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REACTION OF 2-AMINOTHIAZOLES AND THEIR BENZO- AND NAPHTHO DERIVATIVES WITH β-SULFONYL-TRIFLUOROMETHYLVINYLDIOLS

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By cyclocondensation of 2-aminothiazoles and their benzo and naphtho analogs with β-sulfonyltrifluoromethylvinyldiols, we have obtained a series of novel CF_3-containing 6,7-dihydro-5H-[1,3]thiazolo[3,2-a]pyrimidines. In the case of the sterically hindered 2-aminothiazoles, heterocyclization does not occur and the corresponding enamino ketones are formed.

Keywords: 2-aminothiazoles, 6,7-dihydro-5H-[1,3]thiazolo[3,2-*a*]pyrimidines, β-sulfonyltrifluoromethylvinyldiols, cyclocondensation.

Several methods are known for synthesis of thiazolo[3,2-*a*]pyrimidine derivatives. Thus their keto derivatives are obtained by condensation of 2-aminothiazoles with β-keto acid derivatives [1, 2]. Compounds of the second type (onium salts) are synthesized by two alternative schemes: from 2-mercaptopyrimidines and α-halo ketones [3], and by cyclocondensation of α-aminothiazoles with β-diketones, β-keto aldehydes, and their acetals [4], β-chlorovinyl ketones and aldehydes [5-7]. However, so far studies of the method for synthesis of fluorine-containing derivatives of thiazolo[3,2-*a*]pyrimidine have been virtually unknown.

In this work, we have studied the reaction of 2-aminothiazoles and their benzo and naphtho derivatives with β-sulfonyltrifluoromethylvinyldiols **1**, **2**. Sulfones **1, 2** have been obtained previously by oxidation of the corresponding readily accessible sulfides [8]. We have shown that sulfones **1, 2** readily react with various nucleophiles [9, 10], and also enter into the cyclocondensation reaction with 1,3-binucleophiles [11].

We found that when sulfones **1, 2** react with 2-aminothiazoles in acetonitrile, along with the expected cycloadducts 6,7-dihydro-5H-[1,3,4]thiadiazolo]3,2-*a*]pyrimidin-7-ols **3-6**, the enamino ketones **7** are formed (Table 1). For R' = H, the reaction occurs regiospecifically and stereoselectively: the cycloadducts **3-6** are formed as a mixture of stereoisomers with predominance of the isomer with axial sulfonyl and hydroxy groups, probably due to the presence of a hydrogen bond between these groups. We observed similar stereochemistry earlier in cycloadducts obtained when 2-aminothiadiazoles react with sulfones **1, 2**, as is unambiguously supported by the X-ray diffraction data [12]. The presence of a methyl group in the 4 position of the starting 2-aminothiazole creates significant steric hindrance for the sulfonyl group, and accordingly we see stereospecific formation of isomers **3c** or **4c** with an axial sulfonyl group.

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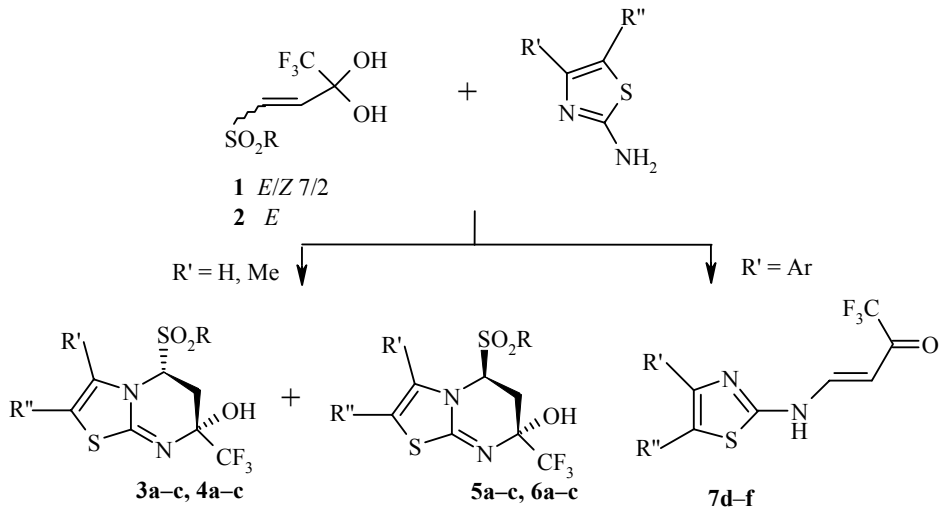
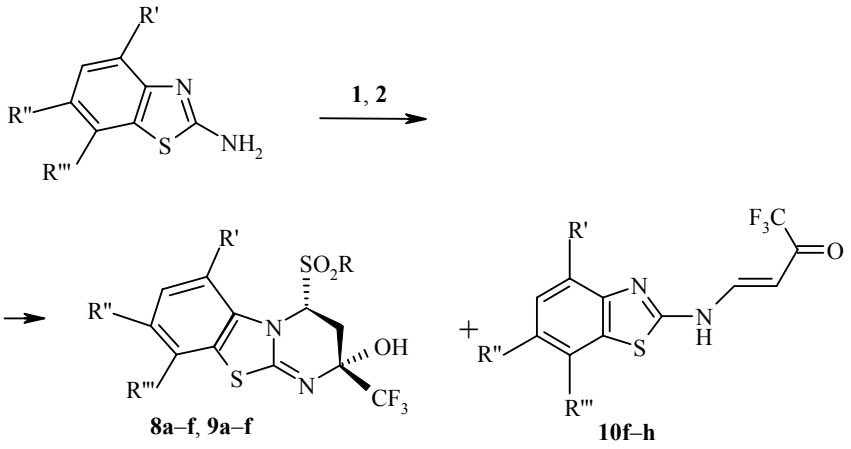


