Supplementary Information (SI) for Environmental Science: Processes & Impacts.

Supporting information

Neonicotinoid Pesticide Residues in Bottled Water: A Worldwide Assessment of Distribution and Human Exposure Risks

Yuanchen Chen[1,2,3], Ruirui Meng[1,3], Gege Liu[1], Wenfei Yu[1], Hangbiao Jin[1,2,3] *

[1] Key Laboratory of Microbial Technology for Industrial Pollution Control of Zhejiang Province, College of Environment, Zhejiang University of Technology, Hangzhou, Zhejiang, 310014, P. R. China.

[2] College of Energy and Carbon Neutrality Science and Education Integration, Zhejiang University of Technology, Hangzhou, Zhejiang, 310014, P. R. China.

[3] Innovation Research Center of Advanced Environmental Technology, Eco-Industrial Innovation Institute ZJUT, Quzhou, Zhejiang, 324400, P. R. China.

* Corresponding author:

Hangbiao Jin, hangbiao@zjut.edu.cn

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Table S1 Global bottled water sampling location and basic information.

Brand	Importing country	Water source	Sample Type	Production date	Precipitation
S.Pellegrino	Italy	San Pellegrino, Province of Bergamo, Italy	Natural water	202302	2.8in/71.12mm
Acqua Panna	Italy	Puna Springs, Tuscany, Italy	Natural water	202211	5.6in/142.24mm
Perrier	French	Vergeza town in southern France	Natural water	202201	3.1in/78.74mm
Oravida	New Zealand	Otakree, Bay of Plenty, New Zealand	Natural water	202206	6in/152.4mm
Ferrarelle	Italy	Italian Ricardo	Natural water	202107	1in/25.4mm
Onepure	New Zealand	Hawke's Bay, New Zealand	Natural water	202210	3.1in/78.74mm
Fiji Water	FIJI	fiji islands	Natural water	202207	3.1in/78.74mm
VOSS	Norway	Norwegian Voss	Natural water	202206	3in/76.2mm
Tynant	U.K	Wales, United Kingdom	Natural water	202201	0in
Sant AnioL	Spain	Fineste, Province of Girona, Spain	Natural water	202209	0in
Dolomia	Italy	Friuli, Dolomites, Italy	Natural water	202111	3in/76.2mm
Antipodes	New Zealand	Whakatane, Bay of Plenty, New Zealand	Natural water	202211	3in/76.2mm
Evian	French	Evian town in the French Alps	Natural water	202303	3in/76.2mm
Yice	Canada	Ontario, Canada	Natural water	202307	181.97mm
Fannybay	Canada	Rocky mountains Vancouver， Canada	Natural water	202305	118.7mm
Andes	Chile	Andes, Araucania region, Chile	Natural water	202307	122.1mm0mm
Nongfu Spring	China	Chun'an, Hangzhou, Zhejiang	Natural water	202306	280.6mm
Tenwow	China	Changxing , Huzhou, Zhejiang	Natural water	202303	78.3mm
Baisui Mountain	China	Yuyao, Ningbo, Zhejiang	Natural water	202305	150.8mm
Wahaha	China	Hangzhou, Zhejiang	Purified water	202306	167.9mm
Cestbon	China	Jiading District, Shanghai	Purified water	202212	27.4mm
Ice Dew	China	Hangzhou, Zhejiang	Purified water	202304	34.4mm
Chunyue	China	Hangzhou, Zhejiang	Purified water	202306	167.9mm

Note: Precipitation refers to the amount of precipitation for the month in which the brand of bottled water was produced in different countries.
Data source: https://www.wunderground.com/; https://weather.gc.ca/canada_e.html; https://www.tianqi24.com/.
A precipitation amount below 40mm is considered a non-rainfall day, and a precipitation amount above 40mm is considered a rainy day.

Table S2. HPLC analysis parameters.

