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Design, syntheses and evaluation of benzoylthioureas as urease inhibitors of agricultural interest

Tiago O. Brito[a,†], Aline X. de Souza[b,†], Yane C. C. Mota[b], Vinicius S. S. Morais[b], Leandro T. de Souza[b,c], Ângelo de Fátima[d], Fernando Macedo Jr[a,*], Luzia V. Modolo[b,*]

[a]Departamento de Química, Centro de Ciências Exatas, Universidade Estadual de Londrina, Londrina, PR, Brazil

[b]Departamento de Botânica, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil.

[c]Departamento de Fitotecnia, Centro de Ciências Agrárias, Universidade Federal de Roraima, Boa Vista, RR, Brazil.

[d]Departamento de Química, Instituto de Ciências Exatas, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil.

Characterization data not yet described in the literature for previously reported benzoylthioureas

***N*-(ethylcarbamothioyl)benzamide (BTU 3):** Recrystallization from ethanol, with overall yield of 58%. M.P.: 125 ºC. FT-IR (KBr, cm^{-1}): 3251 (amide N-H), 3058 (thiourea N-H), 1677 (C=O), 1258 (C=S). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): 1.29 (t, J = 7.4 Hz, 3H, CH_3), 3.70 (q, J = 7.3 Hz, CH_2), 7.47 (m, 2H), 7.57 (m, 1H), 7.79 (m, 2H), 9.01 (s, 1H, CONH), 10.65 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, $CDCl_3$, ppm): 13.7(+) (CH_3), 40.9(-) (CH_2), 127.6(+), 129.2(+), 131.9, 133.6(+), 167.0 (C=O), 179.7 (C=S).

***N*-(4-*tert*-butylphenylcarbamothioyl)benzamide (BTU 12):** Recrystallization from ethanol, with overall yield of 79%. M.P.: 114 ºC. FT-IR (KBr, cm^{-1}): 3226 (amide N-H), 3035 (thiourea N-H), 1665 (C=O), 1261 (C=S). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): 1.32 (s, 9H, $C(CH_3)_3$), 7.43 (m, 2H), 7.52 (m, 2H), 7.63 (m, 3H), 7.87 (m, 2H), 9.09 (s, 1H, CONH), 12.52 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, $CDCl_3$, ppm): 31.5(+) (CH_3), 34.8, 123.8(+), 126.0(+), 127.7(+), 129.4(+), 131.8, 133.9(+), 135.1, 150.1, 167.1 (C=O), 178.3 (C=S).

***N*-(4-hydroxyphenylcarbamothioyl)-4-nitrobenzamide (BTU 29):** Recrystallization from ethanol, with overall yield of 68%. M.P.: 172 ºC. FT-IR (KBr, cm^{-1}): 3275 (amide N-H), 3038 (thiourea N-H), 1676 (C=O), 1265 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 6.80 (d, J = 8.8 Hz, 2H), 7.43 (d, J = 8.8 Hz, 2H), 8.16 (d, J = 8.9 Hz, 2H), 8.33 (d, J = 8.9 Hz, 2H), 9.60 (s, 1H, OH), 11.85 (s, 1H, CONH), 12.21 (s, 1H, CSNH). ^{13}C

NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 115.1(+), 123.3(+), 126.0(+), 129.3, 130.2(+), 138.2, 149.8, 155.9, 166.7 (C=O), 178.6 (C=S).

***N*-(4-chlorophenylcarbamothioyl)-4-nitrobenzamide (BTU 31):** Recrystallization from ethanol/acetone, with overall yield of 83%. M.P.: 173 ºC. FT-IR (KBr, cm^{-1}): 3264 (amide N-H), 3063 (thiourea N-H), 1685 (C=O), 1261 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 7.49 (d, J = 8.7 Hz, 2H), 7.72 (d, J = 8.7 Hz, 2H), 8.17 (d, J = 8.7 Hz, 2H), 8.35 (d, J = 8.7 Hz, 2H), 12.01 (s, 1H, CONH), 12.35 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 123.4 (+), 126.3 (+), 128.7(+), 130.3(+), 130.4, 137.0, 138.1, 149.9, 166.5 (C=O), 179.1 (C=S).

