# Supporting information

# Qutantum dot-based lateral flow immunoassay for rapid detection of three neonicotinoids in tea leaves

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**Text S1. Recovery tests for tea samples.**

The recovery values were calculated as follows, where the parameter ($A_1$, $A_2$, $X_0$, p) obtained from logarithmic equation of the standard, X shows the detectable concentration of neonicotinoids in tea infusion, and Y shows T/C corresponding to its concentration detected by the florescent reader.

$X\ (ng/mL) = X_0 \times POWER\{[(A_1 - A_2)/(Y - A_2) -1], 1/p\}$

Concentration of neonicotinoids in tea (ng/g) = X (ng/mL) × dilution volume (mL) / weight of the tea (g)

Recovery % = Concentration of neonicotinoids in tea (ng/g) / spiked concentration of neonicotinoids (ng/g) × 100

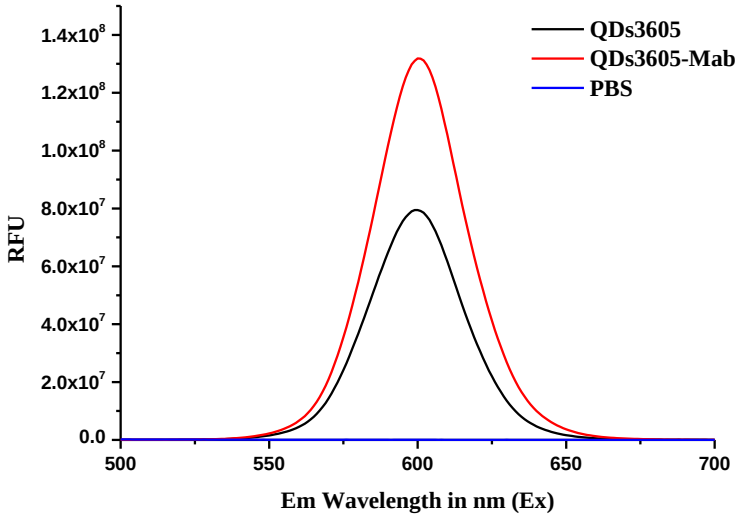
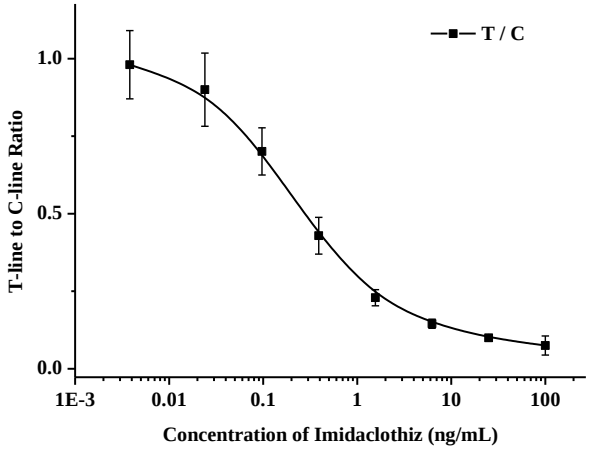
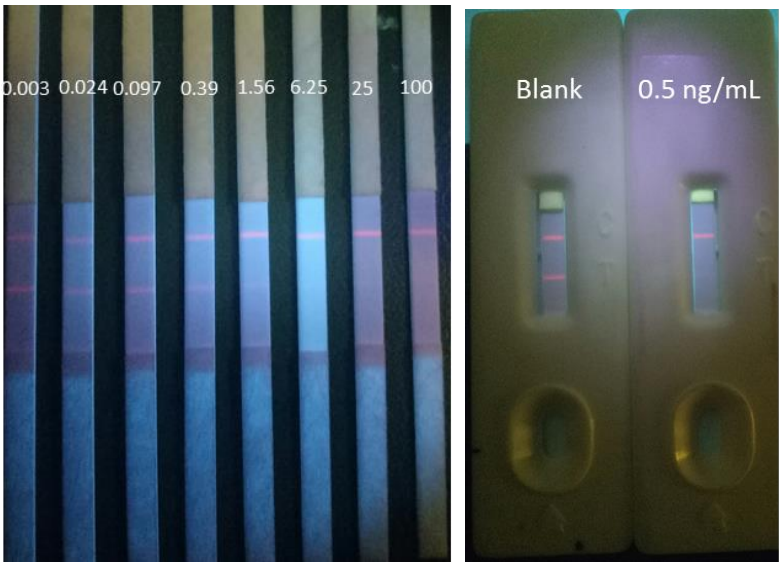



