Supplementary Information

Novel reactions and mechanism of -HN-N= azole derivatives with DMSO

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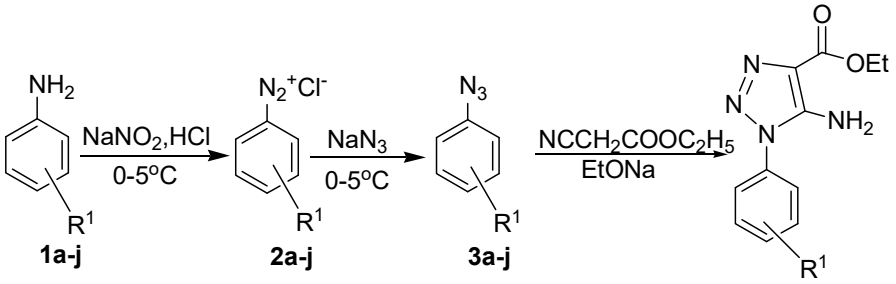
Contents

Scheme 1



1. EXPERIMENTAL

All melting points are uncorrected and determined on an XT_4-100x microscopic melting point apparatus. IR spectra were obtained in KBr discs on a Nicolet NEXUS 670 FT-IR spectrometer. MS were performed on a HP-5988A spectrometer (EI at 70eV). High resolution mass spectra (HRMS) were tested on bruker daltonics apex2 47e ft-icr mass spectra apparatus. ^{1}H NMR spectroscopy ($CDCl_3$) was recorded on a varian Mercury plus-300 instrument with TMS as an internal standard. ^{13}C NMR spectroscopy was performed on a Bruker DRX-200 spectrometer. Elemental analyses were carried out on a Yanaco CHN Corder MT-3 analyzer.

5-Amino-1-aryl-1*H*-1,2,3-triazol-4-carboxylic acid ethyl ester 4a-j was prepared following methods in the literature [1, 2]

A. The preparation of aryl azide 3a-j

0.2 mol (25.85 mL) aryl amine with 80 mL water, 65 mL of concentrated hydrochloric acid was mixture in three bottles of 500 mL. A mechanical agitator, thermometer (-50 °C ~ 50 °C), dropping funnel was installed. When ice - salt bath to control the temperature of the mixture for 0 °C, to start the blender, 0.2 mol, 50 mL solution (13.8 g) $NaNO_2$ was added. Then stir in 0 °C after an hour, the mixture was filtered, was abandoned to residue, filtrate liquid was in three bottles of 1000 mL. Under mechanical agitating, 0.2 mol under 0 °C or so 50 mL solution (13.0 g) NaN_3 was added to the filtrate liquid mixture, after mixing 30 ~ 60 min, dark red mixture was given. The mixture was extracted with 20 mL×5 ether, the ether phase with anhydrous Na_2SO_4 dry overnight, filtering after removing the Na_2SO_4, steaming on the rotary evaporation apparatus to ether aside, get **3a-j**.

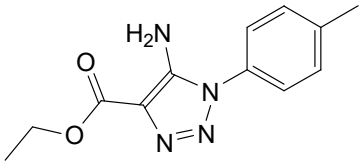
B. The preparation of sodium ethoxide

A 250 mL three-necked flask equipped with condenser pipe (after drying tube), 20 mL absolute ethanol was added, 0.3 mol, sodium (6.9 g) of cut pieces was partial joined in. After reaction was a slow, with a dropping funnel gradually to add in 150 mL of absolute ethanol (Sodium metal with absolute ethanol by 1:10 feeding). The mixture was kept the reaction liquid boiling, until the sodium was reacted completely, was cooled down.