3-nitro-*N*-(phenylcarbamothioyl)benzamide (BTU 32): Recrystallization from ethanol, with overall yield of 73%. M.P.: 149 ºC. FT-IR (KBr, cm^{-1}): 3365 (amide N-H), 3058 (thiourea N-H), 1674 (C=O), 1250 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 7.29 (t, J = 7.3 Hz, 1H), 7.44 (t, J = 7.7 Hz, 2H), 7.70 (d, J = 7.7 Hz, 2H), 7.83 (t, J = 7.9 Hz, 1H), 8.37 (d, J = 7.7 Hz, 1H), 8.49 (d, J = 7.9 Hz, 1H), 8.79 (s, 1H), 12.03 (s, 1H, CONH), 12.44 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 123.7(+), 124.3(+), 126.4(+), 127.3(+), 128.7(+), 130.1(+), 133.9, 135.1(+), 137.9, 147.4, 166.3 (C=O), 178.9 (C=S).

***N*-(benzylcarbamothioyl)-3-nitrobenzamide (BTU 33):** Recrystallization from ethanol, with overall yield of 73%. M.P.: 104 ºC. FT-IR (KBr, cm^{-1}): 3220 (amide N-H), 3056 (thiourea N-H), 1670 (C=O), 1262 (C=S). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): 4.91 (d, J = 5.4 Hz, 2H), 7.36 (m, 5H), 7.73 (t, J = 8.0 Hz, 1H), 8.17 (d, J = 8.0 Hz, 1H), 8.47 (d, J = 8.0 Hz, 1H), 8.72 (s, 1H), 9.36 (s, 1H, CONH), 10.87 (s, 1H, CSNH).

***N*-(4-methoxyphenylcarbamothioyl)-3-nitrobenzamide (BTU 34):** Recrystallization from ethanol, with overall yield of 77%. M.P.: 156 ºC. FT-IR (KBr, cm^{-1}): 3374 (amide N-H), 3083 (thiourea N-H), 1680 (C=O), 1259 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 6.98 (d, J = 8.9 Hz, 2H), 7.57 (d, J = 8.9 Hz, 2H), 7.83 (t, J = 8.1 Hz, 1H), 8.36 (d, J = 8.1 Hz, 1H), 8.48 (d, J = 8.1 Hz, 1H), 8.78 (s, 1H), 11.98 (s, 1H, CONH), 12.30 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 55.3(+) (OCH_3), 113.8(+), 123.7(+), 126.0(+), 127.3(+), 130.1(+), 130.8, 133.9, 135.1(+), 147.4, 157.5, 166.2 (C=O), 178.9 (C=S).

***N*-(4-hydroxyphenylcarbamothioyl)-3-nitrobenzamide (BTU 35):** Recrystallization from ethanol, with overall yield of 81%. M.P.: 195 ºC. FT-IR (KBr, cm^{-1}): 3300 (amide N-H), 3088 (thiourea N-H), 1699 (C=O), 1275 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 6.80 (d, J = 8,6 Hz, 2H), 7.43 (d, J = 8.6 Hz, 2H), 7.83 (t, J = 7.9 Hz, 1H), 8.36 (d, J = 7.9 Hz, 1H), 8.48 (d, J = 7.9 Hz, 1H), 8.77 (s, 1H), 9.61 (s, 1H, OH), 11.94 (s, 1H, CONH), 12.24 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 115.2(+), 123.7(+), 126.0(+), 127.3(+), 129.3, 130.1(+), 134.0, 135.1(+), 147.4, 155.9, 166.3 (C=O), 178.7 (C=S).

3-nitro-*N*-(4-nitrophenylcarbamothioyl)benzamide (BTU 36): Recrystallization from ethanol/acetone, with overall yield of 89%. M.P.: 173 ºC. FT-IR (KBr, cm^{-1}): 3243 (amide N-H), 3077 (thiourea N-H), 1689 (C=O), 1258 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 7.85 (t, J = 7.9 Hz, 1H), 8.08 (d, J = 8.9 Hz, 2H). 8.29 (d, J = 8.9 Hz, 2H), 8.38 (d, J = 7.9 Hz, 1H), 8.50 (d, J = 7.9 Hz, 1H), 8.79 (s, 1H), 12.21 (s, 1H, CONH), 12.67 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6,

ppm): 123.7(+), 124.0(+), 124.4(+), 127.5(+), 130.2(+), 133.7, 135.2(+), 144.0, 144.4, 147.4, 166.1 (C=O), 179.1 (C=S).