1, **3a–c**, **5a–c** R = Ph; **2**, **4a–c**, **6a–c** R = Me

Study of the spin–spin coupling constants for the protons of the –CH–CH_2– moiety of the pyrimidine ring of compounds **3-6** and **8** makes it possible to determine the position of the sulfonyl group in those compounds. Thus in the ^{1}H NMR spectrum of compounds **3, 4, 8**, we observe spin–spin coupling between the equatorial H-5 atom and the hydrogen atoms of the methylene group H-6a and H-6b, with constants J = 0.9-1.9 and J = 7.5-7.9 Hz; in the spectra of compounds **5, 6**, we see a large spin–spin coupling constant (J = 11.7-12.6 Hz), corresponding to *ax–ax* coupling, which is possible only when the H-5 atom is in an axial position.

With a further increase in the steric bulk of the substituent R' as it goes to an aryl group, the cycloadducts **3-6** are generally not formed. Instead, we obtained products with a linear structure in high yields: the trifluoromethyl-containing enamino ketones **7d-f**.



8a–f,i R = Ph; **9a–f,i** R = Me

When various 2-amino-1,3-benzothiazoles and 2-aminonaphtho[2,1-*d*][1,3]thiazole react with sulfones **1, 2**, we also observe formation of both cycloadducts **8, 9** and the products with linear structure **10** (Table 2). However, if the 2-amino-1,3-benzothiazoles contain strong electron-acceptor substituents, for example, 2-amino-6-nitro-1,3-benzothiazole, then the reaction does not occur at room temperature and heating leads to tar formation in the reaction mixture.

TABLE 1. Reaction Conditions and Reaction Products for the Reaction of 2-Aminothiazoles with Sulfones **1, 2**

R	R'	R"	**3–6**	**3(4) / 5(6)***	**7**	mp, °C	Yield, %
Ph	H	H	**3a / 5a**	80 / 20	—	120	86
Me			**4a / 6a**	83 / 17	—	176	90
Ph	H	Me	**3b / 5b**	83 / 17	—	Oil	84
Me			**4b / 6b**	84 / 16	—	156	88
Ph	Me	H	**3c / 5c**	100 / 0	—	Oil	91
Me			**4c / 6c**	100 / 0	—	170	92
Ph	Ph	H	—	—	**d**	174	85
Me			—	—			90
Ph	4-$MeOC_6H_4$	H	—	—	**e**	180	82
Me			—	—			87
Ph	4-ClC_6H_4	H	—	—	**f**	185	80
Me			—	—			85

* The isomer ratio was determined based on the ^{1}H NMR spectra.

In the case of aminobenzothiazoles, we can more rigorously describe the steric requirements imposed on the starting amino heterocycle for the occurrence of the cycloaddition reaction. Probably when the steric bulk of the substituent in the 4 position of the starting 2-amino-1,3-benzothiazole is greater than or equal to the volume of the chlorine atom, the enamine **10** is formed exclusively. On further decrease in the steric bulk of the substituent R' as it goes down to a fluorine atom, we obtained a mixture of the cyclic (**8, 9**) and linear (**10**) compounds. Derivatives of 3,4-dihydro-2H-pyrimido[2,1-*b*][1,3]benzothiazole are formed as the sole reaction

TABLE 2. Reaction Conditions and Reaction Products for the Reaction of 2-Amino-1,3-benzothiazoles with Sulfones **1, 2**

