ORIGINAL ARTICLE

NEW SYNTHESIS OF DIPHENYLSULPHONAMIDES COMPOUNDS WITH PHARMACOLOGICAL PROPERTIES. NOTE II

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Abstract

A series of sulfonylurea derivatives was synthesized, using as a starting point the corresponding azide. This was subjected to Curtis degradation, after which it was condensed with primary aromatic amines. The structures of the new derivatives were confirmed by elemental analysis and spectrometry in IR and NMR.

Rezumat

O serie de derivați de sulfoniluree a fost sintetizată, pornindu-se de la azida corespunzătoare. Aceasta a fost supusă unei degradări Curtius, după care a fost condensată cu amine aromatice primare. Structurile noilor derivați au fost confirmate prin analiză elementală şi spectometrie în IR şi RMN.

Keywords: benzenesulfonamide, urea-derivatives, sulfonylurea

Introduction

In 1932, Gerhardt Domagk used for the first time a sulfonamide compound to treat a streptococcal infection and it was revealed that the substance is highly antibacterial and not toxic. It was named Protonsil® and it was the pioneer of antimicrobial chemotherapy era [4]. Because of the structural similarity with the para-aminobenzoic acid, the sulfonamides inhibit the activity of the enzyme dihydropteroate synthase and prevent the synthesis of folic acid, known as vitamin B9, an essential compound for the life of bacteria [2]. Other sulfonamides derivatives are used for their diuretic and anti-hypertensive effects [5]. New pharmacological actions were attributed to this class of compounds after new studies were performed: antiglaucoma [8], inhibition of carbonic anhydrase [13], inhibition of matrix metalloproteinases [7], free radical scavenging and modulation of cholinesterase activity [1]. New studies have revealed that N-substituted heterocyclic sulfonamides can intercalate between the bases of the DNA chain, by coordinating biologically important metallic ions [6].

Literature survey has showed that the urea moiety presents a large spectrum of pharmacological actions that can be found useful. The antitumor action of urea derivatives appears because of the good inhibitory potencies against EGFR (the epidermal growth factor receptor) and VEGFR-2 (member of vascular endothelial growth factor receptors) [18]. Also, it was demonstrated that they inhibit the c – Kit receptor, a subclass III tyrosine kinase receptor, whose aberrant expression was observed in leukaemia, tumours of gastrointestinal tract and germ cells [12]. The compounds presented an inhibitory activity on p38α mitogen activated protein kinase, a major target in developing anti – inflammatory drugs, mainly because p38α is responsible for the biosynthesis of inflammatory cytokines like tumour necrosis factor-α and interleukin-1β. Also, an antioxidant activity was observed. The anti-tuberculosis activity of urea derivatives is enhanced by two mechanisms: the inhibition of acetohydroxyacid synthase, a key enzyme in the biosynthesis of branched – chain amino acids used by *Mycobacterium tuberculosis* [17] and the inhibition of epoxide hydrolases. It was observed that by changing the central ureic radical, the activity of the compounds was modified [9, 10]. In some studies, it was observed that the compounds have a good anti-proliferative action [3], antidepressant activity, antiulcerogenic, antiacetylcholinesterase, and also antiviral or antitrypanosomal activities [15].

Sulfonylureas were used starting with the 20th century for their antidiabetic action. They stimulate the insulin secretion by the endocrine pancreas and induce the

migration and extrusion of insulin granules [4]. In modern times, new ureido-substituted sulfonamides were tested and they showed inhibitory action on the carbonic anhydrases (CAs), with selectivity for the hCA I isoform over the dominant one, hCA II (normally hCA II has higher affinity for sulfonamides) [11]. By molecular docking of some compounds containing sulfonamide and urea moieties, it was observed that both of the radicals have an important role in the anti-convulsant activity of some new substances [16].

We are presenting in this article, a method for obtaining original sulfonamides derivatives with urea moiety.

Materials and Methods

Reagents and instruments

Melting points were measured in open capillary tubes on an Electrothermal 9100 apparatus and are uncorrected.

