized compounds was tested against *Escherichia coli DSM 423* and *Staphylococcus aureus DSM 346* using the agar cup diffusion technique[33] and results of the biological testing are given in Table 2. The data showed that most of the newly synthesized compounds exhibited remarkable effects.

Table 2: Antimicrobial Screening of Compounds **(3a,b-15a,b)** (inhibition zones mm)

Compd. No.	*Escherichia coli DSM 423*	*Staphylococcus aureus DSM 346*
3a	54	71
3b	27	40
4a	33	29
4b	18	22

(Continued)

Table 2. *(Continued)* Antimicrobial Screening of Compounds **(3a,b-15a,b)** (inhibition zones mm)

Compd. No.	*Escherichia coli DSM 423*	*Staphylococcus aureus DSM 346*
5a	23	21
5b	9	36
6a	—	25
6b	—	55
7a	24	19
7b	40	27
8a	25	22
8b	—	25
9a	45	17
9b	15	12
10a	22	57
10b	—	50
11a	55	21
11b	27	38
12a	65	30
12b	25	37
13a	58	51
13b	26	87
14a	54	71
14b	27	40
15a	33	29
15b	18	22
Tetra-cycline	9	11

EXPERIMENTAL

The time required for completion of each reaction was monitored by TLC. Melting points are uncorrected. NMR (δ, ppm) spectra were measured on an EM-360 90-MHz spectrometer using TMS as internal standard. IR (υ,cm^{-1}) spectra were recorded on a Pye-Unicam SP 200-G spectrophotometer. Elemental analyses were determined on a Perkin Elmer 240 C microanalyser. MS spectra were recorded on Jeol JMS 600 instrument.

2-Amino-4-aryl-3-cyano-6-dimethylaminosulfonyl-4*H*-pyrano[3,2-*h*]quinoline Derivatives **(3a,b)**

A mixture of 5-dimethylaminosulfonyl-8-quinolinol **(1)** (2.52 g, 0.01 mol) and cinnamonitrile derivatives **(2a,b)** (0.01 mol) was heated under reflux in ethanol (50 mL) and catalytic amount of piperidine for 10 h. The solvent was evaporated under reduced pressure and the residue was cooled. The precipitated product was collected by filtration and recrystallized from ethanol (Table 1).

2-Amino-4-aryl-3-(4,5-dihydro-1*H*-imidazol-2-yl)pyrano[3,2-*h*]quinolines **(4a,b)**

General Procedure:

A mixture of **3a,b** (0.01 mol), ethylenediamine (0.64 g, 0.011 mol, 0.8 mL) and *p*-toluenesulfonic acid monohydrate (2.28 g, 0.012 mol) was heated under reflux at 200 °C for 12 h. The reaction mixture was made alkaline with a saturated aqueous solution of sodium carbonate and the precipitate was filtered off and recrystallized from ethanol (Table 1).

2,3-Dihydroimidazo[1,2-*c*]pyrimido[4',5':6,5]pyrano[3,2-*h*]quinolines **(5a,b)**

General Procedure:

To a suspension of **4a,b** (0.01 mol) in triethyl orthoformate (3 mL, 0.018 mol), was added small amount of formic acid (0.61 g, 0.013 mol, 0.5 mL), the mixture was heated under reflux for 6 h. After cooling to rt, the product was collected by filtration and chromatographed on a silica gell column eluting with ethyl acetate/methanol 7:3 as eluent. Evaporation of the eluate gave an oily residue which solidifies upon scratching (Table 1).

2,3,6-Trihydroimidazo[1,2-*c*]pyrimido[4',5':6,5]pyrano[3,2-*h*]quinolines **(6a,b-14a,b)**

General Procedure:

To a solution of **2a,b** (0.01 mol) and the appropriate aldehyde (0.011 mol) or ketone (0.02 mol) in absolute ethanol (30 mL) was added conc. HCl (0.3 mL), and the mixture was stirred at 80-100 °C in a well stoppered round bottom flask fitted with reflux condenser for 12 h. The product was isolated by column chromatograph on silica gel with ethyl acetate/ methanol/ aq. NH_3 (6:2:2) as eluent.

5-Thioxo-2,3,6-trihydroimidazo[1,2-*c*]pyrimido[4',5':6,5]pyrano[3,2-*h*]quinolines **(15a,b)**

A mixture of **4a,b** (0.0012 mol), carbon disulfide (6.33 g, 0.083 mol, 5 mL) in ethanol (50 mL) and two pellets of potassium hydroxide (0.17 g, 0.003 mol) was heated on water bath for 6 h. The solid product obtained was dissolved in water and then acidified with acetic acid. Recrystallization from acetic acid gave brown crystals.

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