***N*-(4-chlorophenylcarbamothioyl)-3-nitrobenzamide (BTU 37):** Recrystallization from ethanol/acetone, with overall yield of 89%. M.P.: 155 ºC. FT-IR (KBr, cm^{-1}): 3215 (amide N-H), 3021 (thiourea N-H), 1673 (C=O), 1262 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 7.49 (d, J = 8.5 Hz, 2H), 7.72 (d, J = 8.5 Hz, 2H), 7.83 (t, J = 7.9 Hz, 1H), 8.37 (d, J = 7.9 Hz, 1H), 8.49 (d, J = 7.9 Hz, 1H), 8.78 (s, 1H), 12.08 (s, 1H, CONH), 12.40 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 123.7(+), 126.3(+), 127.4(+), 128.6(+), 130.2(+), 130.4, 133.8, 135.1(+), 136.9, 147.4, 166.2 (C=O), 179.1 (C=S).

2-nitro-*N*-(phenylcarbamothioyl)benzamide (BTU 38): Recrystallization from ethanol, with overall yield of 82%. M.P.: 172 ºC. FT-IR (KBr, cm^{-1}): 3174 (N-H), 1691 (C=O), 1257 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 7.29 (t, J = 7.4 Hz, 1H), 7.44 (t, J = 7.8, 2H), 7.71 (d, J = 7.6, 2H), 7.80 (m, 2H), 7.91 (m, 1H), 8.23 (d, J = 8.2 Hz, 2H), 12.17 (s, 1H, CONH); 12.28 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 124.2(+), 124.4(+), 126.5(+), 128.8(+), 129.5(+), 130.6, 131.7(+), 134.6(+), 137.8, 145.8, 167.6 (C=O), 178.6 (C=S).

***N*-(benzylcarbamothioyl)-2-nitrobenzamide (BTU 39):** Recrystallization from ethanol, with overall yield of 60%. M.P.: 156 ºC. FT-IR (KBr, cm^{-1}): 3251 (amide N-H), 3033 (thiourea N-H), 1700 (C=O), 1256 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 4.90 (d, J = 5.5 Hz, 2H), 7.30 (t, J = 6.7 Hz, 1H), 7.39 (m, 4H), 7.76 (m, 2H), 7.87 (t, J = 7.3 Hz, 1H), 8.19 (d, J = 8.0 Hz, 1H), 10.90 (t, J = 5.5 Hz, 1H, CSNH),

11.96 (s, 1H, CONH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 48.0(-) (CH_2), 124.2(+), 127.3(+), 127.7(+), 128.5(+), 129.4(+), 130.7, 131.6(+), 134.6(+), 137.4, 145.5, 167.2 (C=O), 180.1 (C=S).

***N*-(4-methoxyphenylcarbamothioyl)-2-nitrobenzamide (BTU 40):** Recrystallization from ethanol/acetone, with overall yield of 76%. M.P.: 179 ºC. FT-IR (KBr, cm^{-1}): 3384 (amide N-H), 3053 (thiourea N-H), 1700 (C=O), 1247 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 3.79 (s, 3H, OCH_3), 6.99 (d, J = 9.0 Hz, 2H), 7.57 (d, J = 9.0 Hz, 2H), 7.80 (m, 2H), 7.91 (t, J = 7.4 Hz, 1H), 8.22 (d, J = 7.4 Hz, 1H), 12.11 (s, 1H, CONH), 12.12 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 55.3(+) (OCH_3), 113.9(+), 124.2(+), 126.0(+), 129.5(+), 130.6, 131.7(+), 134.6(+), 145.5, 157.5, 167.5 (C=O), 178.7 (C=S).

2-nitro-*N*-(4-nitrophenylcarbamothioyl)benzamide (BTU 42): Recrystallization from ethanol/acetone, with overall yield of 43%. M.P.: 216 ºC. FT-IR (KBr, cm^{-1}): 3206 (amide N-H), 3066 (thiourea N-H), 1696 (C=O), 1257 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 7.82 (m, 2H), 7.93 (t, J = 7.6 Hz, 1H), 8.09 (d, J = 8.9 Hz, 2H), 8.24 (d, J = 7.6 Hz, 1H), 8.30 (d, J = 8.9 Hz, 2H), 12.35 (s, 1H, CONH), 12.54 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 124.3(+), 124.3(+), 124.4(+), 129.5(+), 130.4, 131.9(+), 134.7(+), 143.8, 144.5, 145.5, 167.4 (C=O), 178.7 (C=S).

