# Supporting information

## Research on Controllable Degradation of *N*-methylamido and dialkylamino Substituted at the 5th position of the Benzene Ring in Chlorsulfuron in Acidic Soil

Fan-Fei Meng[a], Lei Wu[a], Yu-Cheng Gu[b], Sha Zhou[a], Yong-Hong Li[a], Ming-Gui Chen[c], Shaa Zhou[d], Yang-Yang Zhao[a], Huan-Gong Li[a], Yi Ma[a,*], Zheng-Ming Li[a,*]

[a] *State Key Laboratory of Elemento-Organic Chemistry, Collaborative Innovation Centre of Chemical Science and Engineering (Tianjin), College of Chemistry, Nankai University, Tianjin 300071, China*
[b] *Syngenta Jealott's Hill International Research Centre, RG42 6EY, United Kingdom, UK*
[c] *Tianjin Tianbin Ruicheng Environmental Technology Engineering Co., Ltd, Tianjin 300000, China*
[d] *College of Agriculture and Food Science, Zhejiang A&F University, Zhejiang 311300, China*

*Corresponding Author: Zheng-Ming Li
Email: nkzml@vip.163.com,
Tel.: 0086-22-23503732,
Fax: 0086-22-23505948.

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## **SI1.** Crystal data of **M03**

| | |
|---|---|
| Molecular formula | $C_{17}H_{16}ClN_6O_5S$ |
| Formula weight | 451.87 |
| Temperature | 113.15 K |
| Crystal system, Space group | triclinic system, P-1 |
| Radiation | MoKα (λ = 0.71073 Å) |
| Unit cell dimensions | *a* = 7.8939(16) Å, *b* = 8.9985(18) Å, *c* = 14.466(3) Å; *α* = 85.32(3)°, *β* = 81.63(3)°, *γ* = 72.73(3)°; cell ratio as *a*/*b* = 0.8774, *b*/*c* = 0.6220, *c*/*a* = 1.8325 |
| calculated density | 1.547 g/cm$^3$ |
| Volume | 970.0(4) Å$^3$ |
| Z | 2 |
| Absorption coefficient | 0.350 mm$^{-1}$ |
| F(000) | 466.0 |
| Crystal size | 0.20 mm x 0.18 mm x 0.12 mm |
| 2θ range for data collection/° | 4.744° to 50.052° |
| Index ranges | $-9\leq h\leq 9$; $-10\leq k\leq 10$; $-17\leq l\leq 17$ |
| Reflections collected | 9370 |
| Independent reflections | 3424 [$R_{int}$ = 0.0315, $R_{sigma}$ = 0.0346] |
| Data/restraints/parameters | 3424/3/274 |
| Goodness-of-fit on $F^2$ | 1.058 |
| Final R indexes [I>=2σ (I)] | $R_1$ = 0.0570, $wR_2$ = 0.1506 |
| Final R indexes [all data] | $R_1$ = 0.0676, $wR_2$ = 0.1597 |
| Largest difference peak and hole | 1.67/-0.59 e/Å$^{-3}$ |

## **SI 2.** Crystal data of **N03**

| | |
|---|---|
| Molecular formula | $C_{16}H_{19}ClN_6O_4S$ |
| Formula weight | 426.88 |
| Temperature | 113(2) K |
| Crystal system, Space group | Monoclinic system, P2(1)/c |
| Radiation | MoKα (λ = 0.71073 Å) |
| Unit cell dimensions | *a* = 10.2847(5) Å, *b* = 17.1412(7) Å, *c* = 11.2410(5) Å; *α* = 90°, *β* = 102.533(5)°, *γ* = 90°; cell ratio as *a*/*b* = 0.6000, *b*/*c* = 1.5249, *c*/*a* = 1.0930 |
| calculated density | 1.466 g/cm$^3$ |
| Volume | 1934.48(15) Å$^3$ |
| Z | 4 |
| Absorption coefficient | 0.342 mm$^{-1}$ |
| F(000) | 888 |
| Crystal size | 0.200 mm x 0.180 mm x 0.120 mm |
| θ range for data collection | 2.028° to 26.372° |
| Limiting indices | $-12\leq h\leq 12$; $-21\leq k\leq 21$; $-14\leq l\leq 14$ |
| Reflections collected/unique | 20402 / 3952 [$R_{(int)}$ = 0.0422] |
| Completeness to θ = 25.242 | 100.0 % |
| Absorption correction | Semi-empirical from equivalents |
| Max. and min. transmission | 1 and 0.51980 |
| Refinement method | Full-matrix least-squares on $F^2$ |
| Data/restraints/parameters | 3952/2/262 |
| Goodness-of-fit on $F^2$ | 1.040 |

| | |
|---|---|
| Final R indices [I>2σ(I)] | $R_1$ = 0.0496, $wR_2$ = 0.1274 |
| R indices (all data) | $R_1$ = 0.0589, $wR_2$ = 0.1345 |
| Extinction coefficient | n/a |
| Largest diff. peak and hole | 0.621 and -0.548 e/Å$^{-3}$ |