The Fourier-transform infrared (FT-IR) spectra of the all synthesized compounds were performed on a Bruker Vertex 70 FT-IR spectrometer (Bruker Corporation, Billerica, MA, USA). The spectra were acquired with 32 scans over a range of 400 cm^{-1} to 4000 cm^{-1}. The spectral resolution was 4 cm^{-1}. The signal intensities (height) were denoted by the following abbreviations: w = weak, m = medium, s = strong, v = variable. The NMR spectra were recorded using a Gemini 300BB instrument at room temperature, operating at 300 MHz for ^{1}H and 75 MHz for ^{13}C or Bruker Avance III 500 MHz. The chemical shifts were recorded in δ units (ppm), relative to residual peak of the deuterated solvent (DMSO-d6). Tetramethylsilane was used as internal standard. The coupling constants values are reported in Hertz and the splitting patterns are abbreviated as follows: s, singlet; d, doublet; t, triplet; m, multiplet; b, broad; dd, double doublet; td, triple doublet; tt, triple triplet. The elemental analysis was performed on a Perkin Elmer CHNS/O Analyser Series II 2400 apparatus and the results were in agreement with the calculated values.

All starting materials and solvents were purchased from commercial suppliers and used without purification, unless otherwise noted.

Compound synthesis

In order to obtain new compounds, we used as a starting point the azide (I). We synthesized it using the technique described in a previously published article [14].The azide was treated with substituted aromatic amines in dioxane, following the general procedure described in Figure 1.

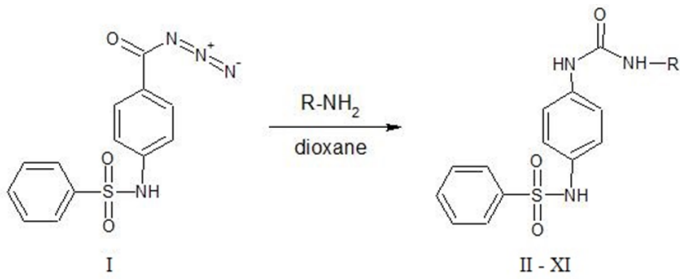


Figure 1.
Synthesis of new derivatives of N-[4-[(phenylcarbamoyl)amino]phenyl]benzenesulfonamide (II - XI)

0.00074 mole of azide I were dissolved in 15 mL dioxane. The solution was added gradually in a warm two neck round bottom flask using a dropping funnel. The solution was refluxed for about an hour (following the Curtius degradation of azide resulting the isocyanate) and we added the equimolecular quantities of amine dissolved in 5 mL dioxane using the same dropping funnel. We continued the heating under reflux for about another hour. After concentration at vacuum, the crude compound was recrystallized from ethanol.

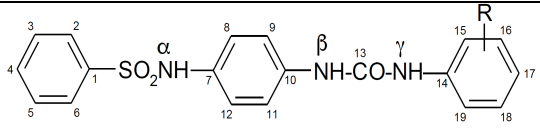
Results and Discussion

Using the general method, we obtained ten new derivatives of N-[4-[(phenylcarbamoyl)amino]phenyl]-benzenesulfonamide having diverse aromatic moieties. The structures were confirmed by elemental analysis, IR and NMR spectra.

The structures of the new compounds, molecular formula, molecular mass, melting points and yields are presented in Table I (the carbon atoms numbering was done in close correlation with the signals attribution of nuclear magnetic resonance spectra as it is described below).

Table I

Characterization data of the new compounds



No.	R	Molecular formula	Molecular mass	m.p. (ºC)	Yield (%)
II	H	$C_{19}H_{17}N_3O_3S$	367.428	180 - 182	68.30
III	*ortho* – CH_3	$C_{20}H_{19}N_3O_3S$	381.448	194 - 195	57.30
IV	*meta* – CH_3	$C_{20}H_{19}N_3O_3S$	381.448	196 - 197	59.20
V	*para* – CH_3	$C_{20}H_{19}N_3O_3S$	381.448	223 - 224	78.78
VI	*ortho* – OCH_3	$C_{20}H_{19}N_3O_4S$	397.442	169 - 170	37.81
VII	*meta* – OCH_3	$C_{20}H_{19}N_3O_4S$	397.442	182 - 183	55.01
VIII	*para* – OCH_3	$C_{20}H_{19}N_3O_4S$	397.442	210 - 211	34.37
IX	*ortho* – OCH_2CH_3	$C_{21}H_{21}N_3O_4S$	411.468	184 - 185	58.10
X	*meta* – OCH_2CH_3	$C_{21}H_{21}N_3O_4S$	411.468	177 - 278	71.38
XI	*para* – OCH_2CH_3	$C_{21}H_{21}N_3O_4S$	411.468	213 - 214	53.12

In the following are presented the results of elemental analysis ^{1}H and ^{13}C magnetic resonance analysis for the compounds II – XI.