***N*-(4-chlorophenylcarbamothioyl)-2-nitrobenzamide (BTU 43):** Recrystallization from ethanol/acetone, with overall yield of 77%. M.P.: 202 ºC. FT-IR (KBr, cm^{-1}): 3236 (amide N-H), 3031 (thiourea N-H), 1692 (C=O), 1256 (C=S). ^{1}H NMR (400 MHz,

DMSO-d_6, ppm): 7.49 (d, J = 8.9 Hz, 2H), 7.73 (d, J = 8.9 Hz, 2H), 7.81 (m, 2H), 7.91 (t, J = 7.9 Hz, 1H), 8.23 (d, J = 7.9 Hz, 1H), 12.21 (s, 1H, CONH), 12.23 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 124.2(+), 126.4(+), 128.6(+), 129.5(+), 130.4, 130.5, 131.8(+), 134.7(+), 136.8, 145.5, 167.4 (C=O), 178.8 (C=S).

4-chloro-*N*-(phenylcarbamothioyl)benzamide (BTU 44): Recrystallization from ethanol, with overall yield of 99%. M.P.: 144 ºC. FT-IR (KBr, cm^{-1}): 3329 (amide N-H), 1668 (C=O), 1259 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 7.28 (t, J = 7.6 Hz, 1H), 7.43 (t, J = 7.8 Hz, 2H), 7.61 (d, J = 8.6 Hz, 2H), 7.69 (d, J = 7.8 Hz, 2H), 8.00 (d, J = 8.6 Hz, 2H), 11.68 (s, 1H, CONH), 12.53 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 124.3(+), 126.3(+), 128.5, 128.7(+), 130.7(+), 131.0, 138.0, 138.0, 167.2 (C=O); 179.0 (C=S).

4-chloro-*N*-(4-hydroxyphenylcarbamothioyl)benzamide (BTU 47): Recrystallization from ethanol, with overall yield of 99%. M.P.: 186 ºC. FT-IR (KBr, cm^{-1}): 3389 (amide N-H), 3056 (thiourea N-H), 1676 (C=O), 1269 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 6.80 (d, J = 8.8 Hz, 2H), 7.43 (d, J = 8.8 Hz, 2H), 7.60 (d, J = 8.6 Hz, 2H), 7.98 (d, J = 8.6 Hz, 2H), 9.59 (s, 1H, OH), 11.59 (s, 1H, CONH), 12.33 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 115.2(+), 126.0(+), 128.5(+), 129.3, 131.0(+), 131.1, 137.9, 155.8, 167.2 (C=O), 178.9 (C=S).

3-chloro-*N*-(phenylcarbamothioyl)benzamide (BTU 48): Recrystallization from ethanol, with overall yield of 68%. M.P.: 135 ºC. FT-IR (KBr, cm^{-1}): 3221 (N-H), 1671 (C=O), 1251 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 7.28 (t, J = 7.4 Hz, 1H),

7.43 (t, *J* = 7.8 Hz, 1H), 7.57 (t, *J* = 7.8 Hz, 1H), 7.71 (m, 3H), 7.92 (d, *J* = 7.8 Hz, 1H), 8.04 (s, 1H), 11.73 (s, 1H, CONH), 12.48 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 124.3(+), 126.4(+), 127.4(+), 128.5(+), 128.7(+), 130.3(+), 132.7(+), 133.1, 134.2, 137.9, 166.9 (C=O), 178.9 (C=S).

***N*-(benzylcarbamothioyl)-3-chlorobenzamide (BTU 49):** Recrystallization from ethanol, with overall yield of 72%. M.P.: 126 ºC. FT-IR (KBr, cm^{-1}): 3208 (amide N-H), 3053 (thiourea N-H), 1677 (C=O), 1251 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 4.88 (d, *J* = 5.5 Hz, 2H), 7.29 (m, 1H), 7.38 (m, 4H), 7.54 (t, *J* = 7.9 Hz, 1H), 7.69 (d, *J* = 7.9 Hz, 1H), 7.87 (d, *J* = 7.9 Hz, 1H), 7.99 (s, 1H), 11.14 (t, *J* = 5.5 Hz, 1H, CONH), 11.59 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 48.1(-) (CH_2), 127.3(+), 127.3(+), 127.7(+), 128.4(+), 128.5(+), 130.3(+), 132.6(+), 133.1, 134.3, 137.3, 166.7 (C=O), 180.4 (C=S).