C. The preparation of 5-amino-1-aryl-1*H*-1,2,3-triazol-4-carboxylic acid ethyl ester 4a-j

In 500 mL of three bottles was contained thermometer (-50 °C ~ 50 °C), electric mixer, dropping funnel. A mixture of aryl azide and 1.1 times the amount of ethyl 2-cyanoacetate was joined to the three bottles after temperature control of 0-5 °C range with ice-salt bath, a good amount of 1.5 times of NaOEt ethanol solution was added by dropping funnel and maintain temperature. After NaOEt ethanol solution was drop-added and was stirred for 1 hour, and then again stirred 8-10 hours at room temperature, was quiet placed. A mixture liquid of some strong hydrochloric acid(~27mL) and ice water in a beaker, control the temperature below 5 °C, the viscous paste mixture of above reaction was added to the mixture liquid strain under stirring, then adjust pH value to 5~6, the precipitation of white solid was given. The precipitation of white solid was filtered by the suction filter, washed many times, the coarse product was gained. The crude product was re-crystallized by ethyl alcohol, and products **4a-j** was given.

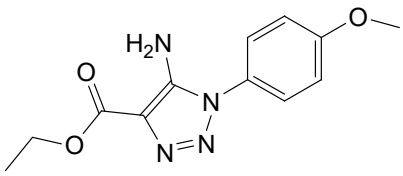
2.Spectrum data of 4a-j



Ethyl 5-amino-1-*p*-tolyl-1*H*-1,2,3-triazole-4-carboxylate 4a[1]

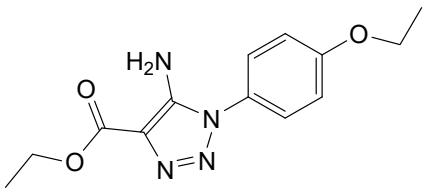
The white needle crystals, yield 86%, mp 152-153 °C(Lit.[10a] m.p. 152-153°C). ^{1}HNMR(300MHz,$CDCl_3$), δ = 7.400-7.428(d, 2H, J = 8.4H_Z, Ar-2,6), 7.351-7.379(d, 2H, J = 8.4H_Z, Ar-3,5), 5.210 (s, 2H, -NH_2), 4.402-4.475(q, 2H, J = 7.2H_Z, -OCH_2-), 2.438 (s, 3H, Ar-CH_3), 1.415-1.461(t, 3H, J = 7.2Hz, -CO_2CH_2-$\underline{CH_3}$); IR(cm^{-1})(KBr disc), 3415, 3284, 3164,

3044, 2977, 2928, 2867, 1688, 1620, 1554, 1520, 1495, 1449, 1411, 1387, 1357, 1323, 1282, 1263, 1124, 1026, 987, 845, 820, 783, 702, 579, 507; MS M/Z(%), 246(M^+,48), 219(2), 201(4), 190(1), 179(3), 172(24), 157(6), 145(100), 133(14), 118(58), 104(6), 91(87), 77(17), 65(37), 57(5), 51(10), 44(7).



Ethyl 5-amino-1-(4-methoxyphenyl)-1*H*-1,2,3-triazole-4-carboxylate 4b[2]

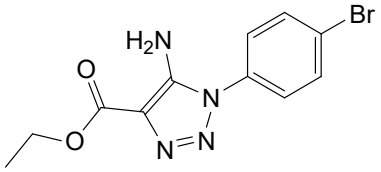
The white needle crystals, yield 83%, mp 148-149 °C. ^{1}HNMR(300MHz,$CDCl_3$), δ = 7.422-7.452(d, 2H, J = 9.0H_Z, Ar-2,6), 7.048-7.078(d, 2H, J = 9.0H_Z, Ar-3,5), 5.163 (s, 2H, -NH_2), 4.405-4.474(q, 2H, J = 6.9H_Z, -OCH_2-), 3.877 (s, 3H, Ar-OCH_3), 1.417-1.463(t, 3H, J = 6.9Hz, -CO_2CH_2-$\underline{CH_3}$); IR(cm^{-1})(KBr disc), 3445, 3303, 3164, 2978, 2938, 2837, 1623, 1521, 1464, 1412, 1384, 1355, 1323, 1253, 1178, 1118, 1028, 982, 835, 806, 782, 703, 678, 636, 583, 523; MS M/Z(%), 262(M^+,25), 219(9), 205(2), 195(7), 191(3), 188(14), 179(15), 173(14), 167(24), 161(33), 157(2), 149(32), 146(7), 133(47), 118(8), 107(12), 92(16), 82(6), 77(100), 69(10), 61(21), 55(11), 51(19), 43(15).