Method parameters	
Injection volume	5μL
Column temperature	35 ℃
Mobile phase A	0.01% acetic acid water
Mobile phase B	Methanol (%)
Flow	0.2 mL·min^{-1}
Gradient	0-1min（95%A-5%B）
	2min（90%A-10%B）
	3-6min（10%A-90%B）
	6.1-9min（95%A-5%B）
Detector	Triple quadrupole mass spectrometer
Interface	Positive electrospray ionization
Temperature	550 ℃
Scan type	MRM (multiple reaction monitoring mode）
Collision gas	Nitrogen

Table S3. Calibration curves and R2, average method detection limit (MDL, ng/L), limit of quantification (LOQ, ng/L) and recovery (%) for different neonicotinoid pesticides.

Compounds	Calibration curve	R^2	MDL, ng/L	LOQ, ng/L	Recoveries（SD), %
ACE	y=0.958x-0.0016	0.9996	0.0171	0.0570	96.6（11）
IMI	y=0.0658x-0.0003	0.9977	0.0251	0.0837	86.1（7.2）
CLO	y=0.0539x-0.0002	0.9993	0.0031	0.0103	109.6（3.7）
THI	y=0.8637x-0.0003	0.999	0.0027	0.0090	78.1（3.1）
IMID	y=0.0948x-0.0004	0.9982	0.0197	0.0657	118.7（5.5）
THIA	y=0.0766x-0.0001	0.9994	0.0109	0.0363	96（6.0）
DIN	y=0.1215x+0.0018	0.9992	0.3603	1.2010	102.3（11.6）
NIT	y=0.0021x+0.0001	0.9994	0.2333	0.7777	94.1（9.1）
FLO	y=0.0002x-0.000004	0.9979	0.0450	0.1500	85.8（5.9）

Note:Recovery was calculated based on matrix samples at four concentration levels (0, 5, 50, and 100 ng). The nine neonicotinoids are acetamiprid (ACE), imidacloprid (IMI), clothianidin (CLO), thiacloprid (THI), imidacloprid (IMID), thiamethoxam (THIA), dinotefuran (DIN), nitenpyram (NIT) and sulfafluoride (FLO).

TableS4. Concentrations of detected NEOs in bottled drinking water (ng/L).

sample type and size		ACE	IMI	IMID	THI	THIA	DIN	NIT	CLO	FLO	SUM	IMIeq
	MDL	0.0171	0.0251	0.0197	0.0027	0.0109	0.3603	0.2333	0.0031	0.0450		
Asia China（n=19）												
natural water（6）	**DF(%)**	**100%**	**0%**	**100%**	**33.3%**	**0%**	**66.7%**	**0%**	**0%**	**0%**	**100%**	
	25th	11.03	＜MDL	3.63	＜MDL	＜MDL	0.26	＜MDL	＜MDL	＜MDL	21.22	27.25
	Median	13.00	＜MDL	9.57	＜MDL	＜MDL	17.77	＜MDL	＜MDL	＜MDL	43.80	77.66
	Mean	15.86	＜MDL	9.75	0.55	＜MDL	18.83	＜MDL	＜MDL	＜MDL	44.90	83.74
	SD	7.30	＜MDL	6.44	0.86	＜MDL	18.79	＜MDL	＜MDL	＜MDL	25.00	64.69
	75th	20.58	＜MDL	16.46	1.55	＜MDL	36.67	＜MDL	＜MDL	＜MDL	72.20	141.19
purified water（13）	**DF(%)**	**100%**	**0%**	**100%**	**15.4%**	**0%**	**30.8%**	**69.2%**	**0%**	**0%**	**100%**	
	25th	5.33	＜MDL	5.22	＜MDL	＜MDL	0.26	0.17	＜MDL	＜MDL	34.62	35.96
	Median	9.46	＜MDL	8.58	＜MDL	＜MDL	0.26	29.48	＜MDL	＜MDL	50.99	75.98
	Mean	14.36	＜MDL	11.03	0.18	＜MDL	10.22	35.16	＜MDL	＜MDL	33.01	88.83
	SD	20.27	＜MDL	6.88	0.44	＜MDL	16.96	33.59	＜MDL	＜MDL	21.96	64.10
	75th	14.81	＜MDL	17.82	＜MDL	＜MDL	22.17	65.75	＜MDL	＜MDL	109.71	122.86
Europe（n=48）												
natural water（48）	**DF(%)**	**100%**	**4.2%**	**45.8%**	**0%**	**29.2%**	**2.1%**	**0%**	**0%**	**0%**	**100%**	
	25th	5.08	＜MDL	0.01	＜MDL	0.01	＜MDL	＜MDL	＜MDL	＜MDL	5.75	4.29
	Median	5.51	＜MDL	0.01	＜MDL	0.01	＜MDL	＜MDL	＜MDL	＜MDL	10.43	11.76
	Mean	6.81	0.41	6.87	＜MDL	1.69	0.33	＜MDL	＜MDL	＜MDL	15.84	29.17
	SD	3.47	1.92	9.27	＜MDL	2.75	0.50	＜MDL	＜MDL	＜MDL	11.56	31.41
	75th	7.37	＜MDL	11.83	＜MDL	4.23	＜MDL	＜MDL	＜MDL	＜MDL	24.41	59.17
Oceania（n=18）												
natural water（18）	**DF(%)**	**94.4%**	**16.7%**	**77.8%**	**0%**	**61.1%**	**0%**	**0%**	**0%**	**0%**	**100%**	
	25th	4.59	0.02	6.65	＜MDL	0.01	＜MDL	＜MDL	＜MDL	＜MDL	17.48	15.99
	Median	5.21	0.02	10.49	＜MDL	4.42	＜MDL	＜MDL	＜MDL	＜MDL	21.89	61.96
	Mean	5.88	1.78	10.67	＜MDL	3.34	＜MDL	＜MDL	＜MDL	＜MDL	21.66	48.89