## **SI3.** The standard curves of target compounds

| Compud. | Standard curve | Correlation coefficient ($R^2$) |
|---|---|---|
| **M01** | Y=64660.8X-17.8837 | $R^2$＞0.9999 |
| **M02** | Y=63086.9X-7391.33 | $R^2$＞0.9999 |
| **M03** | Y=52581.4X+546.885 | $R^2$＞0.9999 |
| **M04** | Y=49791.6X-349.667 | $R^2$＞0.9999 |
| **M05** | Y=55169X+530.779 | $R^2$＞0.9999 |
| **N01** | Y=59911.9X+10548.8 | $R^2$＞0.9999 |
| **N02** | Y=55456.3X+8474.75 | $R^2$＞0.9999 |
| **N03** | Y=66717X+626.688 | $R^2$＞0.9999 |
| **N04** | Y=71978.9X+302.746 | $R^2$＞0.9999 |
| **N05** | Y=50577.7X-2712.01 | $R^2$＞0.9999 |
| **N06** | Y=47970.7X-1104.17 | $R^2$＞0.9999 |
| **N07** | Y=50130.9X+1689.56 | $R^2$＞0.9999 |
| **N08** | Y=49832.2X-395.95 | $R^2$＞0.9999 |
| **N09** | Y=45583.9X+2775.24 | $R^2$＞0.9999 |
| **N10** | Y=43188X+3159.8 | $R^2$＞0.9999 |
| **N11** | Y=47694.5X+4134.51 | $R^2$＞0.9999 |
| **N12** | Y=49563.8X+3671.63 | $R^2$＞0.9999 |
| **N13** | Y=33761.4X+511.688 | $R^2$＞0.9999 |
| **Chlosulfuron** | Y=41190.4X+7389.03 | $R^2$＞0.9999 |

## **SI4.** Characteristic data of target compounds and intermediates **18**

Sodium (4-methoxy-6-methyl-1,3,5-triazin-2-yl)(phenoxycarbonyl)amide **18**:White solid, yield 92.5%; $^1$H NMR (400 MHz, MeOD-*d4*) δ 7.07 (t, *J* = 7.6 Hz, 2H, Ph-**H**), 6.70 (d, *J* = 7.8 Hz, 2H, Ph-**H**), 6.59 (t, *J* = 7.1 Hz, 1H, Ph-**H**), 3.98 (s, 3H, OC**H**$_3$), 2.40 (s, 3H, C**H**$_3$). $^{13}$C NMR (101 MHz, DMSO-*d6*) *δ*: 175.89, 171.81, 171.08, 159.57, 153.97, 129.15, 122.52, 116.00, 53.48, 25.57. HRMS calcd for $C_{12}H_{11}N_4NaO_3^+$[M+H] 283.0807, found 283.0801.

*N*-(4-chloro-3-(*N*-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)sulfamoyl)phenyl)-*N*-methylformamide **M01**: White solid, yield 89.3%, m.p. 181~183 ℃; $^1$H NMR (400 MHz, Acetone-*d6*), *δ*: 12.85 (s, 1H, $SO_2$N**H**CONH), 9.76 (s, 1H, NCO**H**), 7.43 (s, 1H, $SO_2$NHCON**H**), 7.32 (d, *J* = 8.8 Hz, 1H, Ph-**H**), 6.85 (d, *J* = 6.5 Hz, 1H, Ph-**H**), 5.76 (s, 1H, Ph-**H**), 4.03 (s, 3H, OC**H**$_3$), 2.85 (s, 3H, NC**H**$_3$), 2.51 (s, 3H, C**H**$_3$). $^{13}$C NMR (101 MHz, MeOD-*d4*), *δ*: 178.70, 172.16, 149.04, 147.48, 136.61, 133.61, 131.77, 116.91, 115.92, 114.65, 114.58, 54.74, 28.78, 23.81. HRMS calcd for $C_{14}H_{15}ClN_6O_5S^+$[M+H] 415.0591,

found 415.0583.

*N*-(4-chloro-3-(*N*-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)sulfamoyl)phenyl)-*N*-methylacetamide **M02**: White solid, yield 83.5%, m.p 146-148 ℃. $^1$H NMR (400 MHz, $CDCl_3$) *δ:* 12.82 (s, 1H, $SO_2N$**H**CONH), 8.15 (s, 1H, Ph-**H**), 8.04 (s, 1H, $SO_2NHCON$**H**), 7.57 (d, *J* = 7.2 Hz, 1H, Ph-**H**), 7.43 (s, 1H, Ph-**H**), 4.06 (s, 3H, $OC$**H**$_3$), 3.30 (s, 3H, $NC$**H**$_3$), 2.59 (s, 3H, $C$**H**$_3$), 1.94 (s, 3H, $COC$**H**$_3$). $^{13}$C NMR (101 MHz, $CDCl_3$) *δ:* 179.20, 170.59, 170.20, 163.43, 148.02, 143.41, 137.11, 133.15, 132.89, 131.82, 130.72, 55.71, 37.20, 25.44, 22.57. HRMS calcd for $C_{15}H_{17}ClN_6O_5S^+$[M+H] 429.0748, found 429.0741.