R	R'	R"	R'"	**8, 9**	**10**	**8(9) / *Z*-10 / *E*-10**	mp, °C	Yield **8(9)+10**, %
Ph	H	MeO	H	**8a**	—	100 / 0 / 0	190	85
Me				**9a**	—	100 / 0 / 0	192	86
Ph	H	HO	H	**8b**	—	100 / 0 / 0	189	91
Me				**9b**	—	100 / 0 / 0	185	94
Ph	H	Cl	H	**8c**	—	100 / 0 / 0	192	90
Me				**9c**	—	100 / 0 / 0	194	92
Ph	H	Br	H	**8d**	—	100 / 0 / 0	202	93
Me				**9d**	—	100 / 0 / 0	198	95
Ph	H	Me	H	**8e**	—	100 / 0 / 0	196	80
Me				**9e**	—	100 / 0 / 0	194	85
Ph	F	F	H	**8f**	**f**	81 / 14 / 5	184 (131)*	73
Me				**9f**	—	100/ 0*[2]	187	78
Ph	Me	Me	H	—	**g**	0 / 70 / 30	131-133	79
Me				—				82
Ph	Cl	Cl	H	—	**h**	0 / 74 / 26	140-142	85
Me				—				88
Ph	H	Benzo		**8i**	—	100 / 0 / 0	195	90
Me				**9i**	—	100 / 0 / 0	215	92

* Melting point of **8f** (**10f**).

*[2] Product **10** was detected by chromatography.

TABLE 3. Characteristics of Synthesized Compounds*

Compound	Empirical formula	Found, % / Calculated, %		NMR spectrum (CD_3CN/CF_3COOH), δ, ppm (*J*, Hz)*[2]	
		C	H	^1H	^{13}C
1	2	3	4	5	6
3a	$C_{13}H_{11}F_3N_2O_3S_2$	42.74 / 42.85	3.00 / 3.04	2.32 (1H, dd, *J* = 7.5, *J* = 15.6, H-6); 2.74 (1H, d, *J* = 15.6, H-6); 5.45 (1H, dd, *J* = 1.2, *J* = 7.5, H-5); 6.18 (1H, d, *J* = 5.1, CH-Thiaz); 6.33 (1H, d, *J* = 5.1, CH-Thiaz); 7.64 (2H, t, Ph); 7.79 (1H, t, Ph); 7.85 (2H, d, Ph)	25.4, 73.0, 80.6 (q, *J* = 29.8, C–OH); 102.2, 125.0 (q, *J* = 284.8, CF_3); 127.1, 130.4, 130.6, 130.8, 135.9, 164.6
5a				1.75 (1H, dd, *J* = 12.1, *J* = 13.4, H-6); 2.25 (1H, dd, *J* = 6.0, *J* = 13.4, H-6); 5.33 (1H, dd, *J* = 6.0, *J* = 12.1, H-5); 6.31 (1H, d, *J* = 5.1, CH-Thiaz); 7.48 (1H, d, *J* = 5.1, CH-Thiaz); 7.68 (2H, t, Ph); 7.80 (1H, t, Ph); 7.89 (2H, d, Ph)	27.7, 70.6, 81.6 (q, *J* = 29.9, C–OH); 102.5, 125.3 (q, *J* = 285.0, CF_3); 126.2, 130.4, 130.6, 130.8, 136.4, 165.0
4a	$C_8H_9F_3N_2O_3S_2$	31.66 / 31.79	2.94 / 3.00	2.22 (1H, dd, *J* = 7.6, *J* = 15.7, H-6); 2.64 (1H, d, *J* = 15.7, H-6); 3.34 (3H, s, CH_3); 5.50 (1H, d, *J* = 7.6, H-5); 6.50 (1H, d, *J* = 5.0, CH-Thiaz); 6.91 (1H, d, *J* = 5.0, CH-Thiaz)	24.2, 38.0, 71.5, 79.4 (q, *J* = 40.0, C–OH); 101.2, 125.2 (q, *J* = 285.2, CF_3); 126.4, 162.5
6a				1.75 (1H, br. t, *J* = 13.3, H-6); 2.28 (1H, dd, *J* = 5.9, *J* = 13.3, H-6); 3.33 (3H, s, CH_3); 5.32 (1H, dd, *J* = 5.9, *J* = 12.3, H-5); 6.46 (1H, d, *J* = 5.1, CH-Thiaz); 7.28 (1H, d, *J* = 5.1, CH-Thiaz)	26.2, 37.0, 68.5, 80.4 (q, *J* = 40.1, C–OH); 100.9, 124.5, 125.5 (q, *J* = 285.2, CF_3); 164.6
3b	$C_{14}H_{13}F_3N_2O_3S_2$	44.30 / 44.44	3.32 / 3.46	2.06 (3H, d, *J* = 1.6, CH_3); 2.32 (1H, dd, *J* = 7.6, *J* = 15.6, H-6); 2.72 (1H, d, *J* = 15.6, H-6); 5.37 (1H, dd, *J* = 1.1, *J* = 7.6, H-5); 6.07 (1H, d, *J* = 1.6, CH-Thiaz); 7.62 (2H, t, Ph); 7.79 (1H, t, Ph); 7.86 (2H, d, Ph)	12.7, 25.9 73.5, 80.6 (q, *J* = 30.0, C–OH); 123.4, 125.8 (q, *J* = 284.8, CF_3); 131.2, 131.2, 131.4, 131.5, 136.7, 165.7
5b				1.75 (1H, dd, *J* = 12.2, *J* = 13.3, H-6); 2.16 (3H, s, *J* = 1.6, CH_3); 2.25 (1H, dd, *J* = 6.0, *J* = 13.3, H-6); 5.27 (1H, dd, *J* = 6.0, *J* = 12.1, H-5); 7.23 (1H, d, *J* = 1.6, CH-Thiaz); 7.68 (2H, t, Ph); 7.80 (1H, t, Ph); 7.90 (2H, d, Ph)	13.0, 28.2, 71.0, 82.4 (q, *J* = 31.1, C–OH); 115.8, 126.1 (q, *J* = 285.0, CF_3); 131.2, 131.2, 131.4, 131.6, 137.2, 165.8