Ethyl 5-amino-1-(4-ethoxyphenyl)-1*H*-1,2,3-triazole-4-carboxylate 4c[3]

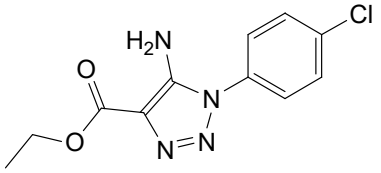
The little yellow needle crystals, yield 84.5%, mp 169-170 °C. ^{1}HNMR(300MHz,$CDCl_3$), δ = 7.406-7.428(d, 2H, J = 6.6H_Z, Ar-2,6), 7.030-7.052(d, 2H, J = 6.6H_Z, Ar-3,5), 5.170 (s, 2H, -NH_2), 4.397-4.469(q, 2H, J = 7.2H_Z, -CO-OCH_2-), 4.053-4.121(q, 2H, J = 6.9H_Z, Ar-OCH_2-), 1.411-1.475(m, 6H, -CO_2CH_2-$\underline{CH_3}$, Ar-OCH_2-$\underline{CH_3}$); IR(cm^{-1})(KBr disc), 3452, 3283, 3222, 3159, 2978, 2934, 2893, 1681, 1628, 1554, 1525, 1460, 1412, 1386, 1307, 1247, 1172, 1114, 1042, 988, 919, 844, 810, 782, 707, 661, 586, 526, 489; MS M/Z(%), 276(M^+,87), 231(7),

219(50), 202(40), 191(22), 173(100), 163(12), 147(89), 135(11), 120(57), 103(6), 93(23), 77(20), 65(54), 57(12), 44(21).



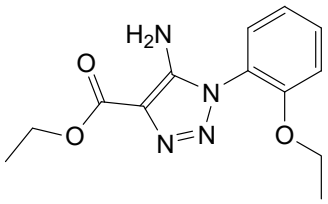
Ethyl 5-amino-1-(4-bromophenyl)-1*H*-1,2,3-triazole-4-carboxylate 4d[4]

The white flocculent crystals, yield 81%, mp 168-169 °C. ^{1}HNMR(300MHz,$CDCl_3$), δ = 7.410-7.429(d, 2H, J = 5.7H_Z, Ar-2,6), 7.242-7.261(d, 2H, J = 5.7H_Z, Ar-3,5), 5.215 (s, 2H, -NH_2), 4.449-4.520(q, 2H, J = 7.2H_Z, -OCH_2-), 1.438-1.485(t, 3H, J = 7.2Hz, -CO_2CH_2-$\underline{CH_3}$); IR(cm^{-1})(KBr disc), 3378, 3164, 3070, 2996, 2929, 1699, 1611, 1571, 1490, 1464, 1400, 1346, 1315, 1274, 1219, 1174, 1116, 1076, 1015, 987, 812, 783, 554, 495; MS M/Z(%), 310(M^+,53), 282(3), 264(5), 246(12), 229(2), 209(8), 200(5), 185(100), 171(5), 157(30), 149(22), 130(50), 123(4), 117(11), 111(6), 102(22), 91(17), 85(11), 76(26), 69(20), 63(11), 57(28), 50(13), 44(66).