**Fig. S1.** The emission spectrum of the commercial QDs and QDs coupled with antibody under the 365 nm excitation. The fluorescent spectrum was measured by a SpectraMax i3 Multi-mode Plate Reader (Molecular Devices, Sunnyvale, CA, USA). Under the UV 365 nm excitation, the maximum emission wavelength of QDs was 600 nm for both commercial QDs and QDs coupled with antibody.



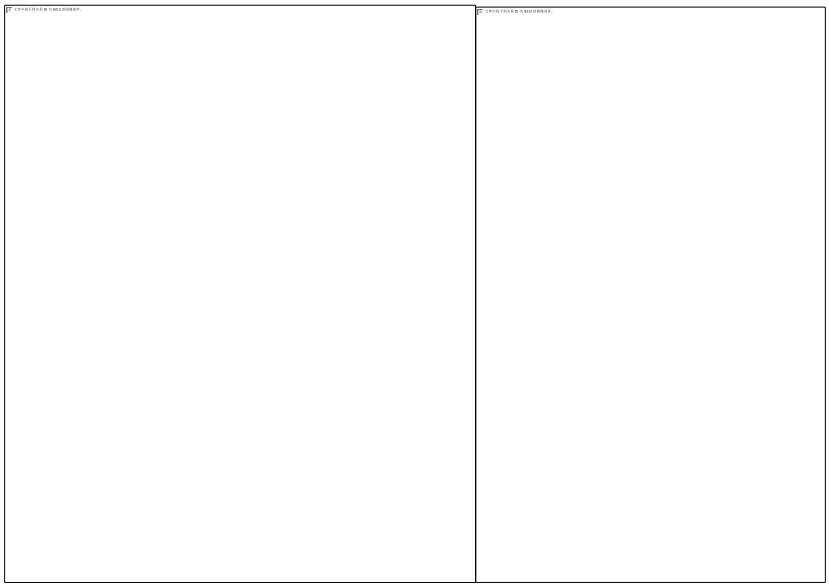

(a)




(b) (c)

**Fig. S2.** The calibration curve and test strips for imidaclothiz. (a) The calibration curve of imidaclothiz in borate buffer (10 mM, pH 7.5). (b) The photo of test strips with different concentrations (0.003-100 ng/mL) of imidaclothiz under 365 nm UV excitation. (c) Test strips treated with borate buffer (imidaclothiz-free) and borate buffer containing imidaclothiz (0.5 ng/mL) under 365 nm UV excitation. Bar, ± SD (n=4)

(a)



(b) (c)

**Fig. S3.** The calibration curve and test strips for clothianidin. (a) The calibration curve of clothianidin in borate buffer (10 mM, pH 7.5). (b) The photo of test strips with different concentrations (0.003-100 ng/mL) of clothianidin under 365 nm UV excitation. (c) Test strips treated with borate buffer (clothianidin-free) and borate buffer containing clothianidin (1 ng/mL) under 365 nm UV excitation. Bar, ± SD (n=4)