	SD	3.13	4.10	8.80	＜MDL	2.85	＜MDL	＜MDL	＜MDL	＜MDL	7.21	27.41
	75th	6.54	0.02	12.79	＜MDL	6.05	＜MDL	＜MDL	＜MDL	＜MDL	28.12	72.12
South America（n=6）												
natural water（6）	**DF(%)**	**100%**	**83.3%**	**0%**	**100%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**	
	25th	3.27	7.46	＜MDL	2.50	＜MDL	＜MDL	＜MDL	＜MDL	＜MDL	14.14	46.90
	Median	3.38	10.09	＜MDL	2.59	＜MDL	＜MDL	＜MDL	＜MDL	＜MDL	16.45	49.09
	Mean	3.62	14.99	＜MDL	2.61	＜MDL	＜MDL	＜MDL	＜MDL	＜MDL	21.21	55.04
	SD	0.65	17.36	＜MDL	0.13	＜MDL	＜MDL	＜MDL	＜MDL	＜MDL	15.68	17.20
	75th	3.87	20.11	＜MDL	2.69	＜MDL	＜MDL	＜MDL	＜MDL	＜MDL	26.62	59.96
North America（n=6）												
natural water（6）	**DF(%)**	**100%**	**0%**	**0%**	**100%**	**50%**	**0%**	**0%**	**0%**	**0%**	**100%**	
	25th	3.09	＜MDL	＜MDL	2.48	＜MDL	＜MDL	＜MDL	＜MDL	＜MDL	6.63	38.11
	Median	3.37	＜MDL	＜MDL	2.70	1.83	＜MDL	＜MDL	＜MDL	＜MDL	8.28	59.38
	Mean	3.38	＜MDL	＜MDL	2.78	2.60	＜MDL	＜MDL	＜MDL	＜MDL	8.77	67.06
	SD	0.32	＜MDL	＜MDL	0.36	3.21	＜MDL	＜MDL	＜MDL	＜MDL	3.07	32.64
	75th	3.74	＜MDL	＜MDL	3.07	5.01	＜MDL	＜MDL	＜MDL	＜MDL	11.91	96.53

n:number of samples

DF: detection frequency.

SD:standard deviation.

＜MDL：under the method detection limits.

Table S5. Neonicotinoid insecticides normalized to imidacloprid based on reference doses (RfD) to generate relative potency factors (RPF).