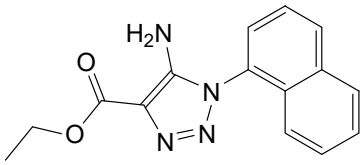
Ethyl 5-amino-1-(4-chlorophenyl)-1*H*-1,2,3-triazole-4-carboxylate 4e[1]

The white granular crystals, yield 78%, mp 165-166 °C(Lit.[10b] m.p. 165-167°C). ^{1}HNMR(300MHz,$CDCl_3$), δ = 7.533-7.562(d, 2H, J = 8.7H_Z, Ar-2,6), 7.486-7.515(d, 2H, J = 8.7H_Z, Ar-3,5), 5.319 (s, 2H, -NH_2), 4.391-4.414(q, 2H, J = 6.9H_Z, -OCH_2-), 1.401-1.435(t, 3H, J = 6.9Hz, -CO_2CH_2-$\underline{CH_3}$); IR(cm^{-1})(KBr disc), 3434, 3287, 3232, 3164, 3095, 2986, 2909, 1696, 1631, 1584, 1558, 1516, 1445, 1412, 1392, 1355, 1325, 1268, 1172, 1129, 1094, 1032, 988, 841, 820, 780, 734, 700, 677, 631, 566, 532, 502, 454; MS M/Z(%), 266(M^+,49), 221(4), 203(11), 192(10), 179(2), 165(90), 157(45), 147(5), 138(100), 131(24), 125(5), 111(97), 102(21), 85(9), 75(69), 68(15), 57(5), 51(17), 44(18).



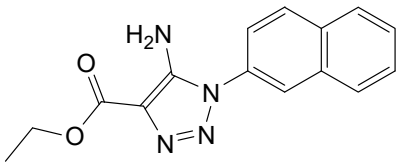
Ethyl 5-amino-1-(2-ethoxyphenyl)-1*H*-1,2,3-triazole-4-carboxylate 4f

The pale yellow granular crystals, yield 67%, mp 129-130 °C. ^{1}HNMR(300MHz,$CDCl_3$), δ = 8.130-8.178(m, 1H, Ar-5), 7.454-7.478(d, 1H, J = 7.2H_Z, Ar-3), 7.090-7.138(m, 1H, Ar-4), 6.953-6.976(d, 1H, J = 6.9H_Z, Ar-6), 5.301 (s, 2H, -NH_2), 4.467-4.451(q, 2H, J = 6.9H_Z, -OCH_2-), 4.128-4.196(q, 2H, J = 7.2H_Z, -OCH_2-), 1.340-1.522(m, 6H, -CO_2CH_2-$\underline{CH_3}$, -Ar-OCH_2-$\underline{CH_3}$); IR(cm^{-1})(KBr disc), 3474, 3389, 3197, 3062, 2990, 2926, 2882, 2695, 2449, 2358, 1660, 1606, 1574, 1484, 1447, 1391, 1363, 1337, 1285, 1245, 1226, 1161, 1114, 1043, 1017, 970, 923, 845, 804, 786, 733, 633, 600, 538, 490, 452, 433; MS M/Z(%), 276(M^+,100), 247(35), 231(5), 219(26), 201(69), 187(12), 173(25), 157(10), 149(48), 131(12), 120(48), 109(8), 102(11), 93(25), 83(14), 77(17), 63(35), 57(24), 43(31).



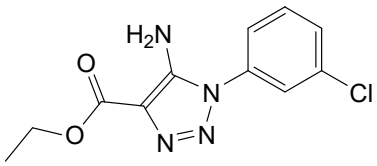
Ethyl 5-amino-1-(naphthalen-1-yl)-1*H*-1,2,3-triazole-4-carboxylate 4g[5]