*N*-(4-chloro-3-(*N*-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)sulfamoyl)phenyl)-*N*-methylcyclopropanecarboxamide **M03**:White solid, yield 88.1%, m.p. 155~157 ℃;$^1$H NMR (400 MHz, $CDCl_3$) *δ:* 12.82 (s, 1H, $SO_2N$**H**CONH), 8.26 (d, *J* = 2.4 Hz, 1H, Ph-**H**), 7.71 (s, 1H, $SO_2NHCON$**H**), 7.56 (d, *J* = 8.4 Hz, 1H, Ph-**H**), 7.51 (dd, *J* = 8.5, 2.4 Hz, 1H, Ph-**H**), 4.06 (s, 3H, $OC$**H**$_3$), 3.35 (s, 3H, $NC$**H**$_3$), 2.59 (s, 3H, $C$**H**$_3$), 1.41 (s, 1H, Cyclopropyl-**H**), 1.15–0.99 (m, 2H, Cyclopropyl-**H**$_2$), 0.84-0.72 (m, 2H, Cyclopropyl-**H**$_2$). $^{13}$C NMR (101 MHz, $CDCl_3$) *δ:* 179.25, 173.44, 170.76, 163.41, 147.93, 143.32, 136.92, 133.15, 132.66, 131.55, 129.96, 55.77, 37.38, 25.49, 13.04, 9.08. HRMS calcd for $C_{17}H_{19}ClN_6O_5S^+$[M+H] 455.0904, found 455.0900.

*N*-(4-chloro-3-(*N*-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)sulfamoyl)phenyl)-*N*-methylpivalamide **M04**:White solid, yield 87.2%, m.p. 154~156 ℃; $^1$H NMR (400 MHz, $CDCl_3$) *δ:* 12.81 (s, 1H, $SO_2N$**H**CONH), 8.19 (s, 1H, Ph-**H**), 7.81 (s, 1H, $SO_2NHCON$**H**), 7.56 (d, *J* = 8.3 Hz, 1H, Ph-**H**), 7.46 (d, *J* = 8.4 Hz, 1H, Ph-**H**), 4.07 (s, 3H, $OC$**H**$_3$), 3.27 (s, 3H, $NC$**H**$_3$), 2.60 (s, 3H, $C$**H**$_3$), 1.12 (s, 9H, $C(C$**H**$_3)_3$).$^{13}$C NMR (101 MHz, $CDCl_3$) *δ:* 179.30, 178.08, 170.64, 163.44, 147.87, 144.61, 136.91, 134.91, 132.86, 132.47, 130.72, 55.75, 41.12, 40.80, 29.37, 25.48. HRMS calcd for $C_{18}H_{23}ClN_6O_5S^+$[M+H] 471.1217, found 471.1216.

*N*-(4-chloro-3-(*N*-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)sulfamoyl)phenyl)-*N*-methylbenzamide **M05**: White solid, yield 90.3%, m.p. 95~97 ℃; $^1$H NMR (400 MHz, $CDCl_3$) *δ:* 12.79 (s, 1H, $SO_2N$**H**CONH), 8.18 (d, *J* = 2.6 Hz, 1H, Ph-**H**), 7.47 (s, 1H, $SO_2NHCON$**H**), 7.32 (m, 2H, Ph-**H**), 7.30 – 7.21 (m, 4H, Ph-**H**), 7.11 – 7.05 (dd, *J* = 12.0, 2.0 Hz, 1H, Ph-**H**), 4.06 (s, 3H, $OC$**H**$_3$), 3.53 (s, 3H, $NC$**H**$_3$), 2.58 (s, 3H, $C$**H**$_3$). $^{13}$C NMR (101 MHz, $CDCl_3$) *δ:* 170.62, 163.38, 147.85, 143.99, 136.70, 134.82, 133.28, 132.07, 130.29, 129.11, 128.78, 128.53, 128.32, 128.29, 126.95, 55.77, 38.34, 25.48. HRMS calcd for $C_{20}H_{19}ClN_6O_5S^+$[M+H] 491.0904, found 491.0899.

2-chloro-N-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)-5-(methyl(propyl)amino)benzenesulfonamide **N02**: White solid, yield 87.9%, m.p. 162~164 ℃; $^1$H NMR

(400 MHz, $CDCl_3$) δ 12.71 (s, 1H, $SO_2N$**H**CONH), 7.51 (d, *J* = 3.1 Hz, 1H, Ph-**H**), 7.30 (s, 1H, $SO_2$NHCON**H**), 7.25 (d, *J* = 10.1 Hz, 1H, Ph-**H**), 6.74 (dd, *J* = 9.0, 3.2 Hz, 1H, Ph-**H**), 4.05 (s, 3H, OC**H**$_3$), 3.32 (t, *J* = 7.6 Hz, 2H, NC**H**$_2$$CH_2CH_3$), 2.99 (s, 3H, NC**H**$_3$), 2.57 (s, 3H, C**H**$_3$), 1.66-1.59 (m, 2H, $NCH_2$C**H**$_2$$CH_3$), 0.93 (t, *J* = 7.4 Hz, 3H, $NCH_2CH_2$C**H**$_3$). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 178.08, 170.70, 163.39, 147.93, 147.89, 135.81, 132.03, 116.96, 116.06, 115.14, 55.71, 54.30, 38.56, 25.46, 19.89, 11.44. HRMS calcd for $C_{16}H_{21}ClN_6O_4S$ $^+$[M+H] 429.1112, found 429.1108.

