Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Supporting information

Effective Control of the Tomato Wilt Pathogen using TiO_2 Nanoparticles as a Green Nanopesticide

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Table S1 The primers of *phcA*, *phcB*, *phcR*, *epsA*, *epsF*, *egl*, *pilT*, *hrp* and *qRSgyrA* genes

Gene	primers (5'→3')
phcA-F	GGACATGATCTTCACGGTCAACT
phcA-R	GACTCATCCTCCTTTTCTGCATC
phcB-F	CGATTATCTGTCCGACAAGGTATG
phcB-R	CATTCCAGCAGGTGTTCCAT
phcR-F	GCGGAATACAGCGACATC
phcR-R	GCTTCTCCAGGATCTTGAA
epsA-F	AATGTCTACGTGATCCGCCG
epsA-R	GTACACCACGTCCTTCGGTT
epsF-F	GCTTTTCGTCGTGGTTTGCT
epsF-R	GGAAGCCAGCAACAACAGTG
egl-F	GGAAGCCAGCAACAACAGTG
egl-R	GGAAGCCAGCAACAACAGTG
pilT-F	AAGAACAAAGCGTCTGATCTGC
pilT-R	CTTCCAGGTTTTCTTCGTAATGCT
hrp-F	TGCTTGGGCTTGGCTTCATC
hrp-R	CATGAGCAAGGACGAAGTCAAG
qRSgyrA-F	CGACTGGAACCGTCCCTAC
qRSgyrA-R	TCCGCACGATGGTGTCATA

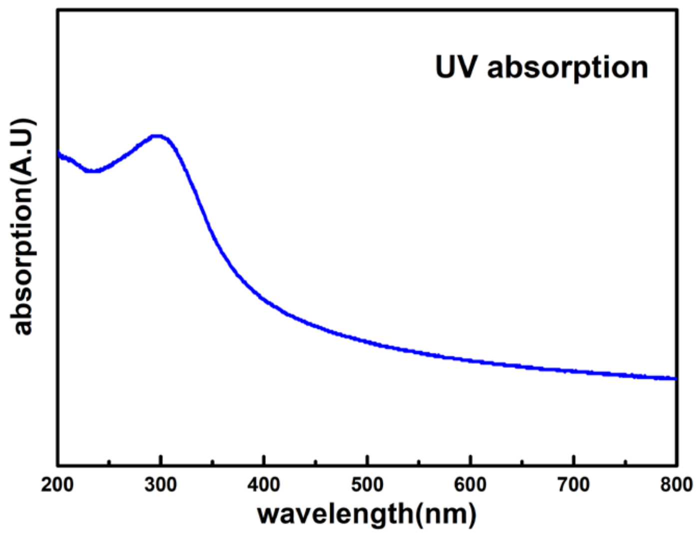

Figure S1. The UV-Vis absorption wavelength of TiO_2

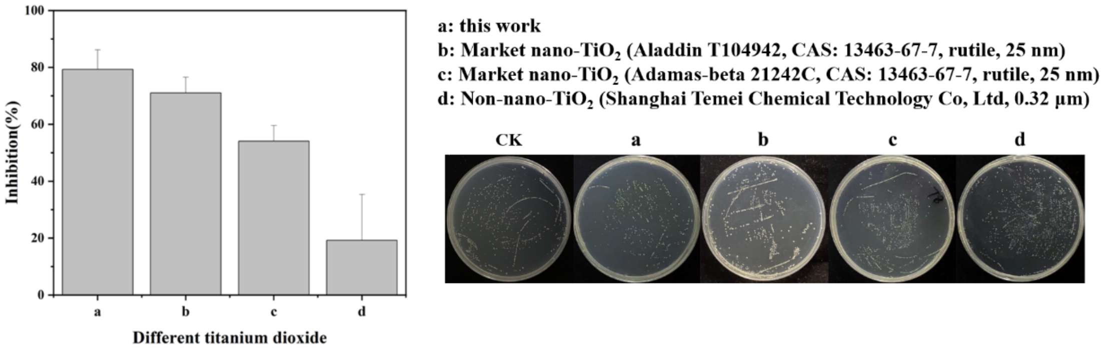

Figure S2. Antibacterial effect of 0.05 mg/L TiO_2 NPs comparing with market nano-TiO_2 and non-nano-TiO_2