The pinkish red needle crystals, yield 81%, mp 159-160 °C. ^{1}HNMR(300MHz,$CDCl_3$), δ = 7.981-8.069(m, 3H, Ar-4,5,8), 7.444-7.591(m, 4H, Ar-2,3,6,7), 5.079 (s, 2H, -NH_2), 4.432-4.496(q, 2H, J = 6.9H_Z, -OCH_2-), 1.443-1.489(t, 3H, J = 6.9H_Z, -CO_2CH_2-$\underline{CH_3}$); IR(cm^{-1})(KBr disc), 3400, 3368, 3291, 3176, 3070, 2977, 2931, 2359, 1833, 1688, 1652, 1582, 1494, 1478, 1456, 1438, 1404, 1377, 1345, 1289, 1252, 1223, 1184, 1132,1016, 986, 951, 885, 855, 788, 769, 667, 634, 587, 561, 540, 504, 416; MS M/Z(%), 282(M^+,100), 254(3), 236(23), 219(5), 208(11), 198(3), 181(68), 167(10), 154(53), 143(8), 127(81), 115(20), 103(9), 91(11), 85(10), 77(29), 55(21), 43(24).



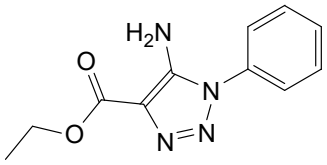
Ethyl 5-amino-1-(naphthalen-2-yl)-1*H*-1,2,3-triazole-4-carboxylate 4h

The white lamellar crystals, yield 84%, mp 148-149 °C. ^{1}HNMR(300MHz,$CDCl_3$), δ = 8.159-8.188(d, 1H, J = 8.7H_Z, Ar-5), 8.092-8.119(d, 1H, J = 8.1H_Z, Ar-4), 8.039-8.068(d, 1H, J = 8.7H_Z, Ar-8), 7.747-7.805(d, 1H, J = 8.7H_Z, Ar-7), 7.604-7.662(t, 1H, J = 8.7H_Z, Ar-6), 7.467(s, 1H, Ar-1), 7.383-7.437(d, 1H, J = 8.1H_Z, Ar-3), 5.348 (s, 2H, -NH_2), 4.434-4.543(q, 2H, J = 6.9H_Z, -OCH_2-), 1.433-1.504(t, 3H, J = 6.9H_Z, -CO_2CH_2-$\underline{CH_3}$); IR(cm^{-1})(KBr disc), 3392, 3171, 3059, 3020, 2991, 2927, 2700, 1661, 1598, 1490, 1466, 1438, 1394, 1365, 1334, 1294, 1219, 1186, 1155, 1127, 1021, 967, 880, 853, 808, 781, 747, 642, 590, 543, 523, 474, 405; MS M/Z(%), 282(M^+,100), 266(5), 254(4), 236(18), 220(3), 208(6), 193(2), 179(17), 168(3), 153(36), 140(5), 127(75), 115(14), 101(6), 85(9), 77(13), 71(13), 57(20), 44(24).



Ethyl 5-amino-1-(3-chlorophenyl)-1*H*-1,2,3-triazole-4-carboxylate 4i[1]

The pale yellow granular crystals, yield 80%, mp 134-135 °C(Lit.[10b] m.p. 134-135°C). ^{1}HNMR(300MHz,$CDCl_3$), δ = 7.981(s, 1H, Ar-2), 7.746-7.769(d, 1H, J = 6.9H_Z, Ar-4), 7.023-7.248(m, 1H, Ar-5), 6.944-6.968(d, 1H, J = 7.2H_Z, Ar-6), 5.282 (s, 2H, -NH_2), 4.539-4.608(q, 2H, J = 7.2H_Z, -OCH_2-), 1.477-1.525(t, 3H, J = 7.2Hz, -CO_2CH_2-$\underline{CH_3}$); IR(cm^{-1})(KBr disc), 3382, 3164, 2979, 2899, 2685, 2556, 1962, 1902, 1815, 1705, 1598, 1564, 1533, 1464, 1418, 1387, 1347, 1294, 1268, 1205, 1172, 1152, 1108, 987, 910, 856, 809, 790, 763, 694, 675, 630, 549, 523, 462, 435; MS M/Z(%), 266(M^+,100), 238(5), 220(51), 192(6), 185(16), 164(16), 157(8), 149(21), 137(49), 130(19), 125(10), 111(61), 102(15), 97(24), 83(25), 75(28), 69(37), 57(51), 43(43).

