4-Amino-5-(arylaminomethyl)-2-(methylthio)furo[2,3-*d*]pyrimidines via Mitsunobu Reaction of 4-Amino-5-(hydroxymethyl)-2-(methylthio)furo-[2,3-*d*]pyrimidine with *N*-Mesyl- and *N*-Nosylarylamines

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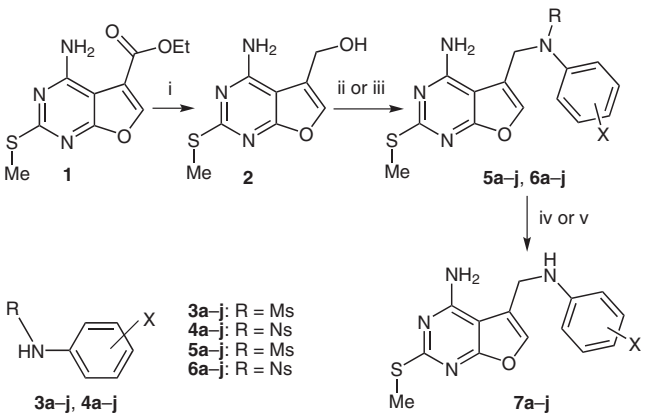
Abstract: An efficient method for the synthesis of 4-amino-5-(arylaminomethyl)-2-(methylthio)furo[2,3-*d*]pyrimidines via the Mitsunobu reaction of 4-amino-5-(hydroxymethyl)-2-(methylthio)furo[2,3-*d*]pyrimidine with *N*-mesyl- and *N*-nosylarylamines, and subsequent removal of the mesyl and nosyl groups, has been developed. The influence of substituents in the arylamine moiety on the Mitsunobu reaction was investigated. An unexpected nucleophilic substitution of a nitro group in the reaction of *N*-({4-amino-2-(methylsulfonyl)furo[2,3-*d*]pyrimidin-5-yl}methyl)-4-nitro-*N*-phenylbenzenesulfonamide with sodium methoxide was observed.

Key words: alkylation, sulfonamides, heterocycles, oxidation, nucleophilic aromatic substitution

Since the introduction of a new synthetic protocol for the preparation of esters in 1967 by Mitsunobu and co-workers,[1a] the reaction, now named after Mitsunobu himself, has become an excellent and versatile tool in synthetic organic chemistry. The Mitsunobu reaction allows the conversion of primary and secondary alcohols into esters, phenyl ethers, thioethers and various other compounds. For a successful course of the Mitsunobu reaction, the pK_a value of an acidic component, when diethyl azodicarboxylate (DEAD) is used, must be around 11 or lower.[1b] For this reason, anilines are out of the application range of the Mitsunobu reaction. On the other hand, the pK_a of *N*-sulfonylanilines is around this critical value and, therefore, they are suitable acidic components in the Mitsunobu reaction. Indeed, *N*-(4-methoxybenzyl)-2-nitro- and -4-nitrobenzenesulfonamides[2] were used for the synthesis of several secondary amines and *N*-(2-halophenyl- or -benzyl)toluenesulfonamides have been shown to undergo alkylation with 2-hydroxyacetaldehyde *O*-benzyloxime under the Mitsunobu reaction conditions to give precursors for indoles.[3] Some *N*-sulfonylamines have found application in the synthesis of non-peptide oxytocin receptor antagonists[4] and nitrogen heterocycles.[5] Notwithstanding these successful examples, the utility of *N*-arylsulfonamides for the synthesis of heterocycles containing secondary arylamines by the Mitsunobu reaction has been insufficiently explored. Meanwhile, the introduction of the arylaminomethyl moiety into heteroaromatic scaffolds is often one of the main steps in the synthesis of potent inhibitors of dihydrofolate reductase, thymidylate synthase and nicotinamide phosphoribosyltransferase.[6] In this connection and continuing our studies on the synthesis of 6/5-fused heterocycles with anticipated biological activities and light-emitting properties,[7] we present herein the synthesis of 4-amino-5-(arylaminomethyl)-2-(methylthio)furo[2,3-*d*]pyrimidines via the Mitsunobu reaction of the corresponding 5-(hydroxymethyl)furo[2,3-*d*]pyrimidine with various *N*-mesyl- and *N*-nosylarylamines. In order to study the scope and limitations of the reaction, a series of *N*-mesylarylamines **3a**–**j** and *N*-nosylarylamines **4a**–**j** bearing various substituents in different positions of the arylamine were employed in the Mitsunobu reaction. Some properties of the 4-amino-5-(arylaminomethyl)-2-(methylthio)furo[2,3-*d*]pyrimidines were also studied.

Initially, 4-amino-5-(hydroxymethyl)-2-(methylthio)furo[2,3-*d*]pyrimidine (**2**) was obtained in 72% yield by reduction of ethyl 4-amino-2-(methylthio)furo[2,3-*d*]pyrimidine-5-carboxylate[8] (**1**) with lithium aluminum hydride in tetrahydrofuran (Scheme 1). Problems with the isolation of 5-(hydroxymethyl)furo[2,3-*d*]pyrimidine **2** from the reaction mixture were solved by using saturated ammonium chloride solution for neutralization of the reaction mixture.



Scheme 1 *Reagents and conditions*: (i) 1. $LiAlH_4$, THF, –50 °C to r.t.; 2. sat. NH_4Cl; (ii) DEAD, Ph_3P, *N*-mesylarylamine **3a**–**j**, THF, 0 °C to r.t.; (iii) DEAD, Ph_3P, *N*-nosylarylamine **4a**–**j**, THF, 0 °C to r.t.; (iv) HBr, AcOH, PhOH, r.t., 10 d (method A); (v) $HSCH_2COOH$, $LiOH·H_2O$, DMF, r.t. (method B).

Compound **2** reacted with *N*-mesylarylamines **3a**–**j** and *N*-nosylarylamines **4a**–**j** under Mitsunobu reaction condi-

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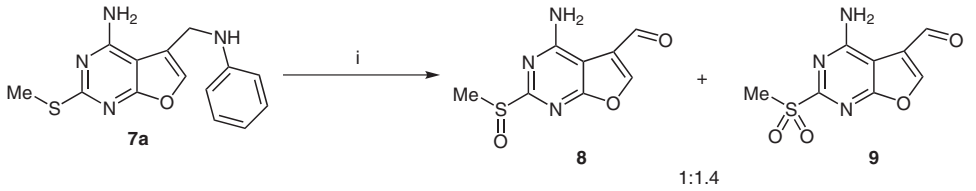


Scheme 2 *Reagents and conditions*: (i) MCPBA, CH_2Cl_2, r.t.

tions to form the corresponding furo[2,3-*d*]pyrimidines **5a–j** and **6a–j** (Scheme 1). The reaction was found to be dependent on the reagent addition order and the concentrations of solutions used. For example, when alcohol **2** (0.1 g) was added to the reaction mixture as a solution in tetrahydrofuran (8 mL) instead of as a suspension in tetrahydrofuran (4 mL), the reaction was 2–3 times slower, and full conversion of **2** was not achieved.

Full conversion of alcohol **2** was reached only when the addition order of reagents was as follows: To a cooled solution (0 °C) of triphenylphosphane in tetrahydrofuran, DEAD was introduced and, after 10 minutes, the corresponding *N*-sulfonylarylamine was added to the solution. Finally, a suspension of alcohol **2** in tetrahydrofuran was added. It is worth noting that these reactions require tetrahydrofuran that has been freshly distilled from lithium aluminum hydride. The reactions of alcohol **2** with sulfonamides **3a–i** and **4a–i** furnished the corresponding products **5a–i** and **6a–i** in good yields (Table 1). The reaction time was up to 1 hour. The *N*-nosyl derivatives **6a–j** were generally obtained in higher yields than the corresponding *N*-mesyl derivatives **5a–j**. The results presented in Table 1 for compounds **5** and **6** also show that the Mitsunobu reaction of alcohol **2** with the *N*-mesyl- and *N*-nosylarylamines does not depend very much on the electronic nature of the substituent in the arylamine moiety; however, steric hindrance of the reaction site seems to be important. Lower yields of the 2,6-diisopropyl derivatives **5j** and **6j** were obtained, presumably because of steric effects of the adjacent isopropyl groups in the sulfonamide moiety (Table 1, entry 10). Slightly lower yields were also obtained when other *ortho*-substituted sulfonamides were employed in the reaction of alcohol **2** (Table 1, entries 2, 5, 8; compounds **5b**, **5e**, **5h**, respectively). ^1H and ^{13}C NMR spectra as well as elemental analysis data of the synthesized compounds are consistent with the structures presented. In the ^1H NMR spectra of compounds **5e**, **5h** and **6e**, **6g**, **6h** geminal-type spin–spin coupling of the methylene protons with *J* from 11.4 to 15.3 Hz is observed (see experimental data).