Compound	abbreviation	RfD（mg/kg bw/d）	RPFs
Acetamiprid	ACE	0.071	0.803
Clothianidin	CLO	0.0098	5.816
Imidacloprid	IMI	0.057	1
Thiacloprid	THI	0.004	14.250
Thiamethoxam	THIA	0.006	9.500
Dinotefuran	DIN	0.02	2.850
Imidaclothiz	IMID	/	1.000*
Nitenpyram	NIT	/	1.000*
Flonicamid	FLO	/	1.000*

USEPA has developed RfDs for some NEOs based on no-observed adverse effect levels (NOAELs) (https://www3.epa.gov/pesticides/chem_search/cleared_reviews).
RPFs: Relative potency factors calculated based on the RfD of each NEO and normalized by the RfD of IMI (Chang et al., 2018); $RPFs=RfD_{IMI}/RfD_s$; There are no RfDs of IMID, NIT and FLO in existing studies, so use the same RfD as IMI.

Table S6. Bottled drinking water intake rates (L/kg bw/d) used to estimate human exposure.

Age groups	USEPA		China	
	Generation	DWIR (L/kg bw/d)	Generation	DWIR (L/kg bw/d)
Infants	< 1 year	0.089	< 1 year	0.0412
Toddlers	1-3 years	0.031	1-3 years	0.0576
Children	4-11 years	0.029	4-11 years	0.0386
Teenagers	11-21 years	0.016	11-18years	0.0242
Adults	≥ 21 years	0.02	≥18years	0.0299

Table S7. Intake rates used in USEPA to estimate human exposure (all age groups).

Intake rates (IR)	EPA	China(＞18year)
Bottled water（L/kg bw/d)	0.0078	0.0186
Drinking water（L/kg bw/d)	0.0128	0.0186
Food（g/kg bw/d)	0.0288	0.0174

Data source: Median DWIR values were used. Asian samples were based on the "Chinese Population Exposure Parameter Manual" (Duan 2013); for other continents, based on based on “Consumer-Only Estimates of Direct and Indirect Water Ingestion (EPA/600/R-09/052F). Dietary exposure data for the Chinese population are average values.

Table S8.Previous studies have examined neonicotinoid concentrations (ng/L) in surface waters (including rivers, lakes, and other surface runoff) on all continents around the world. Contains country, year, sampling date. ND: Not detected or less than the detection limit "/": not analyzed or obtained.

A. Europe

Location	THIA	DIN	IMI	THI	CLO	ACE	NIT	IMID	FLO	Sampling date	Reference
U.K.	12.2	/	119.2	ND	/	224.3	/	/	/	2019	[1]
Spain	ND	/	19.0	4.3	ND	ND	/	/	/	2017-2018	[2]
Spain	/	/	32.0	1.0	1.0	2.0	/	/	/	/	[3]
Spain	/	/	130.0	0.4	/	420.0	/	/	/	2017	[4]
Spain	1.46	/	20.43	1.57	3.89	2	/	/	/	2015-2016	[5]
	ND	/	18.11	2.33	3.92	8.74	/	/	/		
	ND	/	38.1	1.27	4.04	3.66	/	/	/		
Spain and Portugal	0.3	/	2.8	0.3	0.2	0.5	/	/	/	2020	[6]
Portugal	78.44	/	106.47	/	ND	/	/	/	/	2016-2017	[7]
	104.1	/	259.75	/	30.7	/	/	/	/		
	86.3	/	96.2	/	ND	/	/	/	/		
	83.31	/	283	/	2.7	/	/	/	/		
Belgium	/	/	1.7	1.5	0.57	/	/	/	/	2017	[8]
	/	2.07	1.1	0.4	0.6	/	/	/	/		
	/	11	9	65	1.7	/	/	/	/		
	/	1.4	1.28	1.35	0.329	/	/	/	/		
	/	/	0.3	0.34	0.17	/	/	/	/		
	/	54	10	3.9	3.1	/	/	/	/		