5-(allyl(methyl)amino)-2-chloro-N-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)benzenesulfonamide **N03**: White solid, yield 88.6%, m.p. 172~174 ℃; $^1$H NMR (400 MHz, $CDCl_3$) δ 12.67 (s, 1H, $SO_2N$**H**CONH), 7.55 (d, *J* = 3.0 Hz, 1H, Ph-**H**), 7.34 (s, 1H, $SO_2$NHCON**H**),7.25 (d, *J* = 7.9 Hz, 1H, Ph-**H**), 6.76 (dd, *J* = 8.9, 3.1 Hz, 1H, Ph-**H**), 5.80 (ddd, *J* = 15.2, 9.9, 4.8 Hz, 1H, C**H**=$CH_2$), 5.17 (dd, *J* = 20.5, 13.7 Hz, 2H, CH=C**H**$_2$), 4.05 (s, 3H, OC**H**$_3$), 3.97 (d, *J* = 4.7 Hz, 2H, NC**H**$_2$), 3.02 (s, 3H, NC**H**$_3$), 2.57 (s, 3H, C**H**$_3$). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 179.55, 170.50, 163.40, 148.00, 147.89, 135.85, 132.08, 132.02, 117.47, 116.92, 116.83, 115.51, 55.71, 54.98, 38.33, 25.46.HRMS calcd for $C_{16}H_{19}ClN_6O_4S$ $^+$[M+H] 427.0955, found 427.0951.

2-chloro-N-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)-5-(methyl(prop-2-yn-1-yl)amino)benzenesulfonamide **N04**: Yellow solid, yield 91.3%, m.p. 173~175 ℃; $^1$H NMR (400 MHz, $CDCl_3$) δ 12.69 (s, 1H, $SO_2N$**H**CONH), 7.66 (d, *J* = 3.1 Hz, 1H, Ph-**H**), 7.46 (s, 1H, $SO_2$NHCON**H**), 7.32 (d, *J* = 8.9 Hz, 1H, Ph-**H**), 6.92 (dd, *J* = 8.9, 3.1 Hz, 1H, Ph-**H**), 4.08 (d, *J* = 2.3 Hz, 2H, C**H**$_2$CCH), 4.05 (s, 3H, OC**H**$_3$), 3.05 (s, 3H, NC**H**$_3$), 2.57 (s, 3H, C**H**$_3$), 2.23 (t, *J* = 2.3 Hz, 1H, C≡C**H**). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 179.12, 170.66, 163.40, 147.90, 147.61, 136.02, 132.09, 119.00, 118.88, 117.23, 77.97, 72.85, 55.72, 42.22, 38.70, 25.46. HRMS calcd for $C_{16}H_{17}ClN_6O_4S$ $^+$[M+H] 425.0799, found 425.0794.

5-(butyl(methyl)amino)-2-chloro-N-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)benzenesulfonamide **N06**: White solid, yield 86.3%, m.p. 109~111 ℃; $^1$H NMR (400 MHz, $CDCl_3$) δ 12.66 (s, 1H, $SO_2N$**H**CONH), 7.56 (s, 1H, Ph-**H**), 7.44 (s, 1H, $SO_2$NHCON**H**), 7.28 (d, *J* = 7.3 Hz, 1H, Ph-**H**), 6.81 (d, *J* = 7.9 Hz, 1H, Ph-**H**), 4.07 (s, 3H, OC**H**$_3$), 3.37 (t, *J* = 7.2 Hz, 2H, NC**H**$_2$$CH_2CH_2CH_3$), 3.01 (s, 3H, NC**H**$_3$), 2.59 (s, 3H, C**H**$_3$), 1.66-1.52 (m, 2H, $NCH_2$C**H**$_2$$CH_2CH_3$), 1.43-1.30(m, 2H, $NCH_2CH_2$C**H**$_2$$CH_3$), 0.97 (t, *J* = 7.3 Hz, 3H, $NCH_2CH_2CH_2$C**H**$_3$). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 178.78, 170.80, 163.39, 147.87, 147.64, 135.88, 132.06, 117.38, 116.59, 115.55, 55.69, 52.57, 38.70, 28.63, 25.43, 20.21, 13.90. HRMS calcd for $C_{17}H_{23}ClN_6O_4S$ $^+$[M+H] 443.1268, found 443.1266.

2-chloro-5-(isobutyl(methyl)amino)-N-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)benzenesulfonamide **N07**: White solid, yield 86.9%, m.p. 128~130 ℃; $^1$H NMR (400 MHz, $CDCl_3$) δ 12.64 (s, 1H, $SO_2N$**H**CONH), 7.51 (d, *J* = 3.2 Hz, 1H, Ph-**H**), 7.31 (s, 1H, $SO_2$NHCON**H**), 7.25 (d, *J* = 9.0 Hz, 1H, Ph-**H**), 6.73 (dd, *J* = 9.0, 3.2 Hz, 1H, Ph-**H**), 4.05 (s, 3H, OC**H**$_3$), 3.16 (d, *J* = 7.4 Hz,

2H, C**H**$_2$), 3.02 (s, 3H, NC**H**$_3$), 2.57 (s, 3H, C**H**$_3$), 2.05 (dt, *J* = 13.8, 6.8 Hz, 1H, C**H**), 0.93 (d, *J* = 6.6 Hz, 6H, CH(C**H**$_3$)$_2$. $^{13}$C NMR (101 MHz, $CDCl_3$) δ 179.54, 170.85, 163.39, 148.14, 147.88, 135.77, 131.96, 116.86, 115.99, 115.05, 60.54, 55.71, 39.60, 27.22, 25.46, 20.32. HRMS calcd for $C_{17}H_{23}ClN_6O_4S^+$[M+H] 443.1268, found 443.1264.