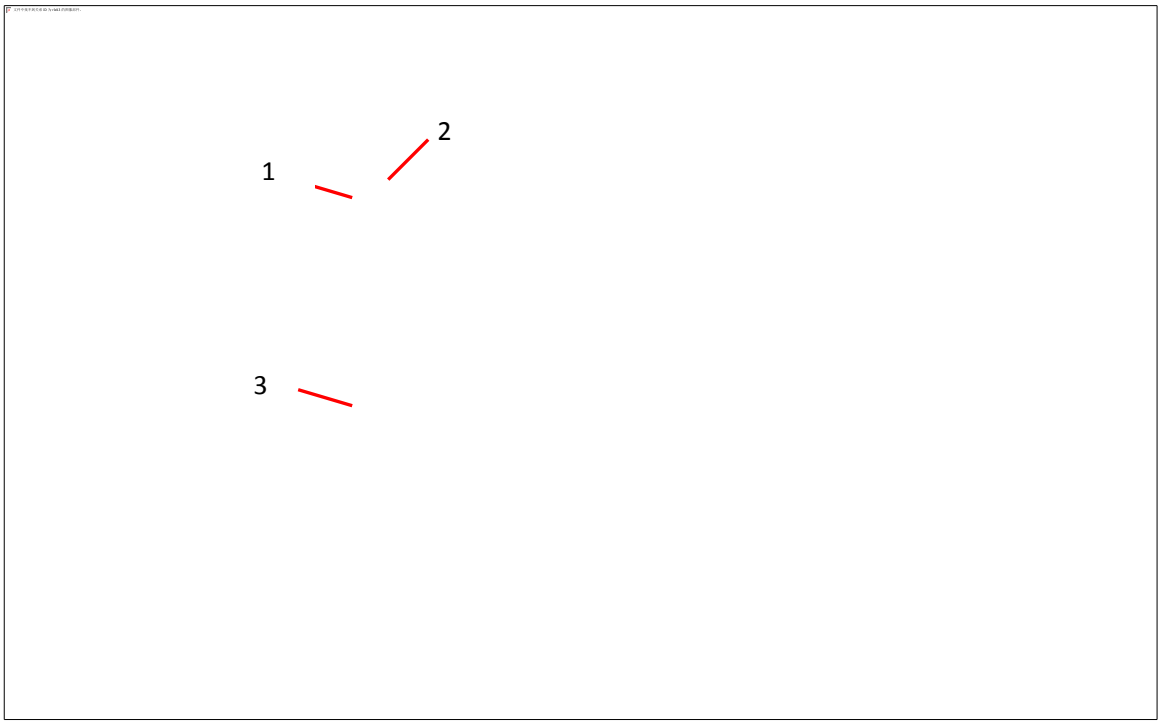



**Fig. S4.** Total ion chromatograms of three neocotinoids detected under multi reaction monitoring mode of UPLC-MS/MS. (1) clothianidin, (2) imidaclothiz, (3) imidacloprid. Application of the multichannel detection of UPLC-MS/MS ensured the distinction of the three partially-overlapped peaks. The LODs for three pesticides were defined as the concentration that produced a signal-to-noise (S/N) ratio of 3, and the LOQs were considered to be S/N ratio of 10. In this work, the LOD was estimated to be 1.96, 1.19, 1.06 ng/mL for imidacloprid, imidaclothiz, and clothianidin, respectiviely; the LOQ of 6.52, 3.97, 3.53 ng/mL was found for imidacloprid, imidaclothiz, and clothianidin, respectively.

**Fig. S5.** Calibration curves for the analytes and their mixtures in tea infusion. Analytes indicate imidacloprid, imidaclothiz and clothianidin. Bar, ± SD (n=4)

**Table S1.** UPLC-MS/MS parameters for detection of three neocotinoids.

| Compounds | Precursor ion (m/z) | Quantitative product ion (m/z) | Collision energy (eV) | Collision cell exit potential (eV) | Confirmation product ion (m/z) | Collision energy (eV) | Collision cell exit potential (eV) |
|---|---|---|---|---|---|---|---|
| Imidacloprid | 256.1 | 209.1 | 17.5 | 6.03 | 175.1 | 23.75 | 9.67 |
| Imidaclothiz | 262.1 | 181.1 | 17.77 | 9.85 | 122.2 | 36.93 | 6.875 |
| Clothiandin | 250.1 | 169.1 | 17.5 | 8.84 | 131.3 | 23.75 | 17.68 |