TABLE 3 (continued)

1	2	3	4	5	6
4b	$C_9H_{11}F_3N_2O_3S_2$	34.22 34.17	3.40 3.51	2.10 (3H, d, *J* = 1.6, CH_3); 2.34 (1H, dd, *J* = 7.5, *J* = 15.5, H-6); 2.72 (1H, d, *J* = 15.5, H-6); 3.35 (3H, s, CH_3); 5.44 (1H, dd, *J* = 1.2, *J* = 7.5, H-5); 6.04 (1H, d, *J* = 1.6, CH-Thiaz);	12.8, 24.3, 38.2, 71.7, 79.6 (q, *J* = 39.8, C–OH); 123.0, 125.6 (q, *J* = 285.1, CF_3); 126.5, 162.4
6b				1.81 (1H, dd, *J* = 12.3, *J* = 13.5, H-6); 2.19 (3H, s, *J* = 1.6, CH_3); 2.20 (1H, dd, *J* = 6.0, *J* = 13.5, H-6); 3.33 (3H, s, CH_3); 5.27 (1H, dd, *J* = 6.0, *J* = 12.3, H-5); 7.26 (1H, d, *J* = 1.6, CH-Thiaz)	13.1, 26.2, 37.5, 68.4, 80.3 (q, *J* = 40.0, C–OH); 116.0, 125.8 (q, *J* = 285.2, CF_3); 128.4, 164.0
3c	$C_{14}H_{13}F_3N_2O_3S_2$	44.28 44.44	3.30 3.46	2.12 (3H, s, CH_3); 2.23 (1H, dd, *J* = 7.6, *J* = 15.5, H-6); 2.71 (1H, d, *J* = 15.5, H-6); 5.42 (1H, d, *J* = 7.6, H-5); 6.15 (1H, s, OH); 6.40 (1H, CH-Thiaz); 7.59 (2H, t, Ph); 7.77 (1H, t, Ph); 7.84 (2H, d, Ph)	13.3, 25.9, 73.7, 80.0 (q, *J* = 31.1, C–OH); 98.4, 125.6 (q, *J* = 285.0, CF_3); 131.2, 131.3, 131.4, 131.6, 134.6, 164.1
4c	$C_9H_{11}F_3N_2O_3S_2$	34.03 34.17	3.42 3.51	2.20 (3H, d, *J* = 1.6, CH_3); 2.26 (1H, dd, *J* = 7.6, *J* = 15.5, H-6); 2.73 (1H, d, *J* = 15.5, H-6); 3.11 (3H, s, CH_3); 5.57 (1H, d, *J* = 7.6, H-5); 6.12 (1H, s, OH); 6.97 (1H, s, CH-Thiaz)	13.2, 26.1, 38.3, 70.5, 78.9 (q, *J* = 40.6, C–OH); 95.8, 125.4 (q, *J* = 285.3, CF_3); 134.1, 163.1