2-chloro-5-(ethyl(propyl)amino)-N-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)benzenesulfonamide **N08**: White solid, yield 86.2%, m.p. 181~183 ℃; $^1$H NMR (400 MHz, $CDCl_3$) δ 12.66 (s, 1H, $SO_2$N**H**CONH), 7.56 (s, 1H, Ph-**H**), 7.37 (s, 1H, $SO_2$NHCON**H**), 7.28 (d, *J* = 3.1 Hz, 1H, Ph-**H**), 6.85 (d, *J* = 7.8 Hz, 1H, Ph-**H**), 4.07 (s, 3H, OC**H**$_3$), 3.43 (t, *J* = 4.0 Hz, 2H, NC**H**$_2$CH$_3$), 3.29 (t, *J* = 4.4 Hz, 2H, NC**H**$_2$CH$_2$CH$_3$), 2.59 (s, 3H, C**H**$_3$), 1.30-1.25 (m, 2H, NCH$_2$C**H**$_2$CH$_3$), 1.20 (t, *J* = 5.6 Hz, 3H, NCH$_2$C**H**$_3$), 0.97 (t, *J* = 6.8 Hz,, 3H, NCH$_2$CH$_2$C**H**$_3$).$^{13}$C NMR (101 MHz, $CDCl_3$) δ 179.32, 171.00, 163.40, 147.87, 146.13, 136.04, 132.20, 117.72, 116.16, 115.86, 55.69, 52.69, 45.83, 25.43, 20.30, 11.84, 11.37.HRMS calcd for $C_{17}H_{23}ClN_6O_4S^+$[M+H] 443.1268, found 443.1264.

2-chloro-5-(cyclopentyl(methyl)amino)-N-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)benzenesulfonamide **N09**: White solid, yield 91.1%, m.p. 81~83 ℃; $^1$H NMR (400 MHz, $CDCl_3$) δ 12.70 (s, 1H, $SO_2$N**H**CONH), 7.65 (d, *J* = 2.9 Hz, 1H, Ph-**H**), 7.41 (s, 1H, $SO_2$NHCON**H**), 7.26 (s, 1H, Ph-**H**), 6.88 (dd, *J* = 9.0, 3.1 Hz, 1H, Ph-**H**), 4.27 – 4.18 (m, 1H, Cyclopentyl-C**H**), 4.08 (s, 3H, OC**H**$_3$), 2.86 (s, 3H, NC**H**$_3$), 2.60 (s, 3H, C**H**$_3$), 2.02-1.89 (m, 2H, Cyclopentyl-C**H**$_2$), 1.70-1.83 (m, 2H, Cyclopentyl-C**H**$_2$), 1.54-1.70 (m, 4H, Cyclopentyl-C**H**$_2$C**H**$_2$). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 179.18, 170.86, 149.24, 147.94, 135.78, 131.96, 129.63, 118.22, 116.71, 116.40, 59.99, 32.14, 28.77, 25.45, 24.25. HRMS calcd for $C_{18}H_{23}ClN_6O_4S^+$[M+H] 455.1268, found 455.1265.

2-chloro-5-(dipropylamino)-N-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)benzenesulfonamide **N10**: White solid, yield 87.6%, m.p. 158~160 ℃; $^1$H NMR (400 MHz, $CDCl_3$) δ 12.64 (s, 1H, $SO_2$N**H**CONH), 7.50 (s, 1H, Ph-**H**), 7.42 (s, 1H, $SO_2$NHCON**H**), 7.23 (d, *J* = 8.8 Hz, 1H, Ph-**H**), 6.74 (s, 1H, Ph-**H**), 4.05 (s, 3H, OC**H**$_3$), 3.28 (t, *J* = 7.2 Hz, 4H, N(C**H**$_2$CH$_2$CH$_3$)$_2$), 2.57 (s, 3H, C**H**$_3$ ), 1.70-1.55 (m, 4H, N(CH$_2$C**H**$_2$CH$_3$)$_2$), 0.94 (t, *J* = 7.3 Hz, 6H, N(CH$_2$CH$_2$C**H**$_3$)$_2$). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 179.79, 170.71, 163.41, 147.91, 146.70, 135.86, 132.09, 117.08, 115.74, 115.37, 55.72, 53.05, 25.45, 20.09, 11.38. HRMS calcd for $C_{18}H_{25}ClN_6O_4S^+$[M+H] 457.1425, found 457.1423.

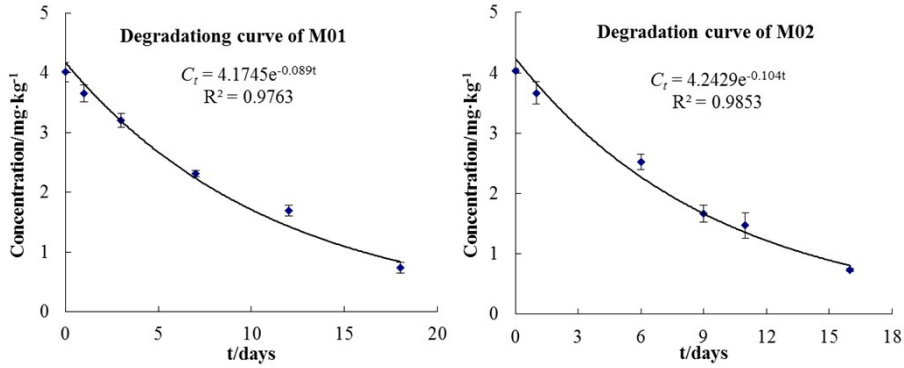
5-(butyl(propyl)amino)-2-chloro-N-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)benzenesulfonamide **N11**: White solid, yield 90.7%, m.p. 145~147 ℃; $^1$H NMR (400 MHz, $CDCl_3$) δ 12.62 (s, 1H, $SO_2$N**H**CONH), 7.50 (d, *J* = 2.7 Hz, 1H, Ph-**H**), 7.39 (s, 1H, $SO_2$NHCON**H**),7.22 (d, *J* = 8.9 Hz, 1H, Ph-**H**), 6.72 (d, *J* = 6.8 Hz, 1H, Ph-**H**), 4.05 (s, 3H, OC**H**$_3$), 3.37-3.17 (m, 4H, NC**H**$_2$CH$_2$CH$_3$, NC**H**$_2$CH$_2$CH$_2$CH$_3$), 2.57 (s, 3H, C**H**$_3$), 1.69-1.52 (m, 4H, NCH$_2$C**H**$_2$CH$_3$, NCH$_2$C**H**$_2$CH$_2$CH$_3$), 1.44-1.30 (m, 2H, NCH$_2$CH$_2$C**H**$_2$CH$_3$), 0.90-1.00 (m, 6H, NCH$_2$CH$_2$C**H**$_3$,