Table S2 The effective concentration comparation for 50% inhibition (EC_{50}) and minimum inhibitory concentration (MIC)

Pesticide	Type	Origin	EC_{50} (mg/L)	MIC (mg/L)	Reference
Copper Hydroxide WG	Commercial	Korea	/	200	1
Copper hydroxide + Oxadixyl WP	Commercial	Korea	/	200	1
Copper oxychloride + Dithianon WP	Commercial	Korea	/	200	1
Copper oxychloride + Kasugamycin WP	Commercial	Korea	/	100	1
Streptomycin + Validamycin A WP	Commercial	Korea	/	10	1
Oxine copper + Polyoxin B WP	Commercial	Korea	/	10	1
Bioxeda	Commercial	France	/	210	2
Sporatec	Commercial	U.S.A.	/	710	2
3% Zhongsheng Mycin WP	Commercial	China	1.31	/	3
20%Thiasen Copper SC	Commercial	China	20.45	/	3
72% Agricultural Streptomycin Sulfate WP	Commercial	China	5.20	/	3
53% Suinoline Copper WP	Commercial	China	42.14	/	3
80% Mancozeb WP	Commercial	China	745.60	/	3
20% Conazole WP	Commercial	China	51.96	/	3
1.5% Thiamezole EW	Commercial	China	108.99	/	3
57.6% Cupric Hydroxide GF	Commercial	China	120.88	/	3
0.5% Chitooligosaccharace AS	Commercial	China	2.18	/	3
Caffeic acid phenethyl ester	Commercial	China	285	/	4
Magnesium Oxide NPs	Commercial	China	/	200	5
TiO_2 NPs	**Research**	**Our lab**	**60**	**240**	**This work**

Table S3 The Zeta potential of *R. solanacearum* and TiO_2

Samples	Zeta potential (mV)
R. solanacearum	-60.55±5.39
TiO_2	40.11±3.15

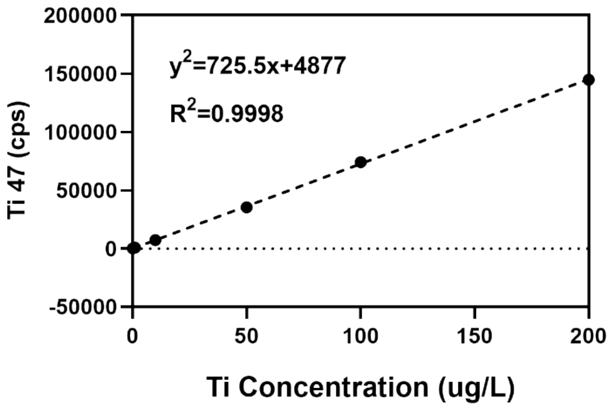

Figure S3. The standard curve of TiO_2 by ICP-MS analysis

Table S4 The quantitative distribution of spraying TiO_2 NPs in tomato plants by ICP-MS

Plant tissues	Content (Mean ± SD) (mg/kg)	RSD (%)
Mature leaves	8.9 ± 0.22	3.13
Sprayed leaf	19.9 ± 0.45	2.35
Young leaves	10.2 ± 0.51	1.61
Roots	6.8 ± 0.33	1.53
Stem	12.6 ± 0.42	1.77