3-chloro-*N*-(4-methoxyphenylcarbamothioyl)benzamide (BTU 50): Recrystallization from ethanol/acetone, with overall yield of 79%. M.P.: 128 ºC. FT-IR (KBr, cm^{-1}): 3240 (amide N-H), 3042 (thiourea N-H), 1669 (C=O), 1250 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 3.78 (s, 3H, OCH_3), 6.98 (d, *J* = 9.0 Hz, 2H), 7.56 (m, 3H), 7.71 (d, *J* = 8.0 Hz, 1H), 7.91 (d, *J* = 8.0 Hz, 1H), 8.03 (s, 1H), 11.67 (s, 1H, CONH), 12.34 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 55.3(+) (OCH_3), 113.8(+), 125.9(+), 127.4(+), 128.4(+), 130.3(+), 130.8, 132.7(+), 133.1, 134.3, 157.5, 166.8 (C=O), 179.0 (C=S).

3-chloro-*N*-(4-hydroxyphenylcarbamothioyl)benzamide (BTU 51): Recrystallization from ethanol, with overall yield of 75%. M.P.: 182 ºC. FT-IR (KBr, cm^{-1}): 3382 (amide

N-H), 3062 (thiourea N-H), 1673 (C=O), 1266 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 6.80 (d, J = 8.4 Hz, 2H), 7.42 (d, J = 8.4, 2H), 7.56 (t, J = 7.9 Hz, 1H), 7.72 (d, J = 7.9 Hz, 1H), 7.90 (d, J = 7.9 Hz, 1H), 8.02 (s, 1H), 9.59 (s, 1H, OH), 11.64 (s, 1H, CONH), 12.28 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 115.1(+), 125.9(+), 127.4(+), 128.4(+), 129.3, 130.3(+), 132.7(+), 133.1, 134.3, 155.8, 166.8 (C=O), 178.8 (C=S).

2-chloro-*N*-(4-hydroxyphenylcarbamothioyl)benzamide (BTU 52): Recrystallization from ethanol, with overall yield of 78%. M.P.: 198 ºC. FT-IR (KBr, cm^{-1}): 3404 (amide N-H), 3026 (thiourea N-H), 1686 (C=O), 1255 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 6.80 (d, J = 8.9 Hz, 2H), 7.44 (m, 3H), 7.54 (m, 2H), 7.62 (d, J = 8.9 Hz, 1H), 9.59 (s, 1H, OH), 11.90 (s, 1H, CONH), 12.16 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 115.1(+), 126.0(+), 127.1(+), 129.2, 129.3(+), 129.6(+), 130.0, 132.1(+), 134.4, 155.9, 167.8 (C=O), 178.6 (C=S).

4-methoxy-*N*-(phenylcarbamothioyl)benzamide (BTU 53): Recrystallization from ethanol, with overall yield of 98%. M.P.: 123 ºC. FT-IR (KBr, cm^{-1}): 3298 (N-H), 1660 (C=O), 1254 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 3.86 (s, 3H, OCH_3), 7.07 (d, J = 8.9 Hz, 2H), 7.27 (t, J = 7.4 Hz, 1H), 7.43 (t, J = 7.8 Hz, 2H), 7.70 (d, J = 7.8 Hz, 2H), 8.03 (d, J = 8.9 Hz, 2H), 11.38 (s, 1H, CONH), 12.74 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 55.6(+) (OCH_3), 113.8(+), 123.8, 124.3(+), 126.2(+), 128.7(+), 131.0(+), 138.0, 163.2, 167.5 (C=O), 179.2 (C=S).

***N*-(benzylcarbamothioyl)-4-methoxybenzamide (BTU 54):** Recrystallization from ethanol, with overall yield of 94%. M.P.: 126 ºC. FT-IR (KBr, cm^{-1}): 3412 (amide N-

H), 3032 (thiourea N-H), 1664 (C=O), 1257 (C=S). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): 3.87 (s, 3H, OCH_3), 4.91 (d, *J* = 5.3 Hz, 2H, CH_2), 6.96 (d, *J* = 8.7 Hz, 2H), 7.34 (m, 5H), 7.80 (d, *J* = 8.7 Hz, 2H), 9.05 (s, 1H, CONH), 11.09 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, $CDCl_3$, ppm): 49.9(-) (CH_2), 55.7(+) (OCH_3), 114.5(+), 123.7, 128.0(+), 129.0(+), 129.7(+), 136.3, 164.0, 166.3 (C=O), 180.3 (C=S).

