# Electronic Supplementary Information for

## Dinotefuran Nano-pesticide with Enhanced Valid Duration and Controlled Release Property Based on Layered Double Hydroxide Nano-Carrier

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## Experimental Details.

**Table 1.** The fabrication of D-LDH with different carrier ratio.

| Sample | $Mg(NO_3)_2 \cdot 6H_2O$ (M) | $Al(NO_3)_3 \cdot 9H_2O$ (M) | SDS (M) | NaOH (M) | Dinotefuran (M) | Carrier ratio（wt%） |
|---|---|---|---|---|---|---|
| S1 | 0.01 | 0.005 | 0.00005 | 0.03 | 0.04 | 41.15 |
| S2 | 0.02 | 0.010 | 0.00010 | 0.06 | 0.04 | 58.31 |
| S3 | 0.03 | 0.015 | 0.00015 | 0.09 | 0.04 | 67.72 |
| S4 | 0.04 | 0.020 | 0.00020 | 0.12 | 0.04 | 73.66 |

### Sample characterization.

The morphology was investigated using a scanning electron microscope (SEM; Zeiss SUPRA 55) with an accelerating voltage of 20 kV. Powder X-ray diffraction patterns were collected on a Bruker D8 Advance X-Ray Diffractometer using a Cu Kα source, at a scan rate of 10°/min. High resolution transmission electron microscopy (HR-TEM) images were recorded with JEOL JEM-2010 equipment with accelerating voltage of 200 kV.

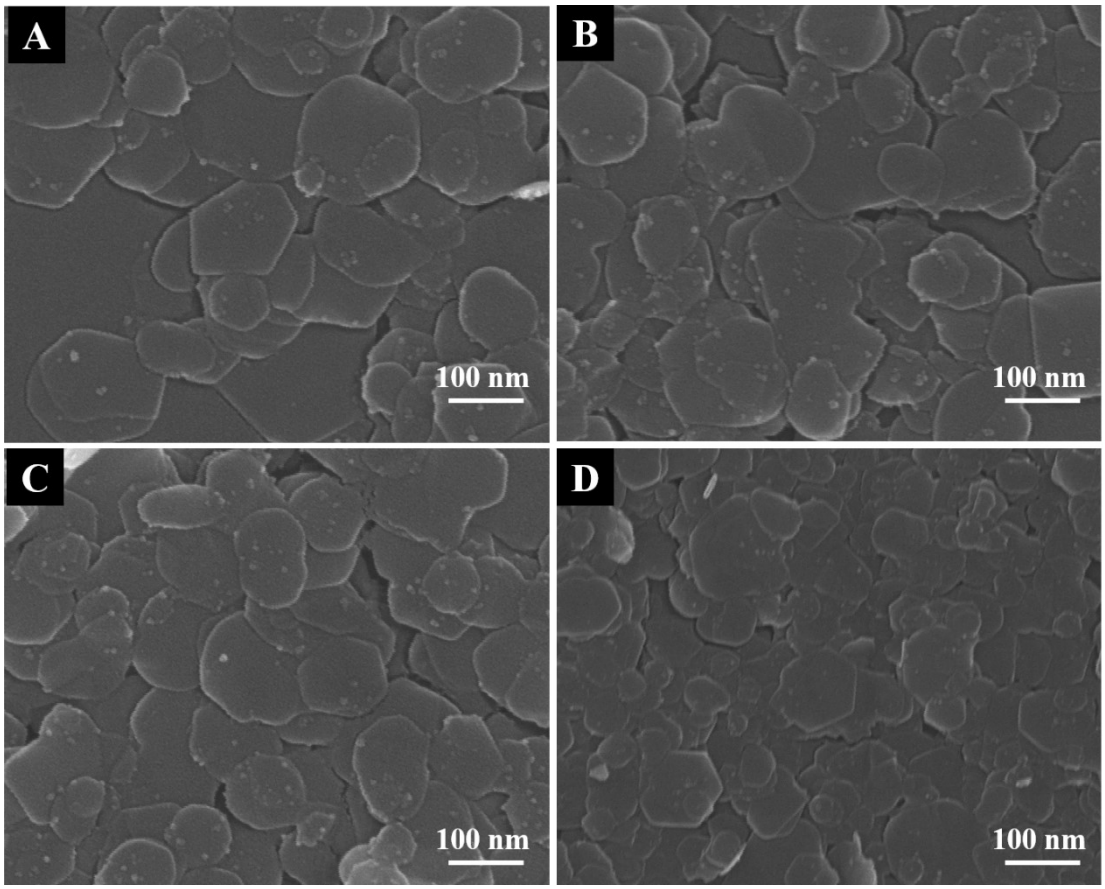


**Figure S1.** SEM image of (A) D-LDH-S1, (B) D-LDH-S2, (C) D-LDH-S3, and (D) D-LDH-S4.

## Field experiment.

### D-LDH for cucumber protection in pot and field experiment.

For the decreased rate of pest (r),

$$r\ (\%) = \frac{N-n}{N} \times 100\%$$

In which, *N* and *n* are the number of alive pests in same field area before and after treated with pesticide or control sample, respectively.

For the control effect (e),

$$e\ (\%) = \frac{r-r0}{100-r0} \times 100\%$$

In which, *r* and r0 are the numbers of pest in pesticide treated field area and control field area, respectively. At given time of 1, 3, 7 and 15 days after treated with pesticides, the control effect of different samples was collected (table S2).