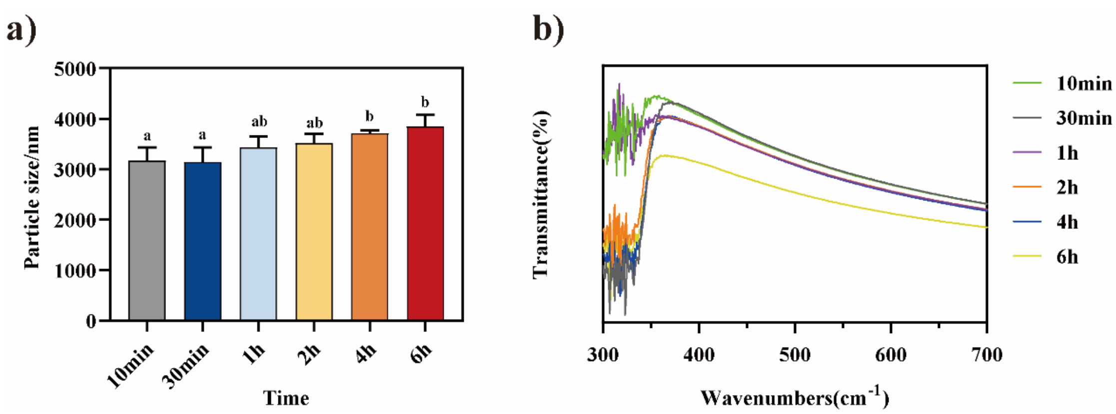

Figure S4. a) and b) are average particle size and UV-Vis absorption spectroscopy of TiO_2 NPs dispersed in xylem and phloem sap for 10 min, 30 min, 1 h, 2 h, 4 h and 6 h, respectively.

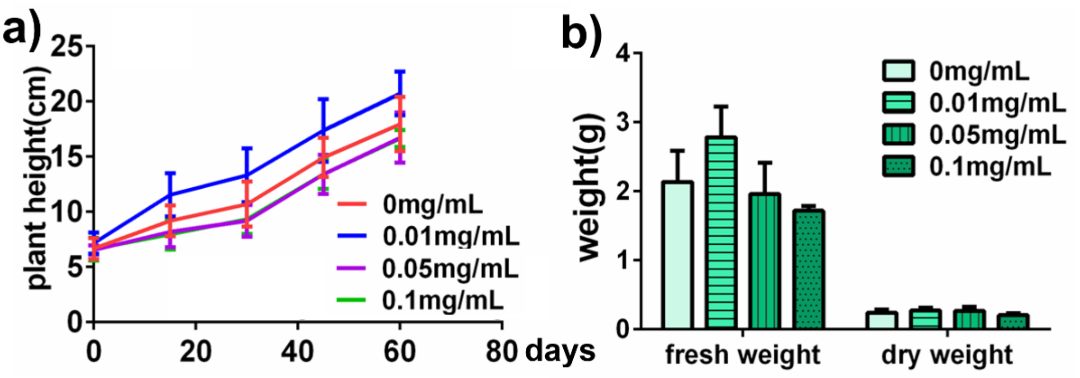

Figure S5. a) Effect of different concentrations of rutile on tomato height; b) Effect of different concentrations of rutile on tomato fresh weight and dry weight