***N*-(4-hydroxyphenylcarbamothioyl)-4-methoxybenzamide (BTU 55):** Recrystallization from ethanol, with overall yield of 81%. M.P.: 170 ºC. FT-IR (KBr, cm^{-1}): 3376 (amide N-H), 3036 (thiourea N-H), 1664 (C=O), 1262 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 3.85 (s, 3H, OCH_3), 6.79 (d, *J* = 8.9 Hz, 2H), 7.06 (d, *J* = 8.9 Hz, 2H), 7.43 (d, *J* = 8.9 Hz, 2H), 8.01 (d, *J* = 8.9 Hz, 2H), 9.60 (s, 1H, OH), 11.29 (s, 1H, CONH), 12.53 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 55.6(+) (OCH_3), 113.8(+), 115.1(+), 124.0, 126.0(+), 129.4, 131.0(+), 155.8, 163.2, 167.5 (C=O), 179.1 (C=S).

4-methoxy-*N*-(4-nitrophenylcarbamothioyl)benzamide (BTU 56): Recrystallization from ethanol, with overall yield of 95%. M.P.: 180 ºC. FT-IR (KBr, cm^{-1}): 3300 (amide N-H), 3011 (thiourea N-H), 1664 (C=O), 1257 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 3.86 (s, 3H, OCH_3), 7.08 (d, *J* = 8.5 Hz, 2H), 8.03 (d, *J* = 8.5 Hz, 2H), 8.09 (d, *J* = 8.7 Hz, 2H), 8.28 (d, *J* = 8.7 Hz, 2H), 11.60 (s, 1H, CONH), 13.02 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 55.6(+) (OCH_3), 113.8(+), 123.6, 123.9, 124.3(+), 131.1(+), 144.1, 144.2, 163.4, 167.4 (C=O), 179.4 (C=S).

3-methoxy-*N*-(phenylcarbamothioyl)benzamide (BTU 57): Recrystallization from ethanol, with overall yield of 82%. M.P.: 103 ºC. FT-IR (KBr, cm^{-1}): 3301 (amide N-

H), 3031 (thiourea N-H), 1675 (C=O), 1274 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 3.86 (s, 3H, OCH_3), 7.22 (d, J = 8.2 Hz, 2H), 7.28 (t, J = 7.5 Hz, 1H), 7.44 (m, 3H), 7.57 (m, 2H), 7.71 (d, J = 7.5 Hz, 2H), 11.59 (s, 1H, CONH), 12.63 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 55.5(+) (OCH_3), 113.3(+), 119.4(+), 121.0(+), 124.4(+), 126.3(+), 128.7(+), 129.7(+), 133.5, 138.0, 159.0, 168.0 (C=O), 179.1 (C=S).

***N*-(benzylcarbamothioyl)-3-methoxybenzamide (BTU 58):** Recrystallization from ethanol, with overall yield of 76%. M.P.: 85 ºC. FT-IR (KBr, cm^{-1}): 3288 (amide N-H), 3028 (thiourea N-H), 1675 (C=O), 1269 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 3.84 (s, 3H, OCH_3), 4.89 (d, J = 5.5 Hz, 2H, CH_2), 7.19 (d, J = 8.2 Hz, 1H), 7.30 (m, 1H), 7.40 (m, 5H), 7.53 (m, 2H), 11.26 (t, J = 5.5 Hz, 1H, CSNH), 11.45 (s, 1H, CONH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 48.2(-) (CH_2), 55.4(+) (OCH_3), 113.1(+), 119.3(+), 120.9(+), 127.3(+), 127.7(+), 128.5(+), 129.6(+), 133.5, 137.3, 159.0, 167.8 (C=O), 180.5 (C=S).

***N*-(4-chlorophenylcarbamothioyl)-3-methoxybenzamide (BTU 60):** Recrystallization from ethanol, with overall yield of 96%. M.P.: 123 ºC. FT-IR (KBr, cm^{-1}): 3301 (amide N-H), 3014 (thiourea N-H), 1671 (C=O), 1272 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 3.85 (s, 3H, OCH_3), 7.22 (d, J = 8.1 Hz, 1H), 7.46 (m, 3H), 7.56 (m, 2H), 7.73 (d, J = 8.5 Hz, 2H), 11.65 (s, 1H, CONH), 12.58 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 55.4(+) (OCH_3), 113.3(+), 119.5(+), 121.0(+), 126.2(+), 128.6(+), 129.7(+), 130.3, 133.4, 137.0, 159.0, 167.9 (C=O), 179.4 (C=S).