7d	$C_{13}H_9F_3N_2OS$	52.20 52.35	2.94 3.04	6.28 (1H, d, *J* = 14.0, CH=); 7.53 (3H, m, CH-Ph); 7.59 (2H, m, CH-Ph); 7.94 (1H, d, *J* = 14.0, CH=); 8.50 (1H, s, CH-Thiaz)	109.4, 118.3, 124.4 (q, *J* = 280.1, CF_3); 128.6, 129.3, 129.8, 133.5, 141.6, 164.8, 171.7, 184.3 (q, *J* = 36.1, CF_3)
7e	$C_{14}H_{11}F_3N_2O_2S$	51.07 51.22	3.15 3.38	3.83 (3H, s, CH_3); 6.21 (1H, d, *J* = 14.2, CH=); 7.08 (2H, d, CH–Ph); 7.55 (2H, d, CH-Ph); 7.93 (1H, d, *J* = 14.2, CH=); 8.64 (1H, s, CH-Thiaz)	55.3, 108.4, 114.2, 117.3, 125.1 (q, *J* = 280.0, CF_3); 125.7, 130.9, 141.9, 160.7, 165.2, 171.6, 184.2 (q, *J* = 36.2, CF_3)
7f	$C_{13}H_8ClF_3N_2OS$	46.85 46.93	2.56 2.42	6.30 (1H, d, *J* = 14.3, CH=); 7.60 (4H, m, CH-Ph); 7.86 (1H, d, *J* = 14.3, CH=); 8.68 (1H, s, CH-Thiaz)	109.0, 116.4, 120.1, 124.8 (q, *J* = 278.8, CF_3); 127.1, 130.5, 141.8, 162.4, 164.9, 171.6, 184.3 (q, *J* = 36.0, CF_3)
8a	$C_{18}H_{15}F_3N_2O_4S_2$	48.48 48.64	3.30 3.40	3.05 (1H, dd, *J* = 6.1, *J* = 16.2, H-6); 3.49 (1H, d, *J* = 16.2, H-6); 3.73 (3H, s, CH_3); 6.23 (1H, d, *J* = 6.1, H-5); 6.47 (1H, d, Ar); 6.65 (1H, d, CH-Ar); 7.21 (1H, s, CH-Ar); 7.43 (2H, t, Ph); 7.67 (2H, d, Ph); 7.68 (1H, t, Ph)	28.5, 57.5, 71.7 81.1 (q, *J* = 32.5, C–OH); 109.3, 116.1, 118.6, 123.3 (q, *J* = 285.5, CF_3); 124.9, 131.6, 131.9, 132.7, 136.8, 139.2, 161.6, 168.9
9a	$C_{13}H_{13}F_3N_2O_4S_2$	40.90 40.83	3.29 3.43	3.01 (1H, dd, *J* = 6.0, *J* = 16.2, H-6); 3.24 (3H, s, CH_3); 3.37 (1H, d, *J* = 16.2, H-6); 3.82 (3H, s, CH_3); 6.28 (1H, d, *J* = 6.0, H-5); 7.19 (1H, d, Ar); 7.33 (1H, s, Ar); 7.69 (1H, d, Ar)	28.5, 42.3, 57.5, 71.4, 80.8 (q, *J* = 32.6, C–OH); 109.5, 117.5, 119.0, 124.2 (q, *J* = 285.5, CF_3); 125.4, 132.1, 160.6, 169.0

TABLE 3 (continued)