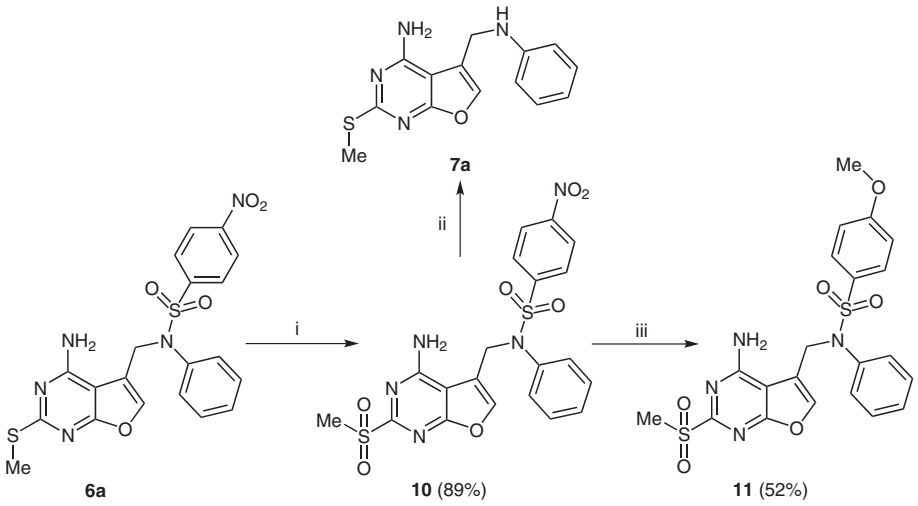
Removal of the *N*-mesyl group in **5a** to give compound **7a** was achieved with hydrogen bromide in acetic acid (Scheme 1). Phenol was used as a trap for the methylsulfonyl group. In general, the use of hydrogen bromide in acetic acid is a good, but time-consuming, method. Full conversion of **5a** and **5i** was achieved only in 10 days; the yields of **7a** and **7i** were 76% and 68% (method A), respectively. Moreover, this method can not be applied for removing the *N*-mesyl group from acid-sensitive substrates (e.g., **5b** or **5f**). Attempts to remove the mesyl group in compounds **5** with Red-Al® as a deprotection reagent[9] failed. Although the starting mesyl derivatives were consumed in 10–20 minutes, the target compounds were not obtained due to the formation of a complex mixture of products. In contrast, the nosyl derivatives **6a–j** can be deprotected under mild conditions via the Meisenheimer complex[2a] using sulfur nucleophiles. Using mercaptoacetic acid and lithium hydroxide monohydrate as a base, deprotected products **7a–i** were obtained in good yields (58–78%) (Scheme 1, method B; Table 1). It should be noted that sodium hydroxide as a base in this reaction did not work well.

Table 1 Yields of Mesyl Derivatives **5**, Nosyl Derivatives **6** and 4-Amino-5-(arylaminomethyl)-2-(methylthio)furo[2,3-*d*]pyrimidines **7**

Entry	X	Yield (%) of **5**	Yield (%) of **6**	Yield[a] (%) of **7**
1	H	**5a**: 73	**6a**: 82	**7a**: 75
2	2,5-$(MeO)_2$	**5b**: 60	**6b**: 83	**7b**: 77
3	4-Ac	**5c**: 78	**6c**: 78	**7c**: 78
4	4-Cl	**5d**: 58	**6d**: 74	**7d**: 74
5	2,5-Cl_2	**5e**: 44	**6e**: 73	**7e**: 58
6	3,4,5-$(MeO)_3$	**5f**: 79	**6f**: 84	**7f**: 70
7	2-O_2N	**5g**: 72	**6g**: 61	**7g**: 63
8	2,3-(–CH=CH–)$_2$	**5h**: 46	**6h**: 79	**7h**: 63
9	4-Ph	**5i**: 62	**6i**: 77	**7i**: 61
10	2,6-(*i*-Pr)$_2$	**5j**: 29	**6j**: 53	**7j**: 34

[a] Yields are for the deprotection reaction of **6a–j** with mercaptoacetic acid (method B).

Although the 2,4-diaminopyrimidine moiety is considered obligatory for dihydrofolate reductase inhibitors, other enzymes of the folic acid cycle are not strictly bound to this fragment. Thus, we thought it would be useful to have a procedure for the introduction of various groups into position 2 of furo[2,3-*d*]pyrimidines. This could be achieved by oxidation of the methylthio group in compounds **7**, and subsequent nucleophilic substitution of the obtained 2-methylsulfonyl derivatives; however, the reaction of compound **7a** with an excess of *m*-chloroperoxybenzoic acid (MCPBA, >3 equiv) gave an inseparable mixture of aldehydes **8** and **9** (Scheme 2).



Scheme 3 *Reagents and conditions*: (i) MCPBA, CH_2Cl_2, r.t.; (ii) $HSCH_2COOH$, $LiOH·H_2O$, DMF, r.t.; (iii) NaOMe, HMPA, r.t.

Therefore, another synthetic pathway to 2-substituted furo[2,3-*d*]pyrimidines was attempted. Oxidation of nosyl derivative **6a** with MCPBA proceeded unambiguously and compound **10** was obtained in 89% yield (Scheme 3). However, the deprotection of **10** with mercaptoacetic acid gave a mixture, from which furo[2,3-*d*]pyrimidine **7a** instead of the desired deprotection product was isolated. The methylsulfonyl group underwent reduction to the methylthio group, probably either by mercaptoacetic acid or by the deprotection byproduct (*p*-nitrophenylthio)acetic acid. In this connection, nucleophilic substitution of furo[2,3-*d*]pyrimidine **10** prior to its deprotection was investigated. It was found that substitution reactions with various nucleophiles (ammonia, *n*-butylamine, sodium phthalimide, urotropine and sodium methoxide) did not take place in solvents like methanol or tetrahydrofuran.

An unexpected result was obtained when performing the reaction of **10** with sodium methoxide in HMPA at room temperature (Scheme 3). In the ^{1}H NMR spectrum of the isolated compound **11** signals for a methoxy group at 3.90 ppm and a methylsulfonyl group at 3.32 ppm were observed. Significant changes were also observed in the region of the *para*-substituted aromatic system. Thus, in the ^{1}H NMR spectrum of nosyl derivative **10** two doublets at 7.98 and 8.50 ppm were observed, while the ^{1}H NMR spectrum of the obtained product **11** had two doublets at 7.20 and 7.63 ppm. The reason for such a change in the ^{1}H NMR spectrum could be due to the presence of an electron-donating methoxy substituent at the *para* position instead of a nitro group. The ^{13}C NMR and IR spectra, and elemental analysis data, are also consistent with the structure of compound **11**. Although displacement of a nitro group with nucleophiles is known in heterocyclic chemistry[10] such a reaction has, to the best of our knowledge, not been reported in carbocyclic aromatics.

In conclusion, the present investigation demonstrates that the introduction of various arylamino structural units into the 5-(hydroxymethyl)furo[2,3-*d*]pyrimidine scaffold can be easily achieved via the Mitsunobu reaction using *N*-mesyl- and *N*-nosylarylamines as acidic components. Several novel potential lipophilic antifolates of the furopyrimidine series bearing an aminomethylene linker between the aromatic and heterocyclic parts of the molecules have been synthesized. In general, the proposed procedure can be easily applied to the introduction of arylamino structural units into other classes of compounds and, thus, expands the application of the Mitsunobu reaction for the functionalization of anilines.

Melting points were determined in open capillaries with a digital melting point IA9100 series apparatus (Thermo Fischer Scientific) and are uncorrected. IR spectra were run in KBr discs on a Perkin–Elmer Spectrum BX II FT-IR spectrophotometer. ^{1}H and ^{13}C NMR spectra were recorded with a Varian Unity Inova spectrometer (300 MHz and 75 MHz for ^{1}H and ^{13}C NMR spectra, respectively) using residual solvent signals as the internal standard. Elemental analysis (C, H, N) results were found to be in good agreement (±0.4%) with the calculated values. All reactions and purity of the synthesized compounds were monitored by TLC using silica gel 60 F254 aluminum plates (Merck). Visualization was accomplished with UV light. Melting points and spectroscopic data of sulfonamides **3a**,[11] **3c**,[11a] **3g**,[11b] **4a**[11] and **4c**[11] corresponded to those reported in the literature. Compounds **3b**,[12a] **3d**,[12b] **3e**,[12b] **3f**,[12c] **3h**,[12b] **3i**,[12d] **3j**,[12e] **4d**,[12f] **4f**,[12g] **4h**[12h] and **4i**[12i] are mentioned in the corresponding references; however, their characterization does not contain some data and, therefore, missing data for these compounds are included below.

4-Amino-5-(hydroxymethyl)-2-(methylthio)furo[2,3-*d*]pyrimidine (2)

A mixture of compound **1** (4 g, 15.8 mmol) and THF (freshly distilled from $LiAlH_4$, 40 mL) was cooled to –50 °C and $LiAlH_4$ (0.9 g, 23.7 mmol) was added. The temperature of the mixture was raised to r.t. over 3 h, then the reaction mixture was neutralized with sat. NH_4Cl soln (about 40 mL). The layers were separated and the aqueous layer was washed with THF (2 × 20 mL). The combined organic layers were dried (Na_2SO_4) and concentrated under reduced pressure, and the residue was recrystallized to give compound **2**.

Yield: 2.40 g (72%); white solid; mp 209.5–212 °C (*n*-BuOH).

IR (KBr): 3340, 3310, 3270, 3178 cm^{-1} (NH_2, OH).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.48 (s, 3 H, SCH_3), 4.59 (d, ^3J = 4.2 Hz, 2 H, CH_2OH), 5.93 (t, ^3J = 4.2 Hz, 1 H, CH_2OH), 7.26 (s, 2 H, NH_2), 7.60 (s, 1 H, CH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.1, 55.0, 98.0, 120.9, 136.5, 159.1, 167.0, 168.2.

Anal. Calcd for $C_8H_9N_3O_2S$: C, 45.49; H, 4.29; N, 19.89. Found: C, 45.63; H, 4.39; N, 19.59.