Compound II: N-[4-[(phenylcarbamoyl)amino]-phenyl]benzenesulfonamide

^{1}H-NMR (DMSO-d6, δ ppm, *J* Hz): 10.00(bs, 1H, H-α, deuterable); 8.59 (s, 1H, HN, H-γ, deuterable); 8.57 (s, 1H, HN, H-β, deuterable); 7.70 (dd, 2H, H-2, H-6, 0.8, 8.6); 7.60 (tt, 1H, H-4, 0.8, 8.6); 7.53 (t, 2H, H-3, H-5, 8.6); 7.40 (d, 2H, H-15, H-19, 7.8); 7.28 (d, 2H, H-9, H-11, 8.6); 7.25 (t, 2H, H-16, H-18, 7.8); 6.97 (d, 2H, H-8, H-12, 8.6); 6.95 (t, 1H, H-17, 7.8).

^{13}C-NMR (DMSO-d6, δ ppm): 152.47 (C-13); 139.65 (C-1); 139.48 (C-14); 136.60 (C-7); 131.33 (C-10); 132.77 (C-4); 129.18 (C-3, C-5); 128.79 (C-, C-); 126.69 (C-2, C-6); 122.15 (C-8, C-12); 121.82 (C-17); 118.89 (C-9, C-11); 118.16 (C-, C-).

FT-IR (solid in ATR, ν cm^{-1}): 3352 m; 3232 s; 3043 w; 1651 s; 1598 s; 1548 vs; 1512 s; 1499 s; 1443 s; 1394 m; 1322 s; 1311 s; 1288 m; 1238 m; 1213 m; 1165 s; 1091 m; 917 m; 756 m; 732 m; 693 s; 663 m.

Elemental analysis: Calculated: C 62.10%, H 4.66%, N 11.43%, S 8.72%; Found C 62.25%, H 4.51%, N 11.40%, S 8.81%.

Compound III: N-[4-[(2-methylphenylcarbamoyl)-amino]phenyl]benzenesulfonamide

^{1}H-NMR (DMSO-d6, δ ppm, *J* Hz): 10.00 (bs, 1H, H-α, deuterable); 8.93 (s, 1H, HN, H-β, deuterable); 7.85 (s, 1H, HN, H-γ, deuterable); 7.78 (d, 1H, H-19, 8.0); 7.70 (dd, 2H, H-2, H-6, 0.8, 8.6); 7.60 (tt, 1H, H-4, 0.8, 8.6); 7.53 (t, 2H, H-3, H-5, 8.6); 7.28 (d, 2H, H-9, H-11, 8.6); 7.15 (d, 1H, H-16, 8.0); 7.11 (t, 1H, H-17, 8.0); 6.98 (d, 2H, H-8, H-12, 8.6); 6.92 (t, 1H, H-18, 8.0); 2.20 (s, 3H, H-20).

^{13}C-NMR (DMSO-d6, δ ppm): 152.59 (C-13); 139.48 (C-1); 137.34 (C-14); 136.82 (C-7); 131.22 (C-10); 127.49 (C-15); 132.77 (C-4); 130.19 (C-19); 129.18 (C-3, C-5); 126.69 (C-2, C-6); 126.16 (C-16); 122.69 (C-17); 122.28 (C-8, C-12); 121.02 (C-18); 118.62 (C-9, C-11); 17.88 (C-20).

FT-IR (solid in ATR, ν cm^{-1}): 3398 s; 3344 s; 3128 m; 1682 vs; 1588 m; 1536 s; 1505 s; 1481 m; 1447 s; 1390 m; 1316 s; 1237 m; 1211 m; 1151 vs; 1089 m; 914 m; 742 m; 723 m; 680 w.

Elemental analysis: Calculated: C 62.97%, H 5.02%, N 11.01%, S 8.40%; Found C 62.70%, H 5.12%, N 11.35%, S 8.30%.