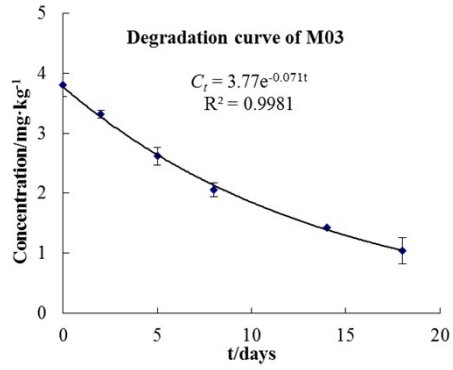
$NCH_2CH_2CH_2C\mathbf{H}_3$). $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 179.03, 171.12, 163.41, 147.89, 146.72, 135.84, 132.07, 116.91, 115.48, 115.30, 55.71, 52.94, 51.03, 28.98, 25.46, 20.23, 20.14, 13.93, 11.39.HRMS calcd for $C_{19}H_{27}ClN_6O_4S^+$[M+H] 471.1581, found 471.1580.

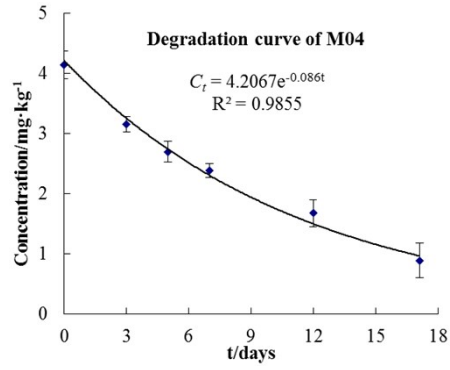
5-(benzyl(methyl)amino)-2-chloro-N-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)benzenesulfonamide **N12**: White solid, yield 92.8%, m.p. 79~81 ℃; $^1H$ NMR (400 MHz, $CDCl_3$) δ 12.63 (s, 1H, $SO_2N\mathbf{H}CONH$), 7.66 (s, 1H, $SO_2NHCON\mathbf{H}$), 7.63 (d, $J$ = 2.6 Hz, 1H, Ph-**H**), 7.32 (t, $J$ = 7.2 Hz, 2H, Ph-**H**), 7.27 (d, $J$ = 6.0 Hz, 1H, Ph-**H**), 7.23 (s, 1H), 7.22-7.16 (m, 2H, Ph-**H**), 6.76 (dd, $J$ = 8.8, 2.6 Hz, 1H, Ph-**H**), 4.57 (s, 2H, $NC\mathbf{H}_2$), 4.05 (s, 3H, $OC\mathbf{H}_3$), 3.09 (s, 3H, $NC\mathbf{H}_3$), 2.57 (s, 3H, $C\mathbf{H}_3$). $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 179.31, 170.62, 163.36, 148.20, 147.90, 137.20, 135.91, 132.05, 128.75, 127.29, 126.55, 117.54, 117.07, 115.38, 56.28, 55.63, 38.79, 25.37. HRMS calcd for $C_{20}H_{21}ClN_6O_4S^+$[M+H] 477.1112, found 477.1110.

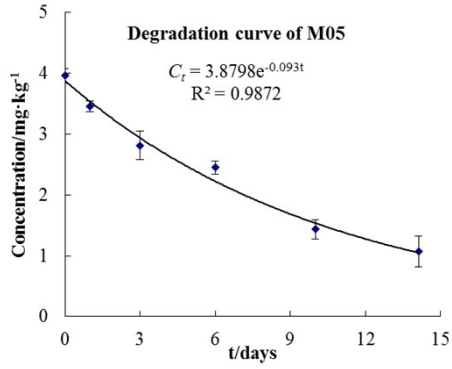
2-chloro-5-(dibutylamino)-N-((4-methoxy-6-methyl-1,3,5-triazin-2-yl)carbamoyl)benzenesulfonamide **N13**: White solid, yield 85.3%, m.p. 79~81 ℃; $^1H$ NMR (400 MHz, $CDCl_3$) δ 12.59 (s, 1H, $SO_2N\mathbf{H}CONH$), 7.84 (s, 1H, $SO_2NHCON\mathbf{H}$), 7.49 (s, 1H, Ph-**H**), 7.22 (d, $J$ = 8.9 Hz, 1H, Ph-**H**), 6.70 (d, $J$ = 7.9 Hz, 1H, Ph-**H**), 4.05 (s, 3H, $NC\mathbf{H}_3$), 3.30 (t, $J$ =7.6, 4H, $N(C\mathbf{H}_2CH_2CH_2CH_3)_2$), 2.56 (s, 3H, $C\mathbf{H}_3$), 1.57 (dd, $J$ = 14.6, 7.4 Hz, 4H, $N(CH_2C\mathbf{H}_2CH_2CH_3)_2$), 1.44 -1.28 (m, 4H, $N(CH_2CH_2C\mathbf{H}_2CH_3)_2$), 0.96 (t, $J$ = 7.3 Hz, 6H, $N(CH_2CH_2CH_2C\mathbf{H}_3)_2$). $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 179.37, 170.62, 163.48, 147.97, 146.80, 135.84, 132.03, 116.80, 115.46, 115.28, 55.69, 50.87, 29.01, 25.42, 20.22, 13.91. HRMS calcd for $C_{20}H_{29}ClN_6O_4S^+$[M+H] 485.1738, found 485.1736.