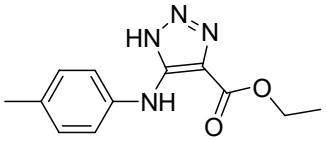


Ethyl 5-amino-1-phenyl-1*H*-1,2,3-triazole-4-carboxylate 4j[1]

The white flocculent crystals, yield 77%, mp 125-126 °C(Lit.[10a] m.p. 124.5-125.5°C). ^{1}HNMR(300MHz,$CDCl_3$), δ = 7.556-7.582(d, 2H, J = 7.8H_Z, Ar-2,6), 7.312-7.365(m, 2H, Ar-3,5), 6.978-7.029(m, 1H, Ar-4), 5.292 (s, 2H, -NH_2), 4.408-4.561(q, 2H, J = 7.2H_Z, -OCH_2-), 1.451-1.501(t, 3H, J = 7.2Hz, -CO_2CH_2-$\underline{CH_3}$); IR(cm^{-1})(KBr disc), 3383, 3148, 3070, 3001, 2931, 2918, 2703, 1702, 1610, 1578, 1544, 1478, 1437, 1388, 1350, 1322, 1279, 1224, 1161, 1111, 1018, 988, 879, 814, 784, 741, 686, 636, 533, 502; MS M/Z(%), 232(M^+,100), 204(1), 186(29), 158(5), 130(23), 103(53), 93(4), 77(54), 65(8), 57(12), 51(21), 40(16).

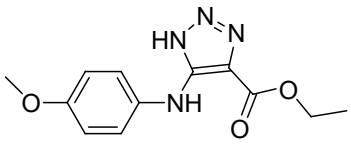
3.Spectrum data of 5a-d

Procedure of preparation of ethyl 5-(arylamino)-1*H*-1,2,3-triazole-4-carboxylate **5a-d** and 5-(arylamino)-2-methylsulfanylmethyl-2*H*-1,2,3-triazol-4-carboxylic acid ethyl ester **6a-j**. [4]



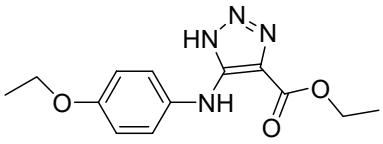
Ethyl 5-(*p*-tolylamino)-1*H*-1,2,3-triazole-4-carboxylate 5a[6]

The pale yellow granular crystals, yield 28%, mp 114-115 °C. ^{1}HNMR(300MHz,$CDCl_3$), δ = 7.826(s, 1H, -NH-), 7.379-7.403(d, 2H, J=7.2H_Z, Ar-3,5), 7.390(s, 1H, Triazole ring-H), 7.136-7.160(d, 2H, J=7.2H_Z, Ar-2,6), 4.444-4.512(q, 2H, J=7.2H_Z, -OCH_2-), 2.318 (s, 3H, Ar-CH_3), 1.433-1.481(t, 3H, J=7.2H_Z, -OCH_2CH_3); IR(cm^{-1})(KBr disc), 3382, 3168, 2977, 2918, 1699, 1606, 1571, 1537, 1517, 1474, 1412, 1387, 1346, 1275, 1206, 1175, 1152, 1113, 1012, 986, 932, 906, 884, 809, 783, 714, 639, 594, 558, 501; MS M/Z(%), 246(M^+,100), 234(4), 218(4), 200(27), 187(5), 171(8), 157(2), 144(15), 132(5), 117(43), 106(4), 91(48), 77(7), 65(20), 51(4), 39(4);



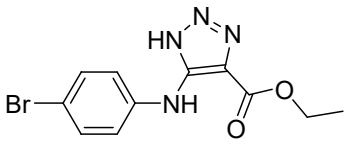
Ethyl 5-(4-methoxyphenylamino)-1*H*-1,2,3-triazole-4-carboxylate 5b[2]