**Table S2.** The accuracy and precision of the developed LFICS for the detection of imidaclothiz in teas.

| Tea types | Spiked level (ng/g) | Intra-batch (n=4) | | | Inter-batch (n=4) | | |
|---|---|---|---|---|---|---|---|
| | | Mean ± SD (ng/g) | CV （%） | Recovery （%） | Mean ± SD (ng/g) | CV （%） | Recovery （%） |
| Green Tea | 6.4 | 6.15 ± 0.32 | 5.13 | 96.09 | 6.47 ± 0.45 | 7.01 | 101.12 |
| | 80 | 60.06 ± 5.87 | 9.77 | 75.07 | 64.01 ± 6.47 | 10.11 | 80.01 |
| | 160 | 138.64 ± 14.68 | 10.59 | 86.65 | 130.14 ± 13.29 | 10.21 | 81.34 |
| Black Tea | 3.2 | 2.98 ± 0.30 | 10.2 | 93.15 | 3.56 ± 0.31 | 8.72 | 111.11 |
| | 40 | 43.47 ± 2.20 | 5.05 | 108.67 | 33.8 ± 3.12 | 9.23 | 84.50 |
| | 80 | 71.99 ± 7.24 | 10.06 | 89.99 | 69.65 ± 7.49 | 10.76 | 87.06 |
| Oolong Tea | 0.8 | 0.73 ± 0.08 | 10.43 | 91.18 | 0.77 ± 0.05 | 6.34 | 96.15 |
| | 10 | 9.37 ± 0.74 | 7.85 | 93.74 | 9.39 ± 0.71 | 7.53 | 93.93 |
| | 20 | 20.47 ± 2.13 | 10.39 | 102.35 | 21.02 ± 2.10 | 10.01 | 105.10 |

Data are mean ± SD from quadruplicate samples at each spiked concentration of imidaclothiz.

**Table S3.** The accuracy and precision of the developed LFICS for the detection of clothianidin in teas.

| Tea types | Spiked level （ng/kg） | Intra-batch (n=4) | | | Inter-batch (n=4) | | |
|---|---|---|---|---|---|---|---|
| | | Mean ± SD (ng/g) | CV （%） | Recovery （%） | Mean ± SD (ng/g) | CV （%） | Recovery （%） |
| Green Tea | 8 | 6.08 ±0.43 | 7.11 | 76.00 | 6.90±0.54 | 7.89 | 86.20 |
| | 160 | 137.79±12.26 | 8.90 | 86.12 | 144.24±10.40 | 7.21 | 90.15 |
| | 320 | 289.98±23.55 | 8.12 | 90.62 | 282.62±26.37 | 9.33 | 88.32 |
| Black Tea | 4 | 3.70±0.36 | 9.84 | 92.54 | 3.51±0.32 | 9.01 | 87.71 |
| | 80 | 70.59±4.34 | 6.15 | 88.24 | 74.48±7.53 | 10.11 | 93.10 |
| | 160 | 138.91±8.63 | 6.21 | 86.82 | 152.05±14.35 | 9.44 | 95.03 |
| Oolong Tea | 1 | 0.90±0.09 | 10.38 | 90.22 | 0.90±0.06 | 6.23 | 89.74 |
| | 20 | 20.7±1.55 | 7.51 | 103.50 | 20.42±1.61 | 7.9 | 102.1 |
| | 40 | 42.89±3.18 | 7.42 | 107.22 | 39.14±2.36 | 6.03 | 97.84 |

Data are mean ± SD from quadruplicate samples at each spiked concentration of clothianidin.