B. South America

Location	THIA	DIN	IMI	THI	CLO	ACE	NIT	IMID	FLO	Sampling date	Reference
Brazil	/	/	4530	/	/	/	/	/	/	2001-2002	[9]
	/	/	810	/	/	/	/	/	/		
	/	/	660	/	/	/	/	/	/		
	/	/	270	/	/	/	/	/	/		
	/	/	1340	/	/	/	/	/	/		
	/	/	1280	/	/	/	/	/	/		
	/	/	920	/	/	/	/	/	/		
	/	/	1885	/	/	/	/	/	/		
	/	/	1353	/	/	/	/	/	/		
Brazil	/	/	70	/	/	/	/	/	/	2014-2015	[10]
Brazil	/	/	20	/	/	/	/	/	/	2014	[11]
	/	/	20	/	/	/	/	/	/		
	/	/	20	/	/	/	/	/	/		
	/	/	20	/	/	/	/	/	/		
	/	/	20	/	/	/	/	/	/		
	/	/	50	/	/	/	/	/	/		
	/	/	20	/	/	/	/	/	/		
	/	/	20	/	/	/	/	/	/		
	/	/	20	/	/	/	/	/	/		
	/	/	50	/	/	/	/	/	/		
	/	/	60	/	/	/	/	/	/		
	/	/	70	/	/	/	/	/	/		
	/	/	183	/	/	/	/	/	/		
	/	/	151	/	/	/	/	/	/		
	/	/	873	/	/	/	/	/	/		
	/	/	627	/	/	/	/	/	/		

	/	/	429	/	/	/	/	/	/		
	/	/	635	/	/	/	/	/	/		
	/	/	1437	/	/	/	/	/	/		
	/	/	468	/	/	/	/	/	/		
	/	/	714	/	/	/	/	/	/		
	/	/	921	/	/	/	/	/	/		
	/	/	802	/	/	/	/	/	/		
	/	/	619	/	/	/	/	/	/		
Argentina	/	/	54	/	/	/	/	/	/	2014-2015	[12]
Argentina	/	/	9.78	/	/	/	/	/	/	2021	[13]
Argentina	/	/	43	/	/	/	/	/	/	2014-2017	[14]

C. Oceania

Location	THIA	DIN	IMI	THI	CLO	ACE	NIT	IMID	FLO	Sampling date	Reference
Sydney	100	/	200	150	60	80	/	/	/	2013	[15]
	/	/	20	/	/	/	/	/	/		
	/	/	40	/	/	/	/	/	/		
	/	/	71	/	/	/	/	/	/		
	/	/	81	/	/	/	/	/	/		
	/	/	15	/	/	/	/	/	/		
	/	/	0.64	/	/	/	/	/	/		
	/	/	0.26	/	/	/	/	/	/		
Australia	/	/	34	/	/	/	/	/	/	2009-2017	[16]
	/	/	120	/	/	/	/	/	/		
	/	/	49	/	/	/	/	/	/		
	/	/	200	/	/	/	/	/	/		
	/	/	0.77	/	/	/	/	/	/		
	/	/	0.25	/	/	/	/	/	/		
	/	/	0.32	/	/	/	/	/	/		
	/	/	51	/	/	/	/	/	/		

D.North America

Area	THIA	DIN	IMI	THI	CLO	ACE	NIT	IMID	FLO	Sample date	Reference
America	4.9	ND	10.4	ND	23.7	ND	/	/	/	2015-2016	[17]
	126.2	ND	159.8	ND	278.2	ND	/	/	/		
	11.7	ND	24.9	ND	65.7	ND	/	/	/		
	40.9	ND	32.2	ND	48.4	ND	/	/	/		
	5.3	ND	12.2	ND	25	ND	/	/	/		
	122.8	ND	212.6	ND	332.7	ND	/	/	/		
	7	ND	16.9	ND	41	ND	/	/	/		
	/	ND	NS	ND	NS	ND	/	/	/		
	5.5	ND	10.1	ND	23.5	ND	/	/	/		
	11.8	ND	21.5	ND	38.6	ND	/	/	/		
	4.7	ND	13.6	ND	27.8	ND	/	/	/		
	41.4	ND	40.2	ND	76.4	ND	/	/	/		
America	10.60	/	13.10	/	8.60	/	/	/	/	2017	[18]
America	2.00	/	20.00	/	10.00	/	/	/	/	2016-2017	[19]
America	ND	/	1.20	/	15.30	/	/	/	/	2017	[20]
America	ND	/	44.85	ND	97.03	2.05	/	/	/	2014.2	[21]
America	40.6	43.28	33.92	/	19.02	ND	/	/	/	2012-2014	[22]
	/	3	12.05	/	/	12.34	/	/	/		
	18.4	/	52	/	14.71	/	/	/	/		
America	135.70	212.82	48.17	/	19.80	/	/	/	/	2016-2017	[23]
Canada	6	ND	4	1	6	ND	ND	/	/	2016-2017	[24]