2-methoxy-*N*-(phenylcarbamothioyl)benzamide (BTU 61): Recrystallization from ethanol, with overall yield of 78%. M.P.: 139 ºC. FT-IR (KBr, cm^{-1}): 3316 (amide N-H), 3027 (thiourea N-H), 1665 (C=O), 1291 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 4.02 (s, 3H, OCH_3), 7.17 (t, J = 7.4 Hz, 1H), 7.29 (m, 2H), 7.44 (t, J = 7.8 Hz, 2H), 7.68 (m, 3H), 7.93 (dd, J = 7.8 & 1.7 Hz, 1H), 11.24 (s, 1H, CONH), 12.56 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 56.7(+) (OCH_3), 112.9(+), 119.5, 121.3(+), 124.2(+), 126.5(+), 128.7(+), 131.2(+), 135.1(+), 137.8, 157.6, 165.3 (C=O), 178.0 (C=S).

***N*-(benzylcarbamothioyl)-2-methoxybenzamide (BTU 62):** Recrystallization from ethanol, with overall yield of 69%. M.P.: 96 ºC. FT-IR (KBr, cm^{-1}): 3254 (amide N-H), 3051 (thiourea N-H), 1678 (C=O), 1261 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 3.99 (s, 3H, OCH_3), 4.88 (d, J = 5.8 Hz, 2H), 7.14 (t, J = 7.6 Hz, 1H), 7.28 (m, 2H), 7.38 (m, 4H), 7.63 (t, J = 8.0 Hz, 1H), 7.88 (d, J = 8.0 Hz, 1H), 11.08 (s, 1H, CONH), 11.11 (t, J = 5.8 Hz, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 48.3(-) (CH_2), 56.6(+) (OCH_3), 112.8(+), 119.6, 121.3(+), 127.3(+), 127.7(+), 128.5(+), 131.1(+), 134.9(+), 137.3, 157.4, 164.9 (C=O), 179.5 (C=S).

2-methoxy-*N*-(4-methoxyphenylcarbamothioyl)benzamide (BTU 63): Recrystallization from ethanol, with overall yield of 95%. M.P.: 116 ºC. FT-IR (KBr, cm^{-1}): 3317 (amide N-H), 3034 (thiourea N-H), 1666 (C=O), 1252 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 3.78 (s, 3H, OCH_3), 4.01 (s, 3H, OCH_3), 6.98 (d, J = 9.0 Hz, 2H), 7.17 (t, J = 7.5 Hz, 1H), 7.29 (d, J = 8.4 Hz, 1H), 7.59 (d, J = 9.0 Hz, 2H), 7.66 (m, 1H), 7.93 (d, J = 7.5 Hz, 1H), 11.18 (s, 1H, CONH), 12.40 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 55.3(+) (OCH_3), 56.7(+)

(OCH_3), 112.8(+), 113.8(+), 119.5, 121.3(+), 125.8(+), 130.7, 131.2(+), 135.1(+), 157.5, 165.2 (C=O), 178.0 (C=S).

***N*-(4-chlorophenylcarbamothioyl)-2-methoxybenzamide (BTU 65):** Recrystallization from ethanol, with overall yield of 76%. M.P.: 145 ºC. FT-IR (KBr, cm^{-1}): 3299 (amide N-H), 3030 (thiourea N-H), 1667 (C=O), 1255 (C=S). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 4.01 (s, 3H, OCH_3), 7.17 (t, J = 7.5 Hz, 1H), 7.29 (d, J = 8.7 Hz, 1H), 7.49 (d, J = 8.7 Hz, 2H), 7.67 (t, J = 7.8 Hz, 1H), 7.74 (d, J = 8.7 Hz, 2H), 7.91 (d, J = 7.5 Hz, 1H), 11.27 (s, 1H, CONH), 12.52 (s, 1H, CSNH). ^{13}C NMR (DEPT-135 phase) (100 MHz, DMSO-d_6, ppm): 56.7(+) (OCH_3), 112.8(+), 119.5, 121.3(+), 126.1(+), 128.6(+), 130.4, 131.1(+), 135.1(+), 136.8, 157.5, 165.3 (C=O), 178.3 (C=S).