The white granular crystals, yield 32%, mp 91-92 °C. ^{1}HNMR(300MHz,$CDCl_3$), δ = 7.721(s, 1H, -NH-), 7.457(s, 1H, Triazole ring-H), 7.396-7.426(d, 2H, J=9.0H_Z, Ar-3,5), 6.882-6.912 (d, 2H, J=9.0H_Z, Ar-2,6), 4.430-4.487(q, 2H, J=7.2H_Z, -OCH_2-),3.803 (s, 3H, Ar-OCH_3), 1.429-1.477 (t, 3H, J=7.2H_Z, -OCH_2CH_3); IR(cm^{-1})(KBr disc), 3383, 3181, 2978, 2933, 2835, 1699, 1606, 1576, 1513, 1468, 1415, 1392, 1339, 1302, 1272, 1247, 1204, 1175, 1147, 1109, 1028, 984, 911, 851, 823, 784, 735, 654, 631, 596, 522, 469; MS M/Z(%), 262(M^+,21), 256(1), 247(2), 219(3), 216(3), 201(8), 195(3), 188(2), 179(15), 173(7), 159(4), 149(22), 133(46), 121(5), 104(19), 91(7), 85(11), 77(99), 69(55), 61(4), 57(37), 5(21), 43(100);



Ethyl 5-(4-ethoxyphenylamino)-1*H*-1,2,3-triazole-4-carboxylate 5c

The white flocculent crystals, yield 46%, mp 115-116 °C. ^{1}HNMR(300MHz,$CDCl_3$), δ = 7.709 (s, 1H, -NH-), 7.400(s, 1H, Triazole ring-H), 7.381-7.410(d, 2H, J=8.7H_Z, Ar- 3,5), 6.884-6.913 (d, 2H, J=8.7H_Z, Ar-2,6), 4.453-4.477 (q, 2H, J=7.2H_Z, -CO_2CH_2 -), 4.008-4.031(q, 2H, J=6.9H_Z, ArOCH_2-), 1.385-1.475 (m, 6H, -$CO_2CH_2CH_3$, Ar-OCH_2CH_3); IR(cm^{-1})(KBr disc), 3371, 3185, 2979, 2933, 2878, 1692, 1606, 1577, 1537, 1511, 1478, 1417, 1392, 1349, 1328, 1299, 1277, 1236, 1209, 1174, 1153, 1112, 1049, 1020, 985, 922, 820, 785, 617, 536; MS M/Z(%), 276(M^+,100), 247(35), 230(5), 219(7), 201(78), 173(16), 148(21), 134(4), 119(39), 108(11), 90(20), 77(14), 65(52), 53(18), 40(58);



Ethyl 5-(4-bromophenylamino)-1*H*-1,2,3-triazole-4-carboxylate 5d[1]

The white granular crystals, yield 30%, mp 164-165 °C. ^{1}HNMR(300MHz,$CDCl_3$), δ = 7.932(s, 1H, -NH-), 7.508-7.533(d, 2H, J=7.5H_Z, Ar-3,5), 7.320-7.345(d, 2H, J=7.5H_Z,

Ar-2,6), 7.007(s, 1H, Triazole ring-H), 4.471-4.533(q, 2H, J=6.9H_Z, OCH_2-), 1.444- 1.477(t, 3H, J=6.9H_Z, -OCH_2CH_3); IR(cm^{-1})(KBr disc), 3378, 3164, 3070, 2996, 2929, 1699, 1610, 1571, 1490, 1464, 1400, 1346, 1315, 1274, 1216, 1176, 1113, 1076, 1015, 987, 909, 882, 844, 812, 783, 669, 552, 495, 430; MS M/Z(%), 312(M^+,56), 282(3), 266(7), 238(2), 209(4), 198(3), 185(100), 171(4), 157(27), 149(13), 130(55), 117(3), 102(21), 91(7), 83(12), 76(23), 69(10), 63(8), 57(10), 50(14), 44(29);

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