	4	ND	2	1	11	ND	ND	/	/		
	3	ND	0.8	ND	7	ND	ND	/	/		
	5	ND	0.8	ND	2	ND	ND	/	/		
	5	ND	38	ND	15	0.6	ND	/	/		
	61	ND	10	ND	88	2.5	ND	/	/		
	11	ND	6	ND	22	ND	ND	/	/		
	6	ND	1.2	ND	15	ND	ND	/	/		
Canada	32.2	/	ND	ND	ND	ND	/	/	/	2015	25
	52.7	/	ND	ND	33.2	ND	/	/	/		
	79.2	/	ND	ND	57.1	ND	/	/	/		
	283.5	/	ND	ND	86.9	ND	/	/	/		
	38.9	/	ND	ND	ND	ND	/	/	/		
	42.9	/	ND	ND	138.1	ND	/	/	/		
	ND	/	2.7	ND	7.2	ND	/	/	/		
	ND	/	4.4	ND	6.8	ND	/	/	/		
	10.8	/	3.7	ND	28.7	ND	/	/	/		
	23.4	/	8.6	ND	48.2	ND	/	/	/		
	ND	/	4.3	ND	5.9	ND	/	/	/		
	18.2	/	13.5	2.7	77.1	ND	/	/	/		
Canada	40.3	/	15.9	/	142	1.1	/	/	/	2012-2013	26
	40.6	/	7.1	/	59.7	0.6	/	/	/		
Canada	51.00	/	58.00	/	36.00	/	/	/	53.00	2012-2019	27
Canada	/	/	10.33	2.23	7.77	8.70	/	/	5.10	2016	28
	/	/	54.33	3.27	82.27	27.67	/	/	31.67		
	3.45	/	4.00	2.20	12.93	30.13	/	/	/		
	623.47	/	1064.30	4.33	389.83	27.23	/	/	732.03		
	10.60	/	6.30	2.27	24.27	81.30	/	/	/		

	2.57	/	4.80	/	13.30	2.67	/	/	1.60		
Canada	18.1	/	/	/	20.1	/	/	/	/	2014	[29]
	27	/	/	/	31.2	/	/	/	/		
Canada	60	/	10		77	106	/	/	/	2013-2015	[30]
	31	/	23	□	20	16	/	/	/		
Canada	5	/	ND	/	16	/	/	/	/	2015	[31]
	2	/	1	/	11	/	/	/	/		
	80	/	0	/	18	/	/	/	/		
	5	/	0	/	8	/	/	/	/		
	1	/	0	/	13	/	/	/	/		
	1	/	ND	/	3	/	/	/	/		
	4	/	2	/	6	/	/	/	/		
	5	/	1	/	4	/	/	/	/		
Canada	/	3.80	/	/	3.60	/	/	/	/	2017	[32]
Canada	1090	/	/	/	40	/	/	/	/	2014-2015	[33]
	31	/	/	/	20	/	/	/	/		
	30	/	/	/	10	/	/	/	/		
	20	/	/	/	10	/	/	/	/		
	60	/	/	/	50	/	/	/	/		
	7	/	/	/	5	/	/	/	/		
	4	/	/	/	10	/	/	/	/		
	3	/	/	/	3	/	/	/	/		
Canada	172	/	11.8	0.52	31.6	0.21	/	/	/	2016	[34]
	5.79	/	113	2.71	13.8	20.8	/	/	/		
	17.8	/	30.7	0.72	13.3	14.3	/	/	/		
	4.69	/	2.53	/	4.19	ND	/	/	/		
	21.2	/	21.7	/	7.78	2.7	/	/	/		
	7.11	/	4.32	0.89	2.65	0.34	/	/	/		

20.1	/	5.25	/	7.28	ND	/	/	/
137	/	856	2.19	41.8	59.3	/	/	/
4.28	/	1.82	/	22.8	ND	/	/	/
23.5	/	4.08	/	11.1	ND	/	/	/
/	/	/	/	ND	ND	/	/	/
12.5	/	1390	2.81	5.17	21.6	/	/	/
58.6	/	5.49	/	28.7	0.26	/	/	/
24.9	/	4.56	/	17.5	ND	/	/	/
15.3	/	19.4	46.2	22.3	9.58	/	/	/