1	2	3	4	5	6
8b	$C_{17}H_{13}F_3N_2O_4S_2$	47.31 47.44	3.10 3.04	3.04 (1H, dd, *J* = 6.0, *J* = 16.2, H-6); 3.51 (1H, d, *J* = 16.2, H-6); 6.22 (1H, d, *J* = 6.0, H-5); 6.41 (1H, d, Ar); 6.63 (1H, d, Ar); 7.22 (1H, s, Ar); 7.45 (2H, t, Ar); 7.68 (2H, m, Ar)	28.6, 71.5, 81.2 (q, *J* = 32.6, C–OH); 102.8, 111.3, 115.7, 123.5 (q, *J* = 285.9, CF_3); 124.2, 131.2, 132.2, 136.0, 138.8, 139.2, 156.9, 168.2
9b	$C_{12}H_{11}F_3N_2O_4S_2$	39.01 39.13	2.93 3.01	2.99 (1H, dd, *J* = 6.1, *J* = 16.1, H-6); 3.22 (3H, s, CH_3); 3.37 (1H, d, *J* = 16.1, H-6); 6.25 (1H, d, *J* = 6.1, H-5); 7.15 (1H, d, Ar); 7.30 (1H, s, Ar); 7.60 (1H, d, Ar)	28.5, 42.2, 71.1, 80.6 (q, *J* = 32.6, C–OH); 112.0, 117.6, 120.0, 124.2 (q, *J* = 285.5, CF_3); 125.4, 132.2, 158.3, 169.2
8c	$C_{17}H_{12}ClF_3N_2O_3S_2$	45.29 45.49	2.51 2.69	3.07 (1H, dd, *J* = 6.1, *J* = 16.0, H-6); 3.47 (1H, d, *J* = 16.0, H-6); 6.25 (1H, d, *J* = 6.1, H-5); 6.57 (1H, d, Ar); 7.04 (1H, d, Ar); 7.43 (2H, t, Ar); 7.68 (3H, m, Ar)	29.2, 72.2, 82.0 (q, *J* = 33.5, C–OH); 117.0, 123.6, 125.0 (q, *J* = 285.4, CF_3); 125.6, 126.2, 132.4, 132.8, 133.7, 137.0, 137.5, 140.4, 170.9
9c	$C_{12}H_{10}ClF_3N_2O_3S_2$	37.11 37.26	2.49 2.61	3.02 (1H, dd, *J* = 6.2, *J* = 16.1, H-6); 3.23 (3H, s, CH_3); 3.35 (1H, d, *J* = 16.2, H-6); 6.30 (1H, d, *J* = 6.2, H-5); 7.53 (1H, d, Ar); 7.68 (1H, s, CH-Ar); 7.74 (1H, d, CH-Ar)	28.8, 42.2, 71.4, 81.2 (q, *J* = 32.8, C–OH); 117.4, 124.3 (q, *J* = 285.4, CF_3); 125.0, 125.1, 131.7, 136.3, 136.8, 169.6
8d	$C_{17}H_{12}BrF_3N_2O_3S_2$	41.32 41.39	2.52 2.44	3.04 (1H, dd, *J* = 6.0, *J* = 16.0, H-6); 3.38 (1H, d, *J* = 16.0, H-6); 6.33 (1H, d, *J* = 6.0, H-5); 6.63 (1H, d, Ar); 7.29 (1H, d, Ar); 7.49 (2H, t, Ar); 7.71 (3H, m, Ar); 7.96 (1H, s, Ar)	28.1, 71.2, 80.8 (q, *J* = 32.7, C–OH); 116.5, 121.4, 123.9 (q, *J* = 285.5, CF_3); 124.8, 127.7, 131.4, 131.9, 133.1, 136.5, 136.8, 138.1, 168.8
9d	$C_{12}H_{10}BrF_3N_2O_3S_2$	33.26 33.42	2.15 2.34	2.99 (1H, dd, *J* = 6.1, *J* = 16.1, H-6); 3.23 (3H, s, CH_3); 3.33 (1H, d, *J* = 16.1, H-6); 6.27 (1H, d, *J* = 6.1, H-5); 7.70 (1H, d, Ar); 7.71 (1H, d, Ar); 7.97 (1H, s, Ar)	27.5, 41.2, 70.2, 79.7 (q, *J* = 32.5, C–OH); 116.9, 121.2, 124.1 (q, *J* = 285.5, CF_3); 124.3, 126.8, 133.0, 136.3, 168.1
8e	$C_{18}H_{15}F_3N_2O_3S_2$	50.31 50.46	3.39 3.53	2.27 (3H, s, CH_3); 3.08 (1H, dd, *J* = 6.1, *J* = 16.1, H-6); 3.52 (1H, d, *J* = 16.1, H-6); 6.24 (1H, d, *J* = 6.1, H-5); 6.41 (1H, d, Ar); 6.87 (1H, d, Ar); 7.39 (2H, t, Ar); 7.45 (1H, s, Ar); 7.64 (3H, m)	21.2, 28.5, 71.5, 81.3 (q, *J* = 32.6, C–OH); 114.7, 123.2, 124.4 (q, *J* = 285.5, CF_3); 125.2, 131.8, 131.9, 132.6, 135.6, 136.6, 139.2, 141.6, 169.4
9e	$C_{13}H_{13}F_3N_2O_3S_2$	42.49 42.62	3.41 3.58	2.40 (3H, s, CH_3); 3.02 (1H, dd, *J* = 6.0, *J* = 16.1, H-6); 3.23 (3H, s, CH_3); 3.38 (1H, d, *J* = 16.1, H-6); 6.32 (1H, d, *J* = 6.0, H-5); 7.45 (1H, d, Ar); 7.60 (1H, s, Ar); 7.65 (1H, d, Ar)	21.3, 28.4, 42.4, 71.1, 80.6 (q, *J* = 32.4, C–OH); 116.1, 123.7, 124.1 (q, *J* = 286.2, CF_3); 125.4, 132.4, 136.1, 141.9, 169.5