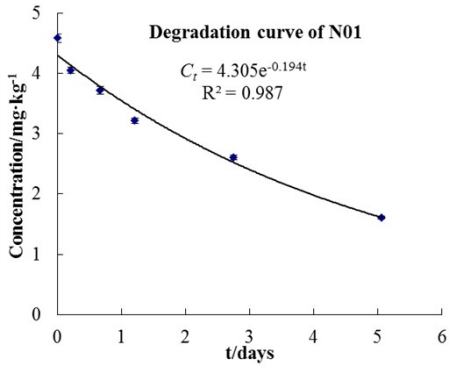
## **SI5**. Degradation curves of target compounds in pH 5.52 soil

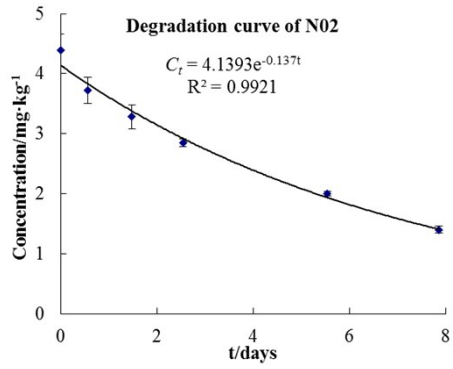


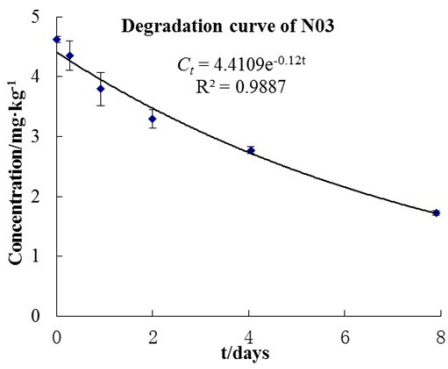

Degradation curve of M03
$C_t = 3.77e^{-0.071t}$
$R^2 = 0.9981$
Concentration/mg·kg⁻¹
t/days

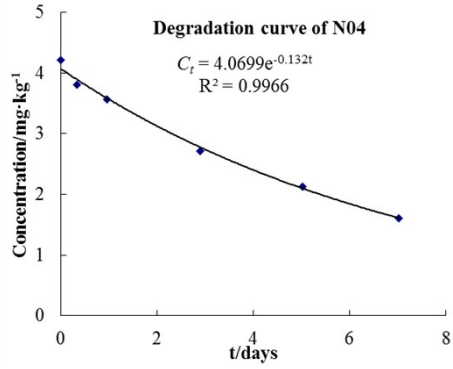

Degradation curve of M04
$C_t = 4.2067e^{-0.086t}$
$R^2 = 0.9855$
Concentration/mg·kg⁻¹
t/days