Compound IV: N-[4-[(3-methylphenylcarbamoyl)-amino]phenyl]benzenesulfonamide

^{1}H-NMR (DMSO-d6, δ ppm, *J* Hz): 10.00 (bs, 1H, H-α, deuterable); 8.56 (s, 1H, HN, H-β, deuterable); 8.52 (s, 1H, HN, H-γ, deuterable); 7.70 (dd, 2H, H-2, H-6, 0.8, 8.6); 7.60 (tt, 1H, H-4, 0.8, 8.6); 7.53 (t, 2H, H-3, H-5, 8.6); 7.29 (d, 2H, H-9, H-11, 8.6); 7.25 (t, 1H, H-15, 1.4); 7.19 (dd, 1H, H-19, 1.4, 7.8); 7.13 (t, 1H, H-18, 7.8); 6.97 (d, 2H, H-8, H-12, 8.6); 6.76 (dd, 1H, H-17, 1.4, 7.8); 2.25 (s, 3H, H-20).

^{13}C-NMR (DMSO-d6, δ ppm): 152.44 (C-13); 139.57 (C-1); 139.48 (C-14); 137.95 (C-16); 136.64 (C-7); 131.31 (C-10); 132.77 (C-4); 129.18 (C-3, C-5); 126.69 (C-2, C-6); 122.16 (C-8, C-12); 118.85 (C-9, C-11); 128.63 (C-18); 122.57 (C-17); 118.67 (C-15); 115.34 (C-19); 21.23 (C-20).

FT-IR (solid in ATR, ν cm^{-1}): 3304 m; 3269 m; 3149 w; 3099 w; 1641 vs; 1606 s; 1555 vs; 1510 vs; 1486 s; 1459 s; 1399 m; 1332 m; 1293 m; 1248 m; 1216 s; 1157 vs; 1087 m; 915 m; 833 w; 811 w; 772 w; 758 m; 728 m; 686 s.

Elemental analysis: Calculated: C 62.97%, H 5.02%, N 11.01%, S 8.40%; Found C 62.80%, H 5.08%, N 11.20%, S 8.35%.

Compound V: N-[4-[(4-methylphenylcarbamoyl)-amino]phenyl]benzenesulfonamide

^{1}H-NMR (DMSO-d6, δ ppm, *J* Hz): 9.98 (bs, 1H, HN-SO_2, deuterable); 8.54 (s, 1H, HN, deuterable); 8.49 (s, 1H, HN, deuterable); 7.71 (dd, 2H, H-2, H-6,

0.8, 8.6); 7.60 (tt, 1H, H-4, 0.8, 8.6); 7.53 (t, 2H, H-3, H-5, 8.6); 7.29 (d, 2H, H-9, H-11, 8.6); 7.27 (d, 2H, H-15, H-19, 8.6); 7.06 (d, 2H, H-16, H-18, 8.6); 6.96 (d, 2H, H-8, H-12, 8.6); 2.22 (s, 3H, H-20).

^{13}C-NMR (DMSO-d6, δ ppm): 152.54 (C-13); 139.53 (C-1); 137.08 (C-7); 136.72 (C-17); 131.27 (C-10); 130.66 (C-14); 132.76 (C-4); 129.18 (C-3, C-5); 129.17 (C-16, C-18); 126.69 (C-2, C-6); 122.19 (C-8, C-12); 118.83 (C-15, C-19); 118.29 (C-9, C-11); 20.34 (C-20).

FT-IR (solid in ATR, ν cm^{-1}): 3331 m; 3221 m; 3037 w; 2916 w; 1651 m; 1606 m; 1554 s; 1506 vs; 1478 m; 1444 m; 1392 w; 1321 m; 1310 m; 1286 m; 1238 w; 1217 m; 1177 s; 1089 m; 907 m; 840 w; 724 m; 681 m.

Elemental analysis: Calculated: C 62.97%, H 5.02%, N 11.01%, S 8.40%; Found C 63.05 %, H 4.95%, N 11.05%, S 8.55%.