TABLE 1 (continued)

1	2	3	4	5	6
8f	$C_{17}H_{11}F_5N_2O_3S_2$	45.15 / 45.33	2.33 / 2.46	3.21 (1H, dd, *J* = 6.4, *J* = 16.5, H-6); 3.36 (1H, d, *J* = 16.5, H-6); 6.37 (1H, br. s, H-5); 6.75 (1H, t, Ar); 7.33 (1H, d, Ar); 7.48 (2H, t, Ar); 7.73 (3H, m, Ar)	29.6, 73.9, 82.2 (q, *J* = 32.5, C–OH); 113.2, 116.1, 121.7, 124.9 (q, *J* = 285.5, CF_3); 132.5, 133.2, 133.6, 135.5, 137.6, 140.1, 141.5, 169.4
9f	$C_{12}H_9F_5N_2O_3S_2$	37.23 / 37.11	2.52 / 2.34	3.10 (1H, dd, *J* = 6.1, *J* = 16.2, H-6); 3.24 (3H, s, CH_3); 3.27 (1H, d, *J* = 16.2, H-6); 6.41 (1H, d, *J* = 6.1, H-5); 6.79 (1H, t, Ar); 7.35 (1H, d, Ar)	29.4, 42.6, 73.1, 81.8 (q, *J* = 32.4, C–OH); 113.5, 116.0, 124.0, 124.3 (q, *J* = 286.4, CF_3); 132.4, 136.1, 141.6, 169.6
cis-**10f**	$C_{11}H_{15}F_5N_2OS$	42.69 / 42.86	1.51 / 1.64	5.85 (1H, d, *J* = 8.3, CH=); 7.08 (1H, m, Ph); 7.44 (1H, m, Ph); 8.08 (1H, dd, *J* = 8.3, *J* = 11.0, CH=)	94.8, 103.8, 105.9, 117.9 (q, *J* = 280.0, CF_3); 130.8, 133.3, 138.0, 149.3, 156.9, 162.1, 182.1 (q, *J* = 35.3, CF_3)
trans-**10f**				6.35 (1H, br. s, CH=); 7.08 (1H, m, Ph); 7.44 (1H, m, CH–Ph); 8.27 (1H, d, *J* = 13.9, CH=)	99.4, 103.8, 105.9, 118.4 (q, *J* = 278.2, CF_3); 130.0, 131.2, 135.8, 146.9, 154.4, 159.7, 183.3 (q, *J* = 35.4, CF_3)
cis-**10g**	$C_{13}H_{11}F_3N_2OS$	51.80 / 51.99	3.54 / 3.69	2.39 (3H, s, CH_3); 2.56 (3H, s, CH_3); 5.84 (1H, d, *J* = 8.0, CH=); 7.10 (1H, s, Ph); 7.46 (1H, s, Ph); 8.10 (1H, d, *J* = 8.0, CH=)	18.3, 21.7, 94.2, 118.1 (q, *J* = 280.1, CF_3); 120.5, 123.5, 126.4, 130.7, 136.9, 150.8, 156.8, 162.0, 182.2 (q, *J* = 35.4, CF_3)
trans-**10g**				2.39 (3H, s, CH_3); 2.56 (3H, s, CH_3); 6.46 (1H, br. s, CH=); 7.09 (1H, s, Ph); 7.43 (1H, s, Ph); 8.31 (1H, d, *J* = 13.6, CH=)	18.3, 21.7, 99.1, 118.5 (q, *J* = 278.8, CF_3); 120.7, 123.8, 126.4, 130.6, 136.4, 147.8, 154.5, 159.3, 183.5 (q, *J* = 35.2, CF_3)
cis-**10h**	$C_{11}H_5Cl_2F_3N_2OS$	38.64 / 38.73	1.30 / 1.48	5.85 (1H, d, *J* = 8.1, CH=); 7.10 (1H, s, Ph); 7.47 (1H, s, Ph); 8.09 (1H, dd, *J* = 8.1, CH=)	94.5, 103.9, 112.6, 118.1 (q, *J* = 279.8, CF_3); 126.8, 132.4, 137.6, 149.5, 156.8, 162.3, 182.2 (q, *J* = 35.4, CF_3)
trans-**10h**				6.33 (1H, br. s, CH=); 7.09 (1H, m, Ph); 7.45 (1H, m, Ph); 8.30 (1H, d, *J* = 13.7, CH=)	99.6, 104.0, 115.3, 118.6 (q, *J* = 278.6, CF_3); 130.1, 131.8, 136.8, 146.9, 154.3, 159.9, 183.5 (q, *J* = 35.3, CF_3)
8i	$C_{21}H_{15}F_3N_2O_3S_2$	54.22 / 54.30	3.31 / 3.26	3.04 (1H, dd, *J* = 6.0, *J* = 16.0, H-6); 3.38 (1H, d, *J* = 16.0, H-6); 6.33 (1H, d, *J* = 6.0, H-5); 6.63 (1H, d, Ar); 7.29 (1H, d, Ar); 7.49 (2H, t, Ar); 7.71 (3H, m, Ar); 7.96 (1H, s, Ar)	28.1, 71.2, 80.8 (q, *J* = 32.7, C-OH); 116.5, 121.4, 123.9 (q, *J* = 285.5, CF_3); 124.8, 127.7, 131.4, 131.9, 133.1, 136.5, 136.8, 138.1, 168.8
9i	$C_{16}H_{13}F_3N_2O_3S_2$	47.60 / 47.75	3.12 / 3.26	2.99 (1H, dd, *J* = 6.1, *J* = 16.1, H-6); 3.23 (3H, s, CH_3); 3.33 (1H, d, *J* = 16.1, H-6); 6.27 (1H, d, *J* = 6.1, H-5); 7.70 (1H, d, Ar); 7.71 (1H, d, Ar); 7.97 (1H, s, Ar)	27.5, 41.2, 70.2, 79.7 (q, *J* = 32.5, C-OH); 116.9, 121.2, 124.1 (q, *J* = 285.5, CF_3); 124.3, 126.8, 133.0, 136.3, 168.1

