**Supplementary Information**

**Experimental study on photodegradation and leaching of typical pesticides in greenhouse soil from Shouguang, Shandong Province, northern China**

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Table S1. List of commonly used pesticides and registered quantities of pesticides in vegetable areas under Shouguang facilities.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Category | Pesticide | Classification | Unit dose package | Pesticides mixture | Integral dose |
| Insecticide | Nitenpyram | Neonicotinoid | 107 | 5 | 112 |
| Acetamiprid | Neonicotinoid | 619 | 102 | 721 |
| Chlorantraniliprole | O-formamide benzoamide | 23 | 3 | 26 |
| Emamectin benzoate | Microbial derivative | 646 | 0 | 646 |
| Buprofezin | Chitin synthesis inhibitor | 201 | 84 | 285 |
| Avermectin B1A | Biogenic pesticide | 830 | 11 | 841 |
| Fungicide | Carbendazim | Benzimidazole | 277 | 304 | 581 |
| Oxadixyl | Phenylamide | 177 | 131 | 308 |
| Metalaxyl | Benzoamide | 39 | 35 | 74 |
| Diethofencarb | Carbamate pesticide | 4 | 14 | 18 |
| Boscalid | Formamide | 68 | 4 | 72 |
| Tebuconazole | Triazole | 377 | 215 | 592 |
| Isoprothiolane | Malonic acid pesticide | 108 | 53 | 161 |
| Hexaconazole | Triazole | 155 | 70 | 225 |
| Difenoconazole | Triazole | 340 | 3 | 343 |
| Pyraclostrobin | Methoxy acrylate | 294 | 18 | 312 |
| Trifloxystrobin | Methoxy acrylate | 39 | 29 | 68 |

Note: The registration status of 17 typical pesticides (including single and mixed formulations) were queried through Chinese Pesticide Information Network (<http://www.chinapesticide.org.cn/>) (as of November 22, 2021), where the registration quantity of emamectin benzoate was excluded from that of avermectin B1A.

Table S2. Elution gradient of mobile phase in liquid chromatography.

|  |  |  |  |
| --- | --- | --- | --- |
| Time (min) | Flow rate (mL/min) | %A*a* | %B*b* |
| 0 | 0.4 | 80 | 20 |
| 0.5 | 0.4 | 80 | 20 |
| 1.5 | 0.4 | 60 | 40 |
| 2 | 0.4 | 60 | 40 |
| 2.5 | 0.4 | 55 | 45 |
| 4 | 0.4 | 55 | 45 |
| 5 | 0.425 | 40 | 60 |
| 6.5 | 0.5 | 25 | 75 |
| 7 | 0.5 | 25 | 75 |
| 7.5 | 0.65 | 5 | 95 |
| 8.5 | 1 | 5 | 95 |
| 9.5 | 1 | 5 | 95 |
| 9.6 | 0.4 | 80 | 20 |
| 12 | 0.4 | 80 | 20 |

*a* Mobile phase A: 0.1% formic acid aqueous solution containing 5 mmol ammonium formate.

*b* Mobile phase B: 100% acetonitrile

Table S3. Instrumental analysis parameters of target pesticides.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Category | Pesticide | Retention time (min) | Cone voltage (V) | Parention (*m*/*z*) | Production 1 (*m*/*z*) | Collisionenergy 1 (eV) | Production 2 (*m*/*z*) | Collisionenergy 2 (eV) |
| Insecticide | Nitenpyram | 1.58 | 22 | 271 | 189 | 12 | 126 | 26 |
| Acetamiprid | 2.48 | 50 | 223 | 187 | 12 | 126 | 15 |
| Chlorantraniliprole | 5.41 | 15 | 484 | 453 | 10 | 286 | 10 |
| Emamectin benzoate | 6.4 | 20 | 886.6 | 158 | 35 | 126 | 30 |
| Buprofezin | 7.85 | 20 | 306 | 201 | 12 | 116 | 16 |
| Avermectin B1A | 8.08 | 16 | 890.3 | 567 | 14 | 305 | 24 |
| Fungicide | Carbendazim | 1.45 | 10 | 192 | 160 | 30 | 132 | 30 |
| Oxadixyl | 2.47 | 10 | 190 | 163 | 20 | 136 | 25 |
| Metalaxyl | 4.28 | 10 | 280 | 220 | 15 | 192 | 20 |
| Diethofencarb | 5.8 | 10 | 168 | 226 | 10 | 124 | 30 |
| Boscalid | 6.11 | 46 | 343 | 307 | 18 | 140 | 20 |
| Tebuconazole | 6.14 | 30 | 308 | 125 | 40 | 70 | 24 |
| Isoprothiolane | 6.45 | 17 | 291 | 231 | 12 | 189 | 22 |
| Hexaconazole | 6.27 | 30 | 314 | 159 | 40 | 70 | 20 |
| Difenoconazole | 6.84 | 35 | 406 | 251 | 25 | 188 | 40 |
| Pyraclostrobin | 7.17 | 25 | 388 | 194 | 12 | 163 | 25 |
| Trifloxystrobin | 7.43 | 25 | 409 | 186 | 14 | 145 | 40 |

Table S4. Recovery of typical pesticides in soil.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Category | Pesticide | Recovery (%) | Relative standard deviation | Matrix effect (%) |
| Insecticide | Nitenpyram | 89.1  | 5.5  | 98.1  |
| Acetamiprid | 76.7  | 1.5  | 94.9  |
| Chlorantraniliprole | 99.3  | 1.6  | 81.8  |
| Emamectin benzoate | 96.2  | 0.7  | 97.7  |
| Buprofezin | 94.1  | 1.3  | 92.9  |
| Avermectin B1A | 84.8  | 2.9  | 86.0  |
| Fungicide | Carbendazim | 89.3  | 1.5  | 95.9  |
| Oxadixyl | 74.4  | 1.7  | 95.3  |
| Metalaxyl | 94.3  | 3.7  | 95.6  |
| Diethofencarb | 97.0  | 2.2  | 100.1  |
| Boscalid | 105.8  | 6.8  | 78.1  |
| Tebuconazole | 96.3  | 1.7  | 77.9  |
| Isoprothiolane | 97.6  | 2.4  | 95.9  |
| Hexaconazole | 81.2  | 4.8  | 82.1  |
| Difenoconazole | 98.8  | 2.0  | 87.3  |
| Pyraclostrobin | 96.3  | 2.1  | 95.1  |
| Trifloxystrobin | 94.6  | 1.2  | 87.9  |



Figure S1. Structural formulas of 17 target pesticides.