Compound VI: N-[4-[(2-methoxyphenylcarbamoyl)-amino]phenyl]benzenesulfonamide

^{1}H-NMR (DMSO-d6, δ ppm, *J* Hz): 10.01 (bs, 1H, H-α, deuterable); 9.24 (s, 1H, HN, H-γ, deuterable); 8.18 (s, 1H, HN, H-β, deuterable); 8.09 (d, 1H, H-19, 7.9); 7.71 (dd, 2H, H-2, H-6, 0.8, 8.6); 7.60 (tt, 1H, H-4, 0.8, 8.6); 7.53 (t, 2H, H-3, H-5, 8.6); 7.29 (d, 2H, H-9, H-11, 8.6); 6.98 (d, 2H, H-8, H-12, 8.6); 6.97 (d, 1H, H-16, 7.9); 6.93 (t, 1H, H-17, 7.9); 6.86 (t, 1H, H-18, 7.9); 3.85 (s, 3H, H-20).

^{13}C-NMR (DMSO-d6, δ ppm): 152.32 (C-13); 147.59 (C-15); 139.49 (C-1); 136.76 (C-7); 131.25 (C-10); 128.63 (C-14); 132.76 (C-4); 129.18 (C-3, C-5); 126.69 (C-2, C-6); 122.24 (C-8, C-12); 121.78 (C-19); 120.55 (C-17); 118.56 (C-9, C-11); 118.19 (C-18); 110.69 (C-16); 55.76 (C-20).

FT-IR (solid in ATR, ν cm^{-1}): 3371 w; 3235 m; 3073 w; 2931 w; 1643 s; 1602 s; 1556 s; 1529 m; 1506 vs; 1485 m; 1453 m; 1430 m; 1395 m; 1318 m; 1284 m; 1257 m; 1211 m; 1157 s; 1120 m; 1087 m; 1047 w; 1027 m; 898 w; 756 w; 731 m; 684 m.

Elemental analysis: **C**alculated: C 60.44%, H 4.818%, N 10.57%, S 8.068%; Found C 60.25%, H 4.82%, N 10.45%, S 7.987%.

Compound VII: N-[4-[(3-methoxyphenylcarbamoyl)-amino]phenyl]benzenesulfonamide

^{1}H-NMR (DMSO-d6, δ ppm, *J* Hz): 10.01 (bs, 1H, H-α, deuterable); 8.62 (s, 1H, HN, H-γ, deuterable); 8.57 (s, 1H, HN, H-β, deuterable); 7.71 (dd, 2H, H-2, H-6, 0.8, 8.6); 7.60 (tt, 1H, H-4, 0.8, 8.6); 7.53 (t, 2H, H-3, H-5, 8.6); 7.29 (d, 2H, H-9, H-11, 8.6); 7.15 (t, 1H, H-18, 8.0); 7.14 (t, 1H, H-15, 2.4); 6.97 (d, 2H, H-8, H-12, 8.6); 6.88 (dd, 1H, H-19, 2.4, 8.0); 6.53 (dd, 1H, H-17, 2.4, 8.0); 3.71 (s, 3H, H-20).

^{13}C-NMR (DMSO-d6, δ ppm): 159.67 (C-16); 152.39 (C-13); 140.89 (C-14); 139.48 (C-1); 136.51 (C-7); 131.40 (C-10); 132.78 (C-4); 129.55 (C-18); 129.18 (C-3, C-5); 126.69 (C-2, C-6); 122.14 (C-8, C-12); 118.96 (C-9, C-11); 110.45 (C-19); 107.22 (C-17); 103.87 (C-15); 54.91 (C-20).

FT-IR (solid in ATR, ν cm^{-1}): 3316 m; 3269 m; 3105 w; 3001 w; 1643 s; 1605 s; 1560 s; 1510 s; 1493 s; 1465 s; 1418 m; 1401 w; 1329 m; 1269 m; 1217 m; 1157 vs; 1088 m; 1037 m; 914 m; 846 w; 832 m; 780 w; 754 w; 726 m; 686 m.

Elemental analysis: Calculated: C 60.44%, H 4.818%, N 10.57%, S 8.068%; Found C 60.30%, H 4.825%, N 10.43%, S 7.97%.