***N*-Arylsulfonamides 3a–j, 4a–f, 4h–j; General Procedure**

To a soln of the corresponding aniline (20 mmol) and pyridine (1.74 g, 1.77 mL, 22 mmol) in CH_2Cl_2 (50 mL), cooled to 0 °C, the corresponding sulfonyl chloride (22 mmol) was added under argon atmosphere slowly to prevent the temperature from rising above 10 °C. Then, the reaction mixture was allowed to warm to r.t. and left overnight under stirring. The reaction mixture was quenched with 6 M NaOH (10 mL), and H_2O was added in an amount enough to extract all of the resultant salt to the aqueous phase. The obtained layers were separated, and the aqueous layer was washed with CH_2Cl_2 (2 × 10 mL), cooled to 0 °C and acidified to pH 2.0 with 18% HCl. The resulting precipitate was collected by filtration, washed with H_2O and recrystallized to give the corresponding *N*-arylsulfonamide **3a–j**, **4a–f**, **4h–j**.

***N*-(2,5-Dimethoxyphenyl)methanesulfonamide (3b)**

Yield: 2.73 g (59%); brown solid; mp 56.5–58 °C (toluene).

IR (KBr): 3295 cm^{-1} (NH).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.98 (s, 3 H, SO_2CH_3), 3.71 (s, 3 H, OCH_3), 3.79 (s, 3 H, OCH_3), 6.76 (dd, ^3J = 9.0 Hz, ^4J = 3.0 Hz, 1 H, Ar-H), 6.89 (d, ^4J = 3.0 Hz, 1 H, Ar-H), 7.01 (d, ^3J = 9.0 Hz, 1 H, Ar-H), 8.90 (s, 1 H, NH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 40.7, 56.1, 57.0, 111.0, 111.9, 113.4, 127.5, 146.9, 153.8.

***N*-(4-Chlorophenyl)methanesulfonamide (3d)**

Yield: 3.0 g (73%); white solid; mp 151–152 °C (benzene) (Lit.[12b] 148 °C).

IR (KBr): 3289 cm^{-1} (NH).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 3.02 (s, 3 H, SO_2CH_3), 7.23 (d, ^3J = 9.0 Hz, 2 H, Ar-H), 7.41 (d, ^3J = 9.0 Hz, 2 H, Ar-H), 9.93 (s, 1 H, NH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 40.0, 121.9, 128.5, 129.9, 138.1.

***N*-(2,5-Dichlorophenyl)methanesulfonamide (3e)**

Yield: 2.93 g (61%); white solid; mp 178–179 °C (*i*-PrOH) (Lit.[12b] 174 °C).

IR (KBr): 3251 cm^{-1} (NH).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 3.12 (s, 3 H, SO_2CH_3), 7.36 (dd, ^3J = 9.0 Hz, ^4J = 2.4 Hz, 1 H, Ar-H), 7.52 (d, ^4J = 2.4 Hz, 1 H, Ar-H), 7.58 (d, ^3J = 9.0 Hz, 1 H, Ar-H), 9.71 (s, 1 H, NH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 41.8, 127.0, 127.7, 127.8, 132.0, 132.6, 136.2.

***N*-(3,4,5-Trimethoxyphenyl)methanesulfonamide (3f)**

Yield: 4.29 g (82%); beige solid; mp 124–126 °C (benzene).

***N*-(Naphthalen-1-yl)methanesulfonamide (3h)**

Yield: 2.70 g (61%); beige solid; mp 127.5–129 °C (*i*-PrOH) (Lit.[12b] 125.5 °C).

IR (KBr): 3252 cm^{-1} (NH).

^{1}H NMR (300 MHz, $CDCl_3$): δ = 3.06 (s, 3 H, SO_2CH_3), 6.96 (s, 1 H, NH), 7.48–7.68 (m, 3 H, Ar-H), 7.71 (d, ^3J = 7.5 Hz, 1 H, Ar-H), 7.84 (d, ^3J = 8.4 Hz, 1 H, Ar-H), 7.94 (dd, ^3J = 7.5 Hz, ^4J = 1.5 Hz, 1 H, Ar-H), 8.10 (dd, ^3J = 9 Hz, ^4J = 1.5 Hz, 1 H, Ar-H).

^{13}C NMR (75 MHz, $CDCl_3$): δ = 40.0, 121.5, 123.0, 126.0, 126.8, 127.4, 127.8, 128.9, 129.0, 131.6, 134.7.

***N*-(Biphenyl-4-yl)methanesulfonamide (3i)**

Yield: 3.86 g (78%); beige solid; mp 180.5–181.5 °C (benzene).

IR (KBr): 3254 cm^{-1} (NH).

^{1}H NMR (300 MHz, $CDCl_3$): δ = 3.10 (s, 3 H, SO_2CH_3), 6.78 (s, 1 H, NH), 7.30–7.42 (m, 3 H, Ar-H), 7.44–7.52 (m, 2 H, Ar-H), 7.58–7.64 (m, 4 H, Ar-H).

^{13}C NMR (75 MHz, $CDCl_3$): δ = 39.7, 121.4, 127.2, 127.7, 128.6, 129.1, 136.1, 138.8, 140.3.

Anal. Calcd for $C_{13}H_{13}NO_2S$: C, 63.13; H, 5.30; N, 5.66. Found: C, 62.72; H, 5.18; N, 5.45.

***N*-(2,6-Diisopropylphenyl)methanesulfonamide (3j)**

Yield: 1.28 g (25%); beige solid; mp 99–99.5 °C (*i*-PrOH–H_2O).

IR (KBr): 3262 cm^{-1} (NH).

^{1}H NMR (300 MHz, $CDCl_3$): δ = 1.28 [d, ^3J = 6.9 Hz, 12 H, 2 × CH(CH_3)$_2$], 3.12 (s, 3 H, SO_2CH_3), 3.53 [septet, ^3J = 6.9 Hz, 2 H, 2 × C*H*(CH_3)$_2$], 6.09 (s, 1 H, NH), 7.20–7.41 (m, 3 H, Ar-H).

^{13}C NMR (75 MHz, $CDCl_3$): δ = 24.3, 28.8, 41.5, 124.4, 129.3, 129.6, 148.4.

Anal. Calcd for $C_{13}H_{21}NO_2S$: C, 61.14; H, 8.28; N, 5.48. Found: C, 61.05; H, 8.05; N, 5.11.

***N*-(2,5-Dimethoxyphenyl)-4-nitrobenzenesulfonamide (4b)**

Yield: 4.40 g (65%); yellow solid; mp 161.5–163 °C (*i*-PrOH).

IR (KBr): 3314 (NH), 1536, 1348 cm^{-1} (NO_2).

^{1}H NMR (300 MHz, $CDCl_3$): δ = 3.62 (s, 3 H, OCH_3), 3.80 (s, 3 H, OCH_3), 6.64 (dd, ^3J = 9.0 Hz, ^4J = 2.7 Hz, 1 H, Ar-H), 6.70 (d, ^3J = 9.0 Hz, 1 H, Ar-H), 7.13 (s, 1 H, NH), 7.20 (d, ^4J = 2.7 Hz, 1 H, Ar-H), 7.97 (d, ^3J = 9.0 Hz, 2 H, Ar-H), 8.28 (d, ^3J = 9.0 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, $CDCl_3$): δ = 56.1, 56.3, 108.4, 110.9, 111.7, 124.3, 125.5, 128.8, 144.1, 145.0, 150.4, 154.1.

Anal. Calcd for $C_{14}H_{14}N_2O_6S$: C, 49.70; H, 4.17. Found: C, 49.95; H, 4.34.

***N*-(4-Chlorophenyl)-4-nitrobenzenesulfonamide (4d)**

Yield: 4.38 g (70%); white solid; mp 182.5–184 °C (*i*-PrOH) (Lit.[12f] 189–190 °C).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 123.0, 125.5, 129.0, 129.7, 130.1, 136.6, 145.2, 150.6.

***N*-(2,5-Dichlorophenyl)-4-nitrobenzenesulfonamide (4e)**

Yield: 4.24 g (61%); beige solid; mp 170–171.5 °C (*i*-PrOH).

IR (KBr): 3270 (NH), 1530, 1348 cm^{-1} (NO_2).

^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.11 (br s, 1 H, NH), 7.15 (dd, ^3J = 8.7 Hz, ^4J = 2.4 Hz, 1 H, Ar-H), 7.25 (d, ^3J = 8.7 Hz, 1 H, Ar-H), 7.75 (d, ^4J = 2.4 Hz, 1 H, Ar-H), 8.00 (d, ^3J = 7.5 Hz, 2 H, Ar-H), 8.35 (d, ^3J = 7.5 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, $CDCl_3$): δ = 123.6, 124.2, 124.7, 127.4, 128.8, 130.7, 133.6, 134.3, 144.4, 150.8.

Anal. Calcd for $C_{12}H_8Cl_2N_2O_4S$: C, 41.51; H, 2.32. Found: C, 41.45; H, 2.25.

4-Nitro-*N*-(3,4,5-trimethoxyphenyl)benzenesulfonamide (4f)

Yield: 6.78 g (92%); beige solid; mp 146.5–148 °C (*i*-PrOH).

IR (KBr): 3165 (NH), 1531, 1353 cm^{-1} (NO_2).

^{13}C NMR (75 MHz, $CDCl_3$): δ = 56.5, 61.2, 100.6, 124.6, 128.8, 131.3, 136.8, 144.8, 150.5, 154.0.