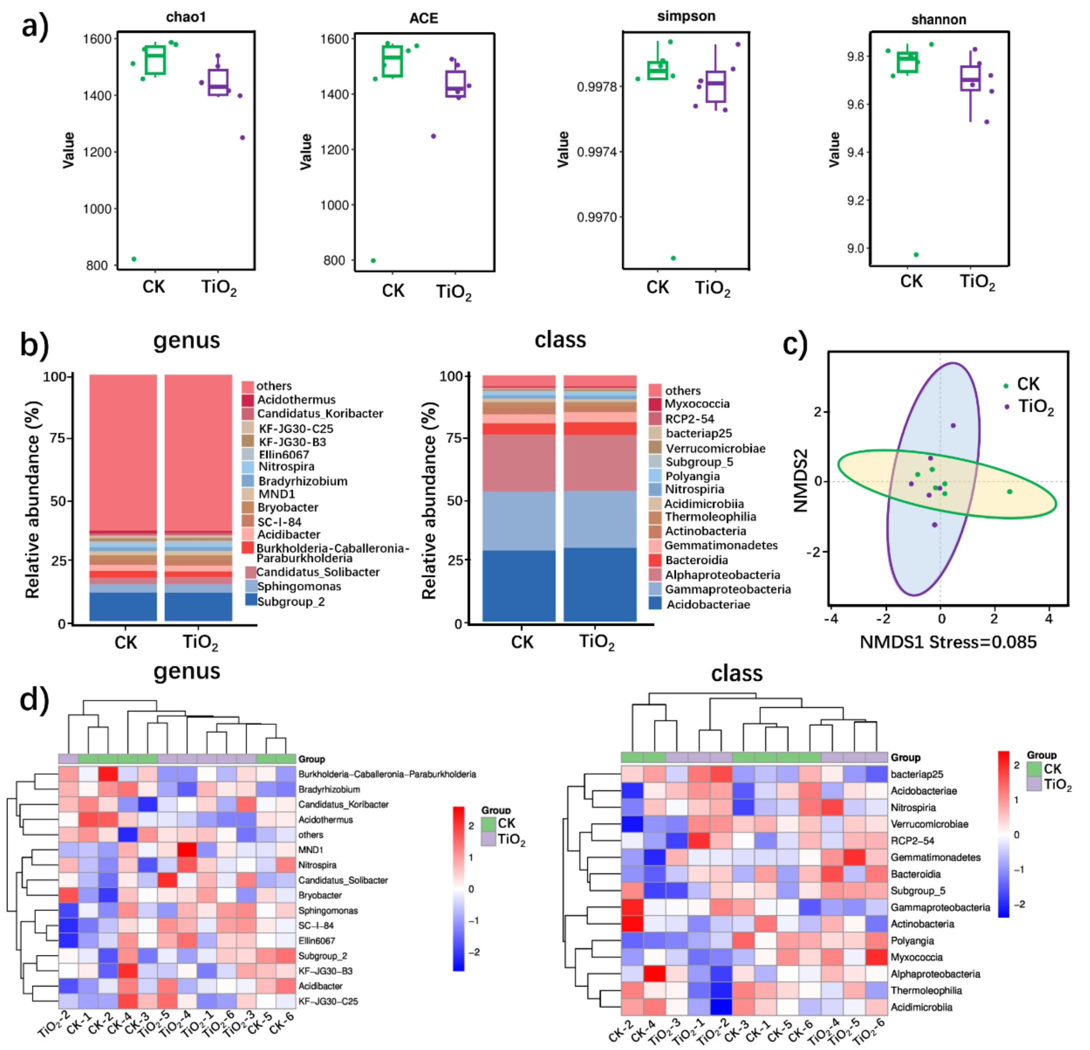

Figure S6. Effect of TiO_2 NPs on the soil bacterial community. (a) Chao1, ACE, simpson and shannon indexs; (b) the bacterial community abundance at the genus and class level after treating with or without TiO_2 NPs; (c) NMDS analysis; (d) Hierarchically clustered heatmaps of top 15 dominant bacterial community abundance at class and genus level, respectively. Abbreviations: Soil only treated with the distilled water (CK), soil treated with TiO_2 NPs suspension (TiO_2).

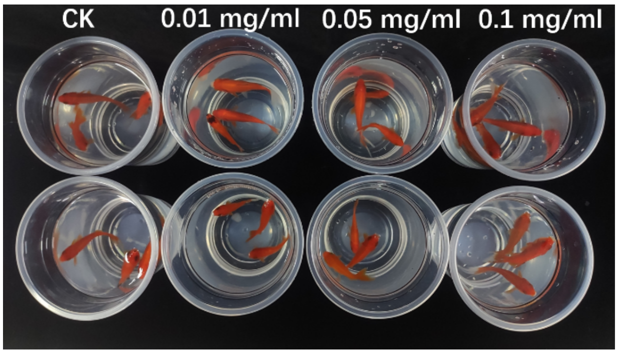

Figure S7. The biosafety evaluation of nano-TiO_2 toward non-target organism goldfish

References

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