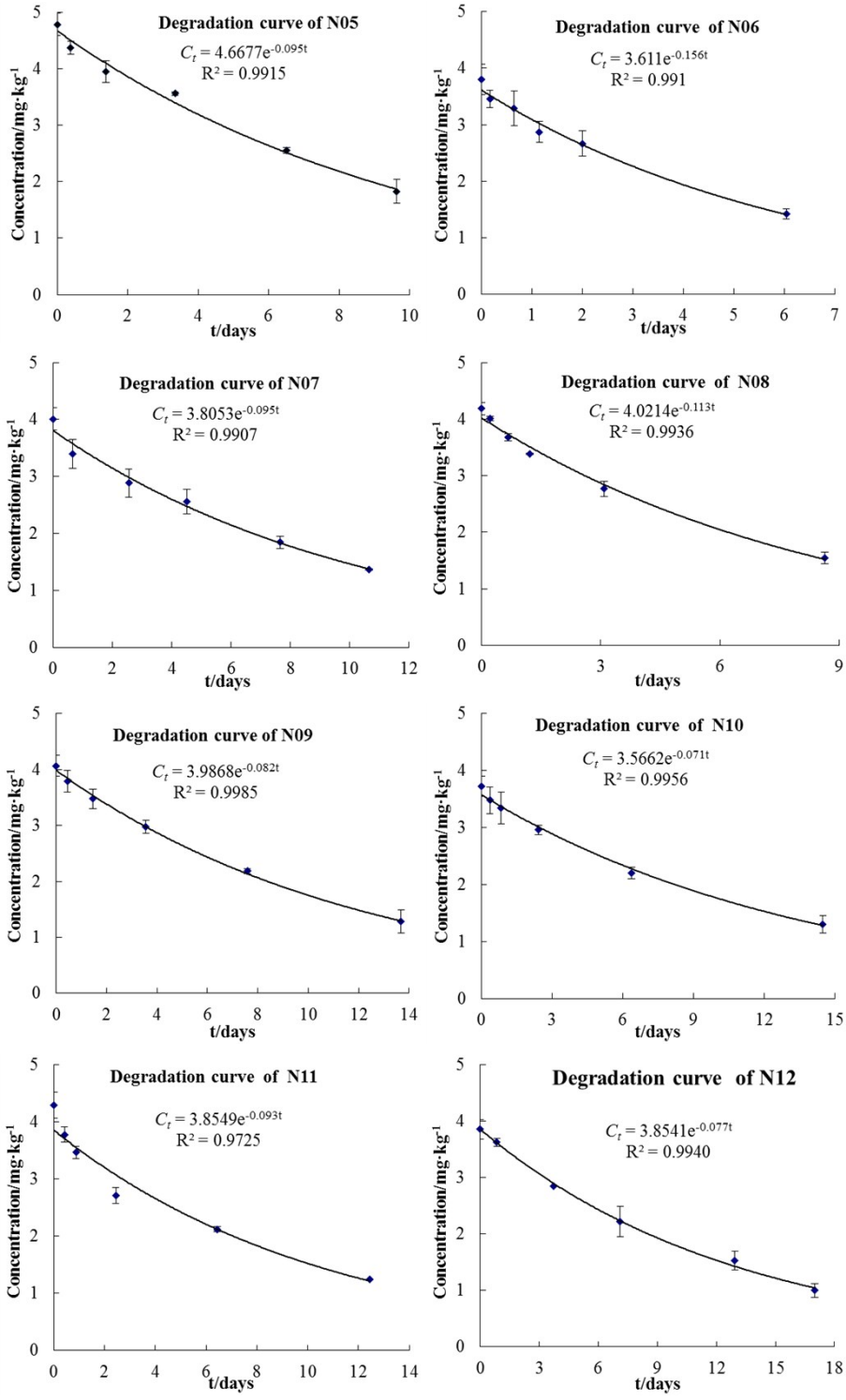

Degradation curve of M05
$C_t = 3.8798e^{-0.093t}$
$R^2 = 0.9872$
Concentration/mg·kg⁻¹
t/days

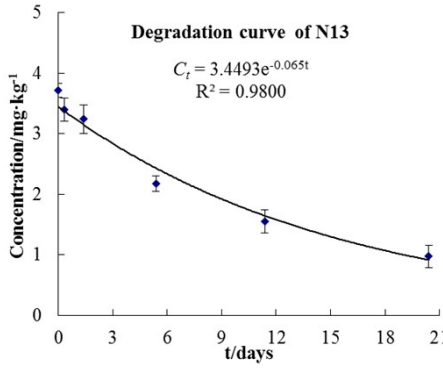

Degradation curve of N01
$C_t = 4.305e^{-0.194t}$
$R^2 = 0.987$
Concentration/mg·kg⁻¹
t/days

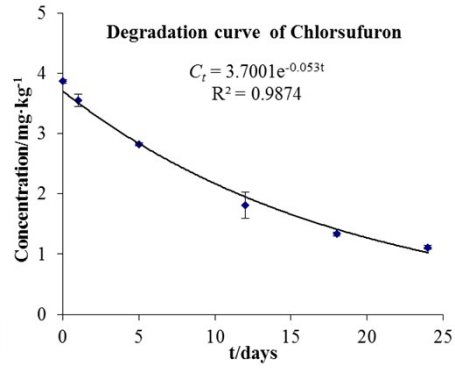

Degradation curve of N02
$C_t = 4.1393e^{-0.137t}$
$R^2 = 0.9921$
Concentration/mg·kg⁻¹
t/days


Degradation curve of N03
$C_t = 4.4109e^{-0.12t}$
$R^2 = 0.9887$
Concentration/mg·kg⁻¹
t/days


Degradation curve of N04
$C_t = 4.0699e^{-0.132t}$
$R^2 = 0.9966$
Concentration/mg·kg⁻¹
t/days


Degradation curve of N05
$C_t = 4.6677e^{-0.095t}$
$R^2 = 0.9915$
Degradation curve of N06
$C_t = 3.611e^{-0.156t}$
$R^2 = 0.991$
Degradation curve of N07
$C_t = 3.8053e^{-0.095t}$
$R^2 = 0.9907$
Degradation curve of N08
$C_t = 4.0214e^{-0.113t}$
$R^2 = 0.9936$
Degradation curve of N09
$C_t = 3.9868e^{-0.082t}$
$R^2 = 0.9985$
Degradation curve of N10
$C_t = 3.5662e^{-0.071t}$
$R^2 = 0.9956$
Degradation curve of N11
$C_t = 3.8549e^{-0.093t}$
$R^2 = 0.9725$
Degradation curve of N12
$C_t = 3.8541e^{-0.077t}$
$R^2 = 0.9940$
Concentration/mg·kg-1
t/days


Degradation curve of N13
$C_t = 3.4493e^{-0.065t}$
$R^2 = 0.9800$
Concentration/mg·kg$^{-1}$
t/days
0
1
2
3
4
5
0
3
6
9
12
15
18
21


Degradation curve of Chlorsufuron
$C_t = 3.7001e^{-0.053t}$
$R^2 = 0.9874$
Concentration/mg·kg$^{-1}$
t/days
0
1
2
3
4
5
0
5
10
15
20
25