***N*-(Naphthalen-1-yl)-4-nitrobenzenesulfonamide (4h)**

Yield: 4.79 g (73%); beige solid; mp 204–206.5 °C (*i*-PrOH).

IR (KBr): 3269 (NH), 1527, 1348 cm^{-1} (NO_2).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 123.6, 124.7, 125.3, 126.3, 127.0, 127.1, 128.1, 128.8, 129.1, 130.5, 132.3, 134.6, 146.2, 150.4.

Anal. Calcd for $C_{16}H_{12}N_2O_4S$: C, 58.53; H, 3.68. Found: C, 58.23; H, 3.77.

***N*-(Biphenyl-4-yl)-4-nitrobenzenesulfonamide (4i)**
Yield: 5.37 g (76%); beige solid; mp 186.5–188 °C (*i*-PrOH) (Lit.[12h] 191–192 °C).

IR (KBr): 3298 (NH), 1527, 1349 cm^{-1} (NO_2).

^1H NMR (300 MHz, DMSO-d_6): δ = 7.22 (d, ^3J = 8.7 Hz, 2 H, Ar-H), 7.28–7.37 (m, 1 H, Ar-H), 7.38–7.48 (m, 2 H, Ar-H), 7.60 (d, ^3J = 8.7 Hz, 4 H, Ar-H), 8.06 (d, ^3J = 8.7 Hz, 2 H, Ar-H), 8.41 (d, ^3J = 8.7 Hz, 2 H, Ar-H), 10.78 (s, 1 H, NH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 121.6, 125.5, 127.0, 128.1, 128.3, 129.0, 129.6, 137.0, 137.1, 139.8, 145.6, 150.6.

***N*-(2,6-Diisopropylphenyl)-4-nitrobenzenesulfonamide (4j)**
Isolation of the product was performed as follows: The reaction mixture was washed with 5% HCl (5 mL), and then with sat. $NaHCO_3$ soln (2 × 10 mL). The CH_2Cl_2 was evaporated and the residue was recrystallized to give compound **4j**.

Yield: 3.54 g (49%); beige solid; mp 117.5–119 °C (hexane).

IR (KBr): 3247 (NH), 1532, 1350 cm^{-1} (NO_2).

^1H NMR (300 MHz, $CDCl_3$): δ = 1.05 [d, ^3J = 6.9 Hz, 12 H, 2 × CH(CH_3)$_2$], 3.07 [septet, ^3J = 6.9 Hz, 2 H, 2 × CH(CH$_3$)$_2$], 6.27 (s, 1 H, NH), 7.17 (d, ^3J = 7.5 Hz, 2 H, Ar-H), 7.34 (dd, ^3J = 7.5, 7.5 Hz, 1 H, Ar-H), 7.99 (d, ^3J = 6.9 Hz, 2 H, Ar-H), 8.36 (d, ^3J = 6.9 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, $CDCl_3$): δ = 24.1, 28.9, 124.4, 124.5, 128.4, 129.0, 129.7, 146.1, 148.5, 150.3.

Anal. Calcd for $C_{18}H_{22}N_2O_4S$: C, 59.65; H, 6.12. Found: C, 59.74; H, 6.07.

4-Nitro-*N*-(2-nitrophenyl)benzenesulfonamide (4g)
To a soln of 2-nitroaniline (0.69 g, 5 mmol) in pyridine (11 mL), DMAP (0.67 g, 5.5 mmol) and nosyl chloride (1.22 g, 5.5 mmol) were added. The reaction mixture was heated at 60 °C (sand bath) for 6 h, then cooled to r.t. and acidified to pH 2 with 18% HCl. The product was extracted with CH_2Cl_2 (50 mL); the organic layer was additionally washed with 5% HCl, then quenched with 6 M NaOH (3 mL), and H_2O was added to dissolve the resultant anion. The obtained layers were separated, and the aqueous layer was washed with CH_2Cl_2 (2 × 10 mL), cooled to 0 °C and acidified to pH 2.0 with 18% HCl. The resulting precipitate was collected by filtration, washed with H_2O and recrystallized to give compound **4g**.

Yield: 0.66 g (41%); yellow solid; mp 156–157.5 °C (*i*-PrOH).

IR (KBr): 3244 (NH), 1539, 1353 cm^{-1} (NO_2).

^1H NMR (300 MHz, $CDCl_3$): δ = 7.28 (ddd, ^3J = 8.7, 7.8 Hz, ^4J = 1.2 Hz, 1 H, Ar-H), 7.69 (ddd, ^3J = 8.7, 7.8 Hz, ^4J = 1.5 Hz, 1 H, Ar-H), 7.89 (dd, ^3J = 8.7 Hz, ^4J = 1.4 Hz, 1 H, Ar-H), 8.08 (d, ^3J = 6.9 Hz, 2 H, Ar-H), 8.17 (dd, ^3J = 8.7 Hz, ^4J = 1.5 Hz, 1 H, Ar-H), 8.35 (d, ^3J = 6.9 Hz, 2 H, Ar-H), 9.97 (s, 1 H, NH).

^{13}C NMR (75 MHz, $CDCl_3$): δ = 121.6, 124.9, 125.2, 126.7, 128.8, 133.0, 136.5, 137.7, 144.5, 150.8.

Anal. Calcd for $C_{12}H_9N_3O_6S$: C, 44.58; H, 2.81. Found: C, 44.43; H, 2.72.

***N*-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-*N*-arylsulfonamides 5a–j, 6a–j; General Procedure**
To a cooled (ice bath) 0.6 M soln of Ph_3P (0.25 g, 0.95 mmol) in THF, DEAD (0.15 g, 0.134 mL, 0.85 mmol) was added. The mixture was stirred for 10 min, then a soln of the corresponding sulfonamide **3a–j**, **4a–j** (0.71 mmol) in a minimal amount of THF was added dropwise. After another 10 min, a suspension of alcohol **2** (0.1 g, 0.47 mmol) in THF (4 mL) was added over 3–5 min. The reaction mixture was stirred at r.t. until full conversion of the alcohol occurred (TLC monitoring, <1 h for all reactions). Then, H_2O was added to the reaction mixture, and the formed precipitate was collected by filtration, washed with Et_2O and recrystallized to give the corresponding compound **5a–j**, **6a–j**.

***N*-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-*N*-phenylmethanesulfonamide (5a)**
Yield: 125 mg (73%); white solid; mp 258–260 °C (MeCN).

IR (KBr): 3421, 3313, 3139 cm^{-1} (NH).

^1H NMR (300 MHz, DMSO-d_6): δ = 2.44 (s, 3 H, SCH_3), 3.19 (s, 3 H, SO_2CH_3), 4.97 (s, 2 H, CH_2), 7.25–7.42 (m, 7 H, Ar-H + NH_2), 7.44 (s, 1 H, CH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 37.0, 45.2, 96.8, 115.2, 128.8, 129.1, 129.7, 138.7, 139.7, 158.7, 167.3, 168.3.

Anal. Calcd for $C_{15}H_{16}N_4O_3S_2$: C, 49.43; H, 4.43; N, 15.37. Found: C, 49.12; H, 4.33; N, 15.14.

***N*-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-*N*-(2,5-dimethoxyphenyl)methanesulfonamide (5b)**
Yield: 120 mg (60%); white solid; mp 259.5–262 °C (MeCN).

IR (KBr): 3408, 3311, 3158 cm^{-1} (NH).

^1H NMR (300 MHz, DMSO-d_6): δ = 2.44 (s, 3 H, SCH_3), 3.19 (s, 3 H, SO_2CH_3), 3.58 (s, 3 H, OCH_3), 3.75 (s, 3 H, OCH_3), 4.84 (s, 2 H, CH_2), 6.56–6.65 (m, 1 H, Ar-H), 6.80–7.02 (m, 2 H, Ar-H), 7.18 (br s, 2 H, NH_2), 7.43 (s, 1 H, CH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 39.3, 44.1, 56.1, 56.6, 97.0, 113.7, 115.0, 115.3, 118.9, 126.5, 139.7, 151.4, 153.2, 158.8, 167.1, 168.2.

Anal. Calcd for $C_{17}H_{20}N_4O_5S_2$: C, 48.10; H, 4.75; N, 13.20. Found: C, 47.83; H, 4.68; N, 13.12.

***N*-(4-Acetylphenyl)-*N*-({4-amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)methanesulfonamide (5c)**
Yield: 150 mg (78%); white solid; mp 262–264 °C (MeCN–H_2O).

IR (KBr): 3432, 3374, 3328 cm^{-1} (NH).

^1H NMR (300 MHz, DMSO-d_6): δ = 2.44 (s, 3 H, SCH_3), 2.56 (s, 3 H, $COCH_3$), 3.22 (s, 3 H, SO_2CH_3), 5.06 (s, 2 H, CH_2), 7.23 (br s, 2 H, NH_2), 7.50 (s, 1 H, CH), 7.52 (d, ^3J = 9.0 Hz, 2 H, Ar-H), 7.93 (d, ^3J = 9.0 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 27.5, 37.3, 44.8, 96.7, 115.0, 128.8, 129.7, 136.6, 139.7, 142.8, 158.7, 167.3, 168.3, 197.8.

Anal. Calcd for $C_{17}H_{18}N_4O_4S_2$: C, 50.23; H, 4.46. Found: C, 50.49; H, 4.62.

***N*-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-*N*-(4-chlorophenyl)methanesulfonamide (5d)**
Yield: 110 mg (58%); white solid; mp 225–227 °C (*i*-PrOH).