**Table S2.** Control effect of D-LDH sample on cucumber with SC and water as references.

| Sample | Repeat | Base number n | 1 day | 3 day | 7 day | 14 day |
|---|---|---|---|---|---|---|
| | | | n | n | n | n |
| D-LDH$_1$ | 1 | 96 | 10 | 4 | 6 | 11 |
| | 2 | 39 | 7 | 3 | 4 | 5 |
| | 3 | 118 | 5 | 4 | 3 | 3 |
| | 4 | 98 | 6 | 1 | 1 | 4 |
| | Ave. | 87.75 | 7.00 | 3.00 | 3.50 | 5.75 |
| D-LDH$_2$ | 1 | 231 | 5 | 1 | 2 | 1 |
| | 2 | 139 | 3 | 2 | 5 | 2 |
| | 3 | 90 | 1 | 1 | 2 | 1 |
| | 4 | 103 | 2 | 3 | 3 | 3 |
| | Ave. | 140.75 | 2.75 | 1.75 | 3.00 | 1.75 |
| D-LDH$_3$ | 1 | 245 | 5 | 0 | 2 | 4 |
| | 2 | 131 | 0 | 1 | 3 | 3 |
| | 3 | 110 | 2 | 0 | 1 | 2 |
| | 4 | 87 | 3 | 2 | 3 | 5 |
| | Ave. | 143.25 | 2.50 | 0.75 | 2.25 | 3.50 |
| S1 | 1 | 113 | 2 | 0 | 2 | 11 |
| | 2 | 59 | 0 | 1 | 1 | 6 |
| | 3 | 111 | 0 | 0 | 3 | 4 |
| | 4 | 101 | 0 | 0 | 5 | 7 |
| | Ave. | 96.00 | 0.50 | 0.25 | 2.75 | 7.00 |
| S2 | 1 | 122 | 2 | 0 | 4 | 8 |
| | 2 | 77 | 2 | 1 | 2 | 6 |
| | 3 | 116 | 1 | 0 | 0 | 6 |
| | 4 | 81 | 0 | 0 | 1 | 4 |
| | Ave. | 99.00 | 1.25 | 0.25 | 1.75 | 6.00 |
| S3 | 1 | 139 | 0 | 0 | 2 | 6 |
| | 2 | 103 | 0 | 0 | 1 | 4 |
| | 3 | 107 | 0 | 1 | 3 | 4 |
| | 4 | 119 | 3 | 0 | 2 | 2 |
| | Ave. | 117.00 | 0.75 | 0.25 | 2.00 | 4.00 |
| S4 | 1 | 112 | 1 | 0 | 1 | 3 |
| | 2 | 83 | 2 | 1 | 0 | 2 |
| | 3 | 52 | 0 | 0 | 1 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 4 | 114 | 0 | 1 | 2 | 2 |
| | Ave. | 90.25 | 0.75 | 0.50 | 1.00 | 2.00 |
| Water | 1 | 43 | 60 | 44 | 45 | 24 |
| | 2 | 94 | 101 | 115 | 78 | 43 |
| | 3 | 107 | 113 | 120 | 81 | 29 |
| | 4 | 119 | 120 | 133 | 66 | 46 |
| | Ave. | 90.75 | 98.50 | 103.00 | 67.50 | 35.50 |

In table S2, *n* represents for the aphid number in 10 plants.

**D-LDH for cotton protection.**

For the effect evaluation of hole application, before transplanting the cotton seedling, every pesticide sample was mixed with base fertilizer at given amount and then they were applied together in holes. According to the actual experience, the base fertilizer dosage was set at 300 kg $ha^{-1}$ and the cotton seedling density was set as 30000 plants $ha^{-1}$.

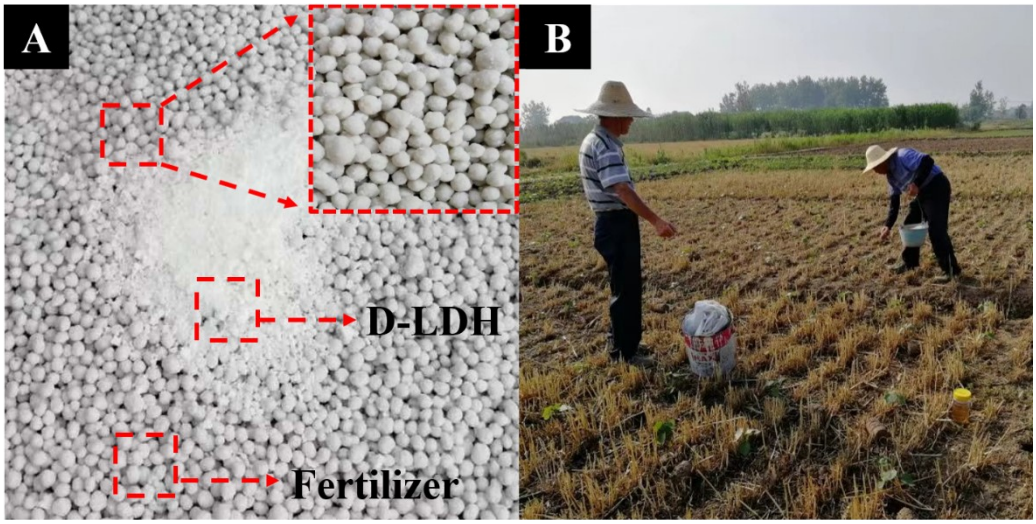


**Figure S2**. The field experiment for the control of cotton aphid. (A) Digital picture of the physical mixing process of D-LDH and control sample with fertilizer. (B) Control method of hole application.

In the measurement of the control effect for cotton aphids in field, D-LDH and reference sample were mixed physically with fertilizer and embedded into soil. In terms of the evaluation of the protection against cotton aphids, the control effect (*e*) was calculated with sample method as cucumber.