Compound VIII: N-[4-[(4-methoxyphenylcarbamoyl)-amino]phenyl]benzenesulfonamide

^{1}H-NMR (DMSO-d6, δ ppm, *J* Hz): 9.98 (bs, 1H, HN-SO_2, deuterable); 8.50 (s, 1H, HN, deuterable); 8.41 (s, 1H, HN, deuterable); 7.70 (dd, 2H, H-2, H-6, 0.8, 8.6); 7.60 (tt, 1H, H-4, 0.8, 8.6); 7.53 (t, 2H, H-3, H-5, 8.6); 7.31 (d, 2H, H-15, H-19, 8.9); 7.28 (d, 2H, H-9, H-11, 8.6); 6.96 (d, 2H, H-8, H-12, 8.6); 6.84 (d, 2H, H-16, H-18, 8.9); 3.70 (s, 3H, H-20).

^{13}C-NMR (DMSO-d6, δ ppm): 154.48 (C-17); 152.70 (C-13); 139.52 (C-1); 136.86 (C-7); 132.78 (C-4); 132.67 (C-10); 131.17 (C-14); 129.18 (C-3, C-5); 126.71 (C-2, C-6); 122.23 (C-8, C-12); 120.04 (C-15, C-19); 118.80 (C-9, C-11); 114.00 (C-16, C-18); 55.19 (C-20).

FT-IR (solid in ATR, ν cm^{-1}): 3373 m; 3334 m; 3241 vs; 3065 w; 3010 w; 2954 w; 2833 w; 1658 vs; 1601 m; 1553 vs; 1510 vs; 1464 m; 1446 m; 1411 w; 1391 m; 1339 s; 1312 s; 1261 s; 1214 s; 1160 vs; 1088 m; 1029 m; 903 m; 842 w; 827 w; 805 w; 790 w; 746 m; 724 s; 683 m.

Elemental analysis: Calculated: C 60.44%, H 4.818%, N 10.57%, S 8.068%; Found C 60.32%, H 4.825%, N 10.605%, S 8.12 %.

Compound IX: N-[4-[(2-ethoxyphenylcarbamoyl)-amino]phenyl]benzenesulfonamide

^{1}H-NMR (DMSO-d6, δ ppm, *J* Hz): 10.02 (bs, 1H, H-α, deuterable); 9.33 (s, 1H, HN, H-γ, deuterable); 8.03 (s, 1H, HN, H-β, deuterable); 7.71 (dd, 2H, H-2, H-6, 0.8, 8.6); 7.60 (tt, 1H, H-4, 0.8, 8.6); 7.53 (t, 2H, H-3, H-5, 8.6); 7.31 (d, 2H, H-9, H-11, 8.6); 6.99 (d, 2H, H-8, H-12, 8.6); 8.07 (dd, 1H, H-19, 1.9, 7.7); 6.98 (dd, 1H, H-16, 2.2, 7.7); 6.90 (td, 1H, H-17, 2.2, 7.7); 6.85 (td, 1H, H-18, 2.2, 7.7); 4.10 (q, 2H, H-20, 7.0); 1.39 (t, 3H, H-21, 7.0).

^{13}C-NMR (DMSO-d6, δ ppm): 152.32 (C-13); 146.74 (C-15); 139.51 (C-1); 136.75 (C-7); 131.30 (C-10); 128.82 (C-14); 132.78 (C-4); 129.17 (C-3, C-5); 126.69 (C-2, C-6); 122.21 (C-8, C-12); 118.68 (C-9, C-11); 121.82 (C-19); 120.48 (C-17); 118.46 (C-18); 111.75 (C-16); 63.97 (C-20); 14.73 (C-21).

FT-IR (solid in ATR, ν cm^{-1}): 3371 w; 3235 m; 3073 w; 2931 w; 1643 s; 1602 s; 1556 s; 1529 m; 1506 vs; 1485 m; 1453 m; 1430 m; 1395 m; 1318 m; 1284 m; 1257 m; 1211 m; 1157 s; 1120 m; 1087 m.

Elemental analysis: Calculated: C 61.29%, H 5.144%, N 10.21%, S 7.793%; Found C 61.32%, H 5.1%, N 10.34%, S 8.05%.