IR (KBr): 3480, 3420, 3330 cm^{-1} (NH).

^1H NMR (300 MHz, DMSO-d_6): δ = 2.43 (s, 3 H, SCH_3), 3.19 (s, 3 H, SO_2CH_3), 4.96 (s, 2 H, CH_2), 6.90–7.60 (br s, 2 H, NH_2), 7.36 (d, ^3J = 9.0 Hz, 2 H, Ar-H), 7.42 (d, ^3J = 9.0 Hz, 2 H, Ar-H), 7.42 (s, 1 H, CH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 37.1, 45.1, 96.7, 115.0, 129.9, 130.9, 133.3, 137.5, 139.8, 158.7, 167.3, 168.3.

Anal. Calcd for $C_{15}H_{15}ClN_4O_3S_2$: C, 45.17; H, 3.79; N, 14.05. Found: C, 44.94; H, 3.71; N, 13.89.

***N*-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-*N*-(2,5-dichlorophenyl)methanesulfonamide (5e)**
Yield: 90 mg (44%); white solid; mp 244–247 °C (MeCN).

IR (KBr): 3401, 3155 cm^{-1} (NH).

^1H NMR (300 MHz, DMSO-d_6): δ = 2.45 (s, 3 H, SCH_3), 3.33 (s, 3 H, SO_2CH_3), 4.83 (d, ^2J = 11.4 Hz, 1 H, CH_aH$_b$), 5.06 (d, ^2J = 11.4 Hz, 1 H, CH$_a$$H_b$), 7.19 (br s, 2 H, NH_2), 7.38–7.56 (m, 3 H, Ar-H), 7.92 (d, ^4J = 2.1 Hz, 1 H, CH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 38.9, 45.4, 97.2, 114.2, 130.89, 130.94, 132.1, 132.9, 135.0, 137.5, 140.2, 158.8, 167.1, 168.2.

Anal. Calcd for $C_{15}H_{14}Cl_2N_4O_3S_2$: C, 41.58; H, 3.26; N, 12.93. Found: C, 41.51; H, 3.23; N, 12.86.

***N*-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-*N*-(3,4,5-trimethoxyphenyl)methanesulfonamide (5f)**
Yield: 170 mg (79%); white solid; mp 226.5–228.5 °C (MeCN).

IR (KBr): 3426, 3120 cm^{-1} (NH).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.44 (s, 3 H, SCH_3), 3.20 (s, 3 H, SO_2CH_3), 3.64 (s, 3 H, OCH_3), 3.73 (s, 6 H, 2 × OCH_3), 4.97 (s, 2 H, CH_2), 6.66 (s, 2 H, Ar-H), 7.18 (br s, 2 H, NH_2), 7.56 (s, 1 H, CH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 37.0, 45.2, 56.8, 60.7, 96.9, 106.9, 115.3, 134.4, 137.8, 139.7, 153.4, 158.7, 167.1, 168.2.

Anal. Calcd for $C_{18}H_{22}N_4O_6S_2$: C, 47.56; H, 4.88. Found: C, 47.94; H, 4.95.

***N*-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-*N*-(2-nitrophenyl)methanesulfonamide (5g)**
Yield: 140 mg (72%); yellow solid; mp 233–235 °C (*n*-BuOH).

IR (KBr): 3411, 3159 (NH); 1531, 1340 cm^{-1} (NO_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.45 (s, 3 H, SCH_3), 3.24 (s, 3 H, SO_2CH_3), 5.05 (br s, 2 H, CH_2), 7.10 (br s, 2 H, NH_2), 7.44 (s, 1 H, CH), 7.56–7.65 (m, 1 H, Ar-H), 7.76–7.85 (m, 2 H, Ar-H), 7.96 (d, ^3J = 7.2 Hz, 1 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 37.8, 44.8, 97.4, 114.1, 126.0, 130.0, 130.3, 131.4, 134.5, 140.3, 149.7, 159.0, 167.0, 168.1.

Anal. Calcd for $C_{15}H_{15}N_5O_5S_2$: C, 44.00; H, 3.69; N, 17.10. Found: C, 44.11; H, 3.67; N, 17.11.

***N*-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-*N*-(naphthalen-1-yl)methanesulfonamide (5h)**
Yield: 90 mg (46%); white solid; mp 200.5–201.5 °C (*i*-PrOH).

IR (KBr): 3453, 3362 cm^{-1} (NH).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.41 (s, 3 H, SCH_3), 3.34 (s, 3 H, SO_2CH_3), 4.90 (d, ^2J = 15.3 Hz, 1 H, CH_aH_b), 5.73 (d, ^2J = 15.3 Hz, 1 H, CH_aH_b), 7.19–7.70 (br s, 2 H, NH_2), 7.22 (s, 1 H, CH), 7.28–7.36 (m, 1 H, Ar-H), 7.41–7.48 (m, 1 H, Ar-H), 7.56–7.64 (m, 1 H, Ar-H), 7.85–7.97 (m, 3 H, Ar-H), 8.01–8.06 (m, 1 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 37.1, 46.7, 97.1, 114.5, 124.1, 125.9, 126.4, 126.9, 127.1, 128.4, 129.6, 133.7, 134.5, 135.9, 139.8, 158.6, 167.1, 168.0.

Anal. Calcd for $C_{19}H_{18}N_4O_3S_2$: C, 55.05; H, 4.38; N, 13.52. Found: C, 54.97; H, 4.28; N, 13.30.

***N*-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-*N*-(biphenyl-4-yl)methanesulfonamide (5i)**
Yield: 130 mg (62%); white solid; mp 258.5–260.5 °C (MeCN).

IR (KBr): 3462, 3416, 3364 cm^{-1} (NH).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.44 (s, 3 H, SCH_3), 3.22 (s, 3 H, SO_2CH_3), 5.02 (s, 2 H, CH_2), 7.23 (br s, 2 H, NH_2), 7.34–7.49 (m, 5 H, Ar-H), 7.50 (s, 1 H, CH), 7.62–7.69 (m, 4 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 37.0, 45.1, 96.8, 115.3, 127.4, 128.0, 128.5, 129.4, 129.7, 137.9, 139.66, 139.68, 140.4, 158.7, 167.3, 168.3.

Anal. Calcd for $C_{21}H_{20}N_4O_3S_2$: C, 57.25; H, 4.58; N, 12.72. Found: C, 57.34; H, 4.50; N, 12.72.

***N*-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-*N*-(2,6-diisopropylphenyl)methanesulfonamide (5j)**
Yield: 60 mg (29%); white solid; mp 219.5–221 °C (*n*-BuOH).

IR (KBr): 3456, 3392, 3350 cm^{-1} (NH).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 0.77 [d, ^3J = 6.8 Hz, 6 H, $CH(CH_3)_2$], 1.23 [d, ^3J = 6.8 Hz, 6 H, $CH(CH_3)_2$], 2.45 (s, 3 H, SCH_3), 2.95–3.07 [m, 2 H, 2 × $CH(CH_3)_2$], 3.34 (s, 3 H, SO_2CH_3), 4.76 (s, 2 H, CH_2), 7.09 (s, 1 H, CH), 7.16–7.35 (m, 3 H, Ar-H), 7.36 (br s, 2 H, NH_2).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 24.5, 25.2, 28.7, 40.6, 45.0, 97.4, 113.5, 125.3, 130.0, 132.0, 141.1, 149.9, 158.7, 167.1, 168.2.

Anal. Calcd for $C_{21}H_{28}N_4O_3S_2$: C, 56.22; H, 6.29. Found: C, 56.09; H, 6.34.

***N*-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-4-nitro-*N*-phenylbenzenesulfonamide (6a)**
Yield: 182 mg (82%); yellowish solid; mp 274.5–276 °C (DMF–H_2O).

IR (KBr): 3444, 3370, 3346 (NH), 1530, 1350 cm^{-1} (NO_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.44 (s, 3 H, SCH_3), 4.96 (s, 2 H, CH_2), 7.00–7.09 (m, 2 H, Ar-H), 7.25–7.35 (m, 3 H, Ar-H), 7.39 (s, 1 H, CH), 7.60 (br s, 2 H, NH_2), 7.97 (d, ^3J = 8.7 Hz, 2 H, Ar-H), 8.49 (d, ^3J = 8.7 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 45.6, 96.7, 114.6, 125.5, 129.0, 129.3, 129.9, 130.1, 137.6, 139.9, 142.3, 151.0, 158.7, 167.3, 168.2.

Anal. Calcd for $C_{20}H_{17}N_5O_5S_2$: C, 50.95; H, 3.63; N, 14.85. Found: C, 50.84; H, 3.51; N, 14.60.

***N*-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-*N*-(2,5-dimethoxyphenyl)-4-nitrobenzenesulfonamide (6b)**
Yield: 210 mg (83%); yellow solid; mp 248.5–250 °C (toluene).

IR (KBr): 3446, 3370, 3306 (NH), 1530, 1350 cm^{-1} (NO_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.45 (s, 3 H, SCH_3), 3.26 (s, 3 H, OCH_3), 3.59 (s, 3 H, OCH_3), 4.89 (br s, 2 H, CH_2), 6.55–6.57 (m, 1 H, Ar-H), 6.87–6.90 (m, 2 H, Ar-H), 7.19 (br s, 2 H, NH_2), 7.40 (s, 1 H, CH), 8.04 (d, ^3J = 8.9 Hz, 2 H, Ar-H), 8.46 (d, ^3J = 8.9 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 44.8, 55.9, 56.1, 97.0, 113.6, 114.7, 115.6, 118.4, 125.1, 125.5, 129.9, 140.0, 144.4, 150.7, 151.2, 153.1, 158.9, 167.2, 168.2.