∗ IR spectrum, ν, cm^{-1}: 1100-1300 (CF_3), 1370-1385 (SO_2), 1590-1610 (C=C), 1655-1670 (C=O), 3100-3400 (OH).

∗[2] The spectra of compounds **3a,b, 4a,b**, and *cis*-**10f-h** were taken in CD_3CN; the spectra of compounds **3s, 4s, 7d-f** were taken in DMSO-d_6.

product only in the absence of a substituent in the 4 position of the starting 2-amino-1,3-benzothiazole. These data agree well with the values for the effective van der Waals radii of the atoms CH_3 (2.00 Å) > Cl (1.80 Å) > F (1.35 Å) > H (1.2 Å) [13].

We must note that the reaction of cyclization of sulfones **1, 2** with 2-amino-1,3-benzothiazoles occurs with regiospecific and stereospecific formation of the isomer with axial sulfonyl and hydroxy groups. In this case, the isomer **8, 9** is more favorable both from the standpoint of hydrogen bond formation and for steric reasons.

Thus we have studied the reaction of 2-aminothiazoles and their benzo and naphtho derivatives with β-sulfonyltrifluoromethylvinyldiols **1, 2**. We have found that the direction of the reaction is substantially affected by the steric bulk of the substituents in the starting aminothiazoles. The reaction of the sterically unhindered 2-aminothiazoles and their benzo and naphtho analogs with sulfones **1, 2** in acetonitrile leads to regiospecific formation of CF_3-containing 6,7-dihydro-5H-[1,3]thiazolo[3,2-*a*]pyrimidines **3, 6** and stereospecific 3,4-dihydro-2H-pyrimido[2,1-*b*][1,3]benzothiazoles **8, 9** respectively. In the case of 2-aminothiazoles and 2-amino-1,3-benzothiazoles containing bulky substituents, the reaction occurs with formation of the corresponding enamino ketones **7, 10**. We must note that the advantages of the synthesis are the simplicity of the reaction, the ease of separating the end products of the reaction, and the high yields.

EXPERIMENTAL

The ^1H and ^{13}C spectra were recorded on a Varian VXR-400 spectrometer (400 MHz and 100 MHz respectively) in a 95:5 CD_3CN–trifluoroacetic acid mixture, internal standard TMS. The IR spectra were obtained on a UR-20 spectrometer in vaseline oil. The TLC analysis was carried out on Silufol UV-254 plates with visualization in an acidified $KMnO_4$ solution and iodine vapors.

Synthesis of Compounds 3-10 (General Procedure). The corresponding 2-aminothiazole (1 mmol), dissolved in a minimal amount of acetonitrile, was added to a solution of sulfone **1**, **2** (1 mmol) in acetonitrile (5 ml) at room temperature. The reaction was monitored by TLC.

In the case of the heterocyclization reaction, the cycloadducts **3-6, 8, 9** formed were filtered out and washed with acetonitrile (3 × 1 ml). The oily cycloadducts **3b/5b** and **3c** were separated chromatographically. When enaminoketones **7, 10** were formed, the solvent was evaporated under vacuum. The enamino ketones were separated by column chromatography on silica gel.

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