Compound X: N-[4-[(3-ethoxyphenylcarbamoyl)-amino]phenyl]benzenesulfonamide

^{1}H-NMR (DMSO-d6, δ ppm, *J* Hz): 10.01 (bs, 1H, H-α, deuterable); 8.59 (s, 1H, HN, H-γ, deuterable); 8.56 (s, 1H, HN, H-β, deuterable); 7.71 (dd, 2H, H-2, H-6, 0.8, 8.6); 7.60 (tt, 1H, H-4, 0.8, 8.6); 7.53 (t, 2H, H-3, H-5, 8.6); 7.28 (d, 2H, H-9, H-11, 8.6); 7.13 (t, 1H, H-18, 8.2); 7.13 (t, 1H, H-15, 1.4); 6.97 (d, 2H, H-8, H-12, 8.6); 6.86 (dd, 1H, H-19, 1.4, 8.2); 6.51 (dd, 1H, H-17, 1.4, 8.2); 3.97 (q, 2H, H-20, 6.9); 1.30 (t, 3H, H-21, 6.9).

^{13}C-NMR (DMSO-d6, δ ppm): 158.95 (C-16); 152.41 (C-13); 140.87 (C-14); 139.48 (C-1); 136.54 (C-7); 131.38 (C-10); 132.79 (C-4); 129.54 (C-18); 129.19 (C-3, C-5); 126.70 (C-2, C-6); 122.14 (C-8, C-12); 118.95 (C-9, C-11); 110.36 (C-19); 107.76 (C-15); 104.34 (C-17); 62.82 (C-20); 14.70 (C-21).

FT-IR (solid in ATR, ν cm^{-1}): 3333 m; 3247 m; 2984 w; 2934 w; 2877 w; 1649 vs; 1609 vs; 1560 vs; 1512 s; 1496 vs; 1460 s; 1424 m; 1395 m; 1329 s; 1290 m; 1267 m; 1214 s; 1159 vs; 1088 m; 1048 m; 809 m; 832 m; 782 w; 727 m; 685 m; 663 m; 629 w.

Elemental analysis: Calculated: C 61.29%, H 5.144%, N 10.21%, S 7.793%; Found C 61.25%, H 5.203%, N 10.32%, S 7.69%.

Compound XI: N-[4-[(4-ethoxyphenylcarbamoyl)-amino]phenyl]benzenesulfonamide

^{1}H-NMR (DMSO-d6, δ ppm, *J* Hz): 9.91 (s, 1H, HN-SO_2, deuterable); 8.50 (s, 1H, H-β, deuterable); 8.40 (s, 1H, H-γ, deuterable); 7.70 (dd, 2H, H-2, H-6, 0.8, 8.6); 7.60 (tt, 1H, H-4, 0.8, 8.6); 7.53 (t, 2H, H-3, H-5, 8.6); 7.29 (d, 2H, H-9, H-11, 8.6); 7.28 (d, 2H, H-15, H-19, 8.9); 6.96 (d, 2H, H-8, H-12, 8.6); 6.83 (d, 2H, H-16, H-18, 8.9); 3.95 (q, 2H, H-20, 7.0); 1.29 (t, 3H, H-21, 7.0).

^{13}C-NMR (DMSO-d6, δ ppm): 153.71 (C-17); 152.67 (C-13); 139.50 (C-1); 136.86 (C-7); 132.57 (C-10); 131.14 (C-14); 132.77 (C-4); 129.18 (C-3, C-5); 126.70 (C-2, C-6); 122.21 (C-8, C-12); 120.00 (C-15, C-19); 118.76 (C-9, C-11); 114.53 (C-16, C-18); 63.09 (C-20); 4.75 (C-21).

FT-IR (solid in ATR, ν cm^{-1}): 3365 m; 3324 m; 3209 m; 3142 w; 2983 w; 2938 w; 1669 m; 1602 m; 1544 s; 1507 vs; 1451 s; 1393 w; 1326 m; 1311 m; 1286 m; 1245 m; 1202 m; 1182 m; 1155 m; 1123 m; 1091 m; 1045 m; 922 m; 842 w; 754 w; 740 w; 722 w; 672 m.

Elemental analysis: Calculated: C 61.29%, H 5.144%, N 10.21%, S 7.793%; Found C 61.37%, H 5.05%, N 10.285%, S 7.705%.

Conclusions

We obtained ten new sulfonamides derivatives with urea moiety, using an azide as a starting point. Their structure could be correlated with a potential pharmacological effect, because both of the structures, the sulfonamide and the urea are known as pharmacophoric structural features. The chemical structures were confirmed by IR, ^{1}H-NMR, ^{13}C-NMR and elemental analysis. Further studies are needed in order to establish their pharmacological properties.

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