Anal. Calcd for $C_{22}H_{21}N_5O_7S_2$: C, 49.71; H, 3.98. Found: C, 50.00; H, 3.94.

***N*-(4-Acetylphenyl)-*N*-({4-amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-4-nitrobenzenesulfonamide (6c)**
Yield: 187 mg (78%); yellowish solid; mp 289–290.5 °C (MeCN).

IR (KBr): 3480, 3446, 3384 (NH), 1528, 1352 cm^{-1} (NO_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.43 (s, 3 H, SCH_3), 2.55 (s, 3 H, $COCH_3$), 5.01 (s, 2 H, CH_2), 7.00–7.60 (br s, 2 H, NH_2), 7.27 (d, ^3J = 8.7 Hz, 2 H, Ar-H), 7.42 (s, 1 H, CH), 7.89 (d, ^3J = 8.7 Hz, 2 H, Ar-H), 8.00 (d, ^3J = 9.0 Hz, 2 H, Ar-H), 8.50 (d, ^3J = 9.0 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 27.5, 45.2, 96.6, 114.3, 125.6, 129.0, 129.8, 130.1, 136.9, 140.1, 141.6, 142.0, 151.1, 158.6, 167.4, 168.2, 197.8.

Anal. Calcd for $C_{22}H_{19}N_5O_6S_2$: C, 51.45; H, 3.73. Found: C, 51.88; H, 4.14.

***N*-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-*N*-(4-chlorophenyl)-4-nitrobenzenesulfonamide (6d)**
Yield: 177 mg (74%); beige solid; mp 273 °C (dec.) (MeCN).

IR (KBr): 3434, 3384 (NH_2), 1526, 1349 cm^{-1} (NO_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.44 (s, 3 H, SCH_3), 4.95 (s, 2 H, CH_2), 7.10 (d, ^3J = 9.0 Hz, 2 H, Ar-H), 7.22 (br s, 2 H, NH_2), 7.40 (d, ^3J = 9.0 Hz, 2 H, Ar-H), 7.41 (s, 1 H, CH), 7.98 (d, ^3J = 9.0 Hz, 2 H, Ar-H), 8.49 (d, ^3J = 9.0 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 45.4, 96.7, 114.4, 125.6, 129.9, 130.2, 130.8, 133.8, 136.5, 140.1, 142.0, 151.1, 158.7, 167.4, 168.3.

Anal. Calcd for $C_{20}H_{16}ClN_5O_5S_2$: C, 47.48; H, 3.19. Found: C, 47.48; H, 3.31.

_N_-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-_N_-(2,5-dichlorophenyl)-4-nitrobenzenesulfonamide (6e)
Yield: 185 mg (73%); yellowish solid; mp 255.5–257.5 °C (MeCN).

IR (KBr): 3479, 3433, 3377 (NH_2), 1531, 1350 cm^{-1} (NO_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.45 (s, 3 H, SCH_3), 4.68 (d, ^2J = 14.7 Hz, 1 H, CH_aH$_b$), 5.23 (d, ^2J = 14.7 Hz, 1 H, CH$_a$$H_b$), 7.21 (br s, 2 H, NH_2), 7.27 (d, ^4J = 2.1 Hz, 1 H, Ar-H), 7.34 (s, 1 H, CH), 7.44–7.55 (m, 2 H, Ar-H), 8.12 (d, ^3J = 8.7 Hz, 2 H, Ar-H), 8.53 (d, ^3J = 8.7 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 45.7, 97.1, 113.6, 125.6, 130.4, 130.8, 131.4, 132.3, 132.7, 134.8, 136.4, 140.5, 142.7, 151.2, 158.8, 167.3, 168.2.

Anal. Calcd for $C_{20}H_{15}Cl_2N_5O_5S_2$: C, 44.45; H, 2.80. Found: C, 44.35; H, 2.93.

_N_-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-4-nitro-_N_-(3,4,5-trimethoxyphenyl)benzenesulfonamide (6f)
Yield: 222 mg (84%); yellowish solid; mp 269 °C (dec) (MeCN).

IR (KBr): 3474, 3425, 3374 (NH_2), 1529, 1352 cm^{-1} (NO_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.45 (s, 3 H, SCH_3), 3.60 (s, 6 H, 2 × OCH_3), 3.63 (s, 3 H, OCH_3), 4.93 (br s, 2 H, CH_2), 6.36 (s, 2 H, Ar-H), 7.16 (br s, 2 H, NH_2), 7.53 (s, 1 H, CH), 8.03 (d, ^3J = 8.4 Hz, 2 H, Ar-H), 8.49 (d, ^3J = 8.4 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 45.8, 56.7, 60.7, 96.9, 106.9, 114.8, 125.3, 130.4, 133.5, 138.1, 139.9, 142.4, 151.0, 153.3, 158.7, 167.2, 168.2.

Anal. Calcd for $C_{23}H_{23}N_5O_8S_2$: C, 49.19; H, 4.13. Found: C, 49.46; H, 4.09.

_N_-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-4-nitro-_N_-(2-nitrophenyl)benzenesulfonamide (6g)
Yield: 149 mg (61%); yellow solid; mp 263–265.5 °C (MeCN).

IR (KBr): 3476, 3432, 3378 (NH_2), 1570, 1532, 1351 cm^{-1} (NO_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.45 (s, 3 H, SCH_3), 4.67 (d, ^2J = 13.5 Hz, 1 H, CH_aH$_b$), 5.36 (d, ^2J = 13.5 Hz, 1 H, CH$_a$$H_b$), 7.18 (br s, 2 H, NH_2), 7.20–7.39 (m, 2 H, CH + Ar-H), 7.49–7.76 (m, 2 H, Ar-H), 7.75–7.82 (m, 3 H, Ar-H), 8.48 (d, ^3J = 8.1 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 45.1, 97.4, 113.4, 125.7, 126.4, 129.7, 130.3, 130.4, 130.8, 134.4, 140.6, 141.8, 149.6, 151.2, 159.0, 167.1, 168.1.

Anal. Calcd for $C_{20}H_{16}N_6O_7S_2$: C, 46.51; H, 3.12. Found: C, 46.68; H, 2.89.

_N_-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-_N_-(naphthalen-1-yl)-4-nitrobenzenesulfonamide (6h)
Yield: 193 mg (79%); beige solid; mp 273 °C (dec) (MeCN).

IR (KBr): 3474, 3425, 3378 (NH_2), 1529, 1350 cm^{-1} (NO_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.41 (s, 3 H, SCH_3), 4.63 (d, ^2J = 14.4 Hz, 1 H, CH_aH$_b$), 5.53 (d, ^2J = 14.4 Hz, 1 H, CH$_a$$H_b$), 7.06 (d, ^3J = 7.2 Hz, 1 H, Ar-H), 7.14 (s, 1 H, CH), 7.30–7.52 (m, 5 H, NH_2 + Ar-H), 7.84–7.97 (m, 2 H, Ar-H), 8.00–8.12 (m, 3 H, Ar-H), 8.52 (d, ^3J = 8.7 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 47.0, 97.0, 113.9, 123.7, 125.6, 126.05, 126.09, 127.1, 127.2, 128.6, 130.0, 130.5, 133.5, 134.5, 134.7, 140.2, 142.1, 151.1, 158.6, 167.2, 168.0.

Anal. Calcd for $C_{24}H_{19}N_5O_5S_2$: C, 55.27; H, 3.67. Found: C, 55.43; H, 3.61.

_N_-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-_N_-(biphenyl-4-yl)-4-nitrobenzenesulfonamide (6i)
Yield: 197 mg (77%); yellowish solid; mp 281.5–284.5 °C (MeCN).

IR (KBr): 3479, 3441, 3377 (NH_2), 1530, 1349 cm^{-1} (NO_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.44 (s, 3 H, SCH_3), 5.00 (s, 2 H, CH_2), 7.18 (d, ^3J = 8.7 Hz, 2 H, Ar-H), 7.30–7.50 (m, 7 H, NH_2 + Ar-H), 7.59–7.76 (m, 3 H, Ar-H + CH), 8.01 (d, ^3J = 9.0 Hz, 2 H, Ar-H), 8.50 (d, ^3J = 9.0 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.1, 45.5, 96.8, 114.7, 125.5, 127.4, 127.9, 128.6, 129.4, 129.7, 130.2, 136.9, 139.4, 139.9, 140.4, 142.3, 151.0, 158.7, 167.4, 168.3.

Anal. Calcd for $C_{26}H_{21}N_5O_5S_2$: C, 57.03; H, 3.87. Found: C, 57.44; H, 3.69.

_N_-({4-Amino-2-(methylthio)furo[2,3-*d*]pyrimidin-5-yl}methyl)-_N_-(2,6-diisopropylphenyl)-4-nitrobenzenesulfonamide (6j)
Isolation of the product was performed as follows: The reaction mixture was concentrated and the residue was treated with Et_2O. The formed crystals were collected by filtration and dried to give compound **6j**.

Yield: 139 mg (53%); beige solid; mp 243–245 °C (MeCN).

IR (KBr): 3461, 3419, 3364 (NH_2), 1533, 1349 cm^{-1} (NO_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 0.62 [d, ^3J = 6.0 Hz, 6 H, CH(CH_3)$_2$], 0.89 [d, ^3J = 6.0 Hz, 6 H, CH(CH_3)$_2$], 2.47 (s, 3 H, SCH_3), 4.99 (s, 2 H, CH_2), 7.03 (s, 1 H, CH), 7.14 (d, ^3J = 7.8 Hz, 2 H, Ar-H), 7.33 (t, ^3J = 7.8 Hz, 1 H, Ar-H), 7.48 (br s, 2 H, NH_2), 8.33 (d, ^3J = 8.7 Hz, 2 H, Ar-H), 8.50 (d, ^3J = 8.7 Hz, 2 H, Ar-H); the CH(CH_3)$_2$ signals overlapped with residual DMSO signals.

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 24.8, 25.0, 29.0, 45.8, 97.3, 113.1, 125.61, 125.64, 130.0, 130.4, 130.6, 141.1, 145.6, 150.0, 150.8, 158.6, 167.3, 168.3.

Anal. Calcd for $C_{26}H_{29}N_5O_5S_2$: C, 56.20; H, 5.26. Found: C, 56.44; H, 5.13.

4-Amino-5-(arylaminomethyl)-2-(methylthio)furo[2,3-*d*]pyrimidines 7a–j; General Procedures
Method A: PhOH (64.0 mg, 0.68 mmol) and the corresponding *N*-mesyl derivative **5a** or **5i** (0.27 mmol) were added to HBr soln, prepared from acetyl bromide (5 mL) and H_2O (1.22 mL) at 0 °C. The reaction mixture was stirred at r.t. for 10 d, then poured onto crushed ice; 6 M NaOH was added to reach pH 14. The resulting precipitate was collected by filtration, washed with H_2O and recrystallized on demand to give compound **7a** or **7i**.

Method B: The *N*-nosyl derivative **6a**–**j** (0.545 mmol) was dissolved in DMF (3 mL), and $HSCH_2COOH$ (0.1 g, 76 μL, 1.09 mmol) was added dropwise. Then, LiOH·H_2O (0.18 g, 4.37 mmol) was added to the mixture. The reaction mixture was stirred at r.t. under argon atmosphere for 1 h, then quenched with H_2O (5–10 mL). The precipitate was collected by filtration and dissolved in CH_2Cl_2 (50 mL). The solution was washed with sat. $NaHCO_3$ soln (2 × 50 mL) and H_2O (2 × 50 mL), dried (Na_2SO_4) and concentrated under reduced pressure. The obtained residue was recrystallized to give the corresponding compound **7a**–**j**.

2-(Methylthio)-5-(phenylaminomethyl)furo[2,3-*d*]pyrimidin-4-amine (7a)
Yield: 59 mg (76%, method A), 117 mg (75%, method B); white solid; mp 292.5–294 °C (*i*-PrOH).

IR (KBr): 3410, 3281 cm^{-1} (NH).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.47 (s, 3 H, SCH_3), 4.29 (d, ^3J = 5.1 Hz, 2 H, CH_2), 6.18 (t, ^3J = 5.1 Hz, 1 H, NH), 6.66 (t,

^3J = 7.2 Hz, 1 H, Ar-H), 6.76 (d, ^3J = 7.5 Hz, 2 H, Ar-H), 7.13 (dd, ^3J = 7.2, 7.5 Hz, 2 H, Ar-H), 7.25 (br s, 2 H, NH_2), 7.71 (s, 1 H, CH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.1, 39.0, 97.8, 114.1, 118.1, 118.9, 129.6, 137.9, 149.0, 159.1, 166.9, 168.3.

Anal. Calcd for $C_{14}H_{14}N_4OS$: C, 58.72; H, 4.93; N, 19.57. Found: C, 58.54; H, 4.76; N, 19.42.

5-[(2,5-Dimethoxyphenylamino)methyl]-2-(methylthio)furo[2,3-*d*]pyrimidin-4-amine (7b)
Yield: 145 mg (77%, method B); white solid; mp 204–245.5 °C (benzene).

IR (KBr): 3358, 3300, 3126, 3110 cm^{-1} (NH + NH_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.45 (s, 3 H, SCH_3), 3.52 (s, 3 H, OCH_3), 3.74 (s, 3 H, OCH_3), 4.33 (d, ^3J = 4.8 Hz, 2 H, CH_2), 5.72 (t, ^3J = 4.8 Hz, 1 H, NH), 6.14 (dd, ^3J = 9 Hz, ^4J = 2.7 Hz, 1 H, Ar-H), 6.31 (d, ^4J = 2.7 Hz, 1 H, Ar-H), 6.72 (d, ^3J = 9 Hz, 1 H, Ar-H), 7.31 (br s, 2 H, NH_2), 7.74 (s, 1 H, CH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 38.5, 55.7, 56.7, 97.5, 99.4, 100.1, 111.4, 119.0, 138.3, 139.2, 142.3, 154.8, 158.9, 166.8, 168.4.

Anal. Calcd for $C_{16}H_{18}N_4O_3S$: C, 55.48; H, 5.24; N, 16.17. Found: C, 55.64; H, 5.16; N, 16.15.

5-[(4-Acetylphenylamino)methyl]-2-(methylthio)furo[2,3-*d*]pyrimidin-4-amine (7c)
Yield: 140 mg (78%, method B); white solid; mp 268–270.5 °C (acetone–H_2O).

IR (KBr): 3456, 3432, 3370, 3344, 3322 cm^{-1} (NH + NH_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.42 (s, 3 H, SCH_3), 2.47 (s, 3 H, $COCH_3$), 4.44 (d, ^3J = 3.9 Hz, 2 H, CH_2), 6.74 (d, ^3J = 9 Hz, 2 H, Ar-H), 7.03 (t, ^3J = 3.9 Hz, 1 H, NH), 7.15 (br s, 2 H, NH_2), 7.67 (s, 1 H, CH), 7.76 (d, ^3J = 9 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.1, 26.7, 38.2, 97.4, 112.4, 117.9, 126.5, 131.0, 138.2, 153.0, 158.9, 166.9, 168.4, 196.0.

Anal. Calcd for $C_{16}H_{16}N_4O_2S$: C, 58.52; H, 4.91; N, 17.06. Found: C, 58.66; H, 4.89; N, 17.28.

5-[(4-Chlorophenylamino)methyl]-2-(methylthio)furo[2,3-*d*]pyrimidin-4-amine (7d)
Yield: 130 mg (74%, method B); white solid; mp 221–222.5 °C (MeCN).

IR (KBr): 3443, 3278, 3204 cm^{-1} (NH + NH_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.47 (s, 3 H, SCH_3), 4.30 (d, ^3J = 4.8 Hz, 2 H, CH_2), 6.35 (br s, 1 H, NH), 6.75 (d, ^3J = 9.0 Hz, 2 H, Ar-H), 7.15 (d, ^3J = 9.0 Hz, 2 H, Ar-H), 7.17 (br s, 2 H, NH_2), 7.68 (s, 1 H, CH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.1, 39.0, 97.6, 115.3, 118.5, 121.2, 129.3, 138.0, 147.9, 159.0, 166.9, 168.3.

Anal. Calcd for $C_{14}H_{13}ClN_4OS$: C, 52.42; H, 4.08. Found: C, 52.34; H, 4.01.

5-[(2,5-Dichlorophenylamino)methyl]-2-(methylthio)furo[2,3-*d*]pyrimidin-4-amine (7e)
Yield: 112 mg (58%, method B); white solid; mp 218.5–220.5 °C (toluene).

IR (KBr): 3356, 3292, 3247 cm^{-1} (NH + NH_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.45 (s, 3 H, SCH_3), 4.48 (br s, 2 H, CH_2), 6.38 (br s, 1 H, NH), 6.65 (d, ^3J = 7.5 Hz, 1 H, Ar-H), 6.86 (s, 1 H, Ar-H), 7.27 (br s, 2 H, NH_2), 7.28 (d, ^3J = 7.5 Hz, 1 H, Ar-H), 7.75 (s, 1 H, CH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 38.0, 97.1, 112.0, 117.3, 117.6, 117.8, 130.8, 133.1, 138.7, 145.4, 158.7, 166.9, 168.4.

Anal. Calcd for $C_{14}H_{12}Cl_2N_4OS$: C, 47.33; H, 3.40. Found: C, 47.59; H, 3.24.

2-(Methylthio)-5-[(3,4,5-trimethoxyphenylamino)methyl]furo[2,3-*d*]pyrimidin-4-amine (7f)
Yield: 144 mg (70%, method B); white solid; mp 217.5–219 °C (EtOAc).

IR (KBr): 3406, 3295, 3224 cm^{-1} (NH + NH_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.47 (s, 3 H, SCH_3), 3.55 (s, 3 H, OCH_3), 3.71 (s, 6 H, 2 × OCH_3), 4.27 (br s, 2 H, CH_2), 5.98 (br s, 1 H, NH), 6.09 (s, 2 H, Ar-H), 7.25 (br s, 2 H, NH_2), 7.74 (s, 1 H, CH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.1, 39.4, 56.3, 60.8, 92.0, 97.9, 118.9, 130.4, 137.9, 145.7, 154.1, 159.1, 166.9, 168.3.

Anal. Calcd for $C_{17}H_{20}N_4O_4S$: C, 54.24; H, 5.36. Found: C, 54.30; H, 5.36.

2-(Methylthio)-5-[(2-nitrophenylamino)methyl]furo[2,3-*d*]pyrimidin-4-amine (7g)
Yield: 114 mg (63%, method B); intensive yellow solid; mp 227.5–229 °C (MeCN).

IR (KBr): 3495, 3370 (NH + NH_2), 1570, 1530 cm^{-1} (NO_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.44 (s, 3 H, SCH_3), 4.72 (br s, 2 H, CH_2), 6.70 (br s, 1 H, NH), 7.14 (d, ^3J = 8.1 Hz, 1 H, Ar-H), 7.35 (br s, 2 H, NH_2), 7.50 (s, 1 H, Ar-H), 7.78 (s, 1 H, NH), 8.06 (d, ^3J = 6.0 Hz, 1 H, Ar-H), 8.65 (br s, 1 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.0, 37.6, 96.8, 115.7, 116.4, 117.0, 126.9, 132.4, 136.9, 139.1, 145.1, 158.7, 167.0, 168.5.

Anal. Calcd for $C_{14}H_{13}N_5O_3S$: C, 50.75; H, 3.95. Found: C, 50.85; H, 4.03.

2-(Methylthio)-5-[(naphthalen-1-ylamino)methyl]furo[2,3-*d*]pyrimidin-4-amine (7h)
Yield: 115 mg (63%, method B); beige solid; mp 251–253.5 °C (MeCN).

IR (KBr): 3392, 3229, 3119 cm^{-1} (NH + NH_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.46 (s, 3 H, SCH_3), 4.51 (d, ^3J = 3.3 Hz, 2 H, CH_2), 6.61–6.85 (m, 2 H, NH + Ar-H), 7.18–7.56 (m, 6 H, NH_2 + Ar-H), 7.72–7.86 (m, 2 H, CH + Ar-H), 8.19 (d, ^3J = 6.9 Hz, 1 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.1, 38.9, 97.8, 105.7, 117.9, 118.6, 122.2, 124.5, 125.2, 126.5, 127.3, 128.8, 134.6, 138.4, 143.9, 159.0, 166.8, 168.4.

Anal. Calcd for $C_{18}H_{16}N_4OS$: C, 64.26; H, 4.79. Found: C, 64.47; H, 4.97.

5-[(Biphenyl-4-ylamino)methyl]-2-(methylthio)furo[2,3-*d*]pyrimidin-4-amine (7i)
Yield: 67 mg (68%, method A), 121 mg (61%, method B); beige solid; mp 222–223.5 °C (dioxane–H_2O).

IR (KBr): 3441, 3313, 3290 cm^{-1} (NH + NH_2).

^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.48 (s, 3 H, SCH_3), 4.35 (d, ^3J = 4.2 Hz, 2 H, CH_2), 6.36 (br s, 1 H, NH), 6.85 (d, ^3J = 7.8 Hz, 2 H, Ar-H), 7.25 (t, ^3J = 6.9 Hz, 1 H, Ar-H), 7.40 (dd, ^3J = 7.8, 6.9 Hz, 2 H, Ar-H), 7.42 (br s, 2 H, NH_2), 7.47 (d, ^3J = 8.4 Hz, 2 H, Ar-H), 7.54 (d, ^3J = 7.8 Hz, 2 H, Ar-H), 7.73 (s, 1 H, CH).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.1, 39.0, 97.7, 114.4, 118.8, 126.3, 126.7, 128.0, 129.5, 129.8, 138.0, 141.2, 148.5, 159.1, 166.9, 168.3.

Anal. Calcd for $C_{20}H_{18}N_4OS$: C, 66.28; H, 5.01. Found: C, 66.56; H, 5.09.

5-[(2,6-Diisopropylphenylamino)methyl]-2-(methylthio)furo[2,3-*d*]pyrimidin-4-amine (7j)
Yield: 69 mg (34%, method B); white solid; mp 154.5–156 °C (MeCN).

IR (KBr): 3437, 3307, 3154 cm^{-1} (NH + NH_2).

^1H NMR (300 MHz, DMSO-d_6): δ = 1.15 [d, ^3J = 5.7 Hz, 12 H, 2 × CH(CH_3)$_2$], 2.49 (s, 3 H, SCH_3), 3.32–3.35 [m, 2 H, 2 × C*H*(CH_3)$_2$], 3.96 (d, ^3J = 5.7 Hz, 2 H, CH_2), 4.45 (br s, 1 H, NH), 7.12 (s, 3 H, Ar-H), 7.63 (s, 1 H, CH), 7.79 (s, 2 H, NH_2).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 14.4, 24.6, 28.4, 47.0, 98.1, 117.4, 124.4, 125.7, 136.8, 141.4, 142.8, 158.6, 168.4, 168.5.

Anal. Calcd for $C_{20}H_{26}N_4OS$: C, 64.83; H, 7.07. Found: C, 65.05; H, 7.11.

4-Amino-2-(methylsulfinyl)furo[2,3-*d*]pyrimidine-5-carbaldehyde (8) and 4-Amino-2-(methylsulfonyl)furo[2,3-*d*]pyrimidine-5-carbaldehyde (9)
To a soln of compound **7a** (0.1 g, 0.35 mmol) in CH_2Cl_2 (5 mL), cooled to 0 °C, 77% MCPBA (0.26 g, 1.16 mmol) was added. The mixture was stirred at 0 °C for 10 min, left to reach r.t. and stirred for an additional 2 h. Then, the solvent was removed under reduced pressure. The residue was washed with Et_2O (15 mL) to give 56 mg of a yellowish mixture consisting of **8** and **9** in the ratio 1:1.4 (from ^1H NMR data).

IR (KBr): 3385, 3299, 3236, 3192 (NH_2), 1674, 1641 cm^{-1} (CO).

Compound 8
^1H NMR (300 MHz, DMSO-d_6): δ = 2.85 (s, 3 H, $SOCH_3$), 7.65 (s, 1 H, NH_2), 8.60 (s, 1 H, NH_2), 8.98 (s, 1 H, CH), 9.97 (s, 1 H, CH).

Compound 9
^1H NMR (300 MHz, DMSO-d_6): δ = 3.35 (s, 3 H, SO_2CH_3), 7.77 (s, 1 H, NH_2), 8.82 (s, 1 H, NH_2), 9.07 (s, 1 H, CH), 9.99 (s, 1 H, CH).

***N*-{(4-Amino-2-(methylsulfonyl)furo[2,3-*d*]pyrimidin-5-yl)methyl}-4-nitro-*N*-phenylbenzenesulfonamide (10)**
To a soln of compound **6a** (1.0 g, 2.12 mmol) in CH_2Cl_2 (10 mL), cooled to 0 °C, 77% MCPBA (1.57 g, 7 mmol) was added. The mixture was stirred at 0 °C for 2 h, left to reach r.t. and stirred for an additional 12 h. Then, CH_2Cl_2 was removed under reduced pressure. The residue was dissolved in boiling MeCN and quenched with sat. $NaHCO_3$ soln. The resulting precipitate was collected by filtration, washed with H_2O and recrystallized.

Yield: 0.95 g (89%); white solid; mp 279–281 °C (MeCN).

IR (KBr): 3461, 3358 (NH_2), 1351 cm^{-1} (NO_2).

^1H NMR (300 MHz, DMSO-d_6): δ = 3.32 (s, 3 H, SO_2CH_3), 5.07 (s, 2 H, CH_2), 6.90–7.50 (br s, 2 H, NH_2), 7.11 (s, 2 H, Ar-H), 7.32 (br s, 3 H, Ar-H), 7.78 (s, 1 H, CH), 7.98 (d, ^3J = 8.7 Hz, 2 H, Ar-H), 8.50 (d, ^3J = 8.7 Hz, 2 H, Ar-H).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 39.8, 45.4, 101.9, 115.4, 125.5, 129.0, 129.4, 130.0, 130.1, 137.6, 142.3, 143.7, 151.0, 159.9, 161.7, 166.5.

Anal. Calcd for $C_{20}H_{17}N_5O_7S_2$: C, 47.71; H, 3.40. Found: C, 47.95; H, 3.42.

***N*-{(4-Amino-2-(methylsulfonyl)furo[2,3-*d*]pyrimidin-5-yl}methyl)-4-methoxy-*N*-phenylbenzenesulfonamide (11)**
To a soln of compound **10** (0.2 g, 0.40 mmol) in HMPA (3 mL), NaOMe (0.075 g, 1.39 mmol) was added. The mixture was stirred at r.t. for 3 h, and then brine was poured into the reaction mixture. The resulting precipitate was collected by filtration, washed with H_2O and recrystallized.

Yield: 100 mg (52%); white solid; mp 220–222 °C (MeOH).

IR (KBr): 3450, 3354 cm^{-1} (NH_2).

^1H NMR (300 MHz, DMSO-d_6): δ = 3.32 (s, 3 H, SO_2CH_3), 3.90 (s, 3 H, OCH_3), 4.92 (br s, 2 H, CH_2), 7.06 (br s, 2 H, Ar-H), 7.20 (d, ^3J = 7.8 Hz, 2 H, Ar-H), 7.23–7.40 (m, 3 H, Ar-H), 7.63 (d, ^3J = 7.8 Hz, 2 H, Ar-H), 7.75 (s, 1 H, CH), 8.66 (br s, 2 H, NH_2).

^{13}C NMR (75 MHz, DMSO-d_6): δ = 39.7, 44.7, 56.6, 102.1, 115.4, 115.5, 128.1, 128.8, 128.9, 129.7, 130.8, 138.2, 143.7, 159.9, 161.7, 163.4, 166.5.

Anal. Calcd for $C_{21}H_{20}N_4O_6S_2$: C, 51.63; H, 4.13. Found: C, 51.88; H, 4.18.

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