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E. Asia

Location	THIA	DIN	IMI	THI	CLO	ACE	NIT	IMID	FLO	Sampling date	Reference
Yangtze River	4.3	/	6.1	0.0	0.4	2.7	0.5	/	/	2015	[35]
	28.6	11.3	35.6	□	7.52	15	15.9	17.7	ND		
	2.97	9.69	4.18	0.57	8.01	4.74	9.35	4.71	ND		
	ND	14.3	25.3	0.752	ND	7.69	28.7	23	ND		
	12.5	23.7	22.4	0.223	6.62	8.55	42.9	15.7	ND		
	2.35	6.88	11.41	ND	ND	4.93	8.89	22.6	ND		
	8.75	84.6	9.38	0.66	ND	7.54	113	11.3	ND		
	9.63	704	15	3.85	46.3	18.5	241	23.7	ND		
	18.6	20.2	27.4	3.04	ND	6.73	53	15.1	ND		
	16.3	ND	15.3	ND	1.57	22.9	16.5	6.11	ND		
	87.7	921	46.7	3.12	17.4	15.4	800	83.4	ND		
Yangtze River	5.1	4.5	8.88	ND	ND	4.8	ND	9.25	ND	2016	[36]
	22.6	274	36.3	1.8	14.4	9.77	292	32.56	ND		
	157	33.5	49.9	ND	9.05	18.2	544	85	ND		
	16.3	28.7	586	0.113	9.63	1.31	319	22.7	ND		
	2.33	41.5	31.2	1.79	0.473	6.22	39.2	21	ND		
	6.61	77.5	18.2	2.09	31.4	6.2	285	29.9	ND		
	0.06	ND	1.11	ND	ND	8.28	2.76	37.9	ND		
	42.31	719	22.5	3.72	22.2	8.12	603	44.1	ND		
	43.8	1380	26.6	7.83	24.7	14.5	881	76.9	ND		
	20.8	112	24.6	2.82	38.6	ND	172	40.1	ND		
	4.16	3.92	0.292	ND	13.5	ND	363	19.9	ND		
	20.5	1730	71.4	3.28	81.3	7.02	1250	72.2	ND		

	16.2	12.2	0.401	ND	8.18	ND	27.8	20.6	ND		
	43.4	1020	30.9	3.07	8.5	5.67	673	81.9	ND		
Yellow River	67.4	16.7	39.2	0.5	9.8	25.5	ND	6.9	/	2022	37
Tai hu Lake	8.2	1.4	38	ND	0.7	15	/	/	/	2019	38
	43	2.2	32	0.3	2.2	10	/	/	/		
	46	19	69	0.3	13	30	/	/	/		
	5.6	2.9	27	0.6	ND	16	/	/	/		
Tai hu Lake	12	/	70.2	/	/	8.33	/	/	/	2018	39
	2.89	/	48.3	/	/	9.07	/	/	/		
	0.4	/	45.6	/	/	4.69	/	/	/		
	1.24	/	7.24	/	/	0.87	/	/	/		
Pan yang Lake	7.2	40.2	13.4	0.9	2.6	2.5	/	/	/	2019	40
Pearl River	39	/	51.2	15.7	28.9	32.1	/	/	19.6	2021	41
	24.7	/	40.3	6.89	24.3	20.6	/	/	6.57		
	19.1	/	21.4	4.79	9.3	13.9	/	/	9.47		
	30.9	/	45.5	10.3	11.1	23.5	/	/	7.48		
	22.3	/	55.5	9.77	16.9	22.3	/	/	14.4		
	22.8	/	46.4	8.02	4.48	14.9	/	/	1.27		
	10.2	/	ND	3.27	ND	11	/	/	ND		
Pearl River	50.2	/	78.3	1.2	25.3	36.0	/	/	/	2017	42
Pearl River	10.9	/	81.1	ND	25.6	51.2	/	/	/	2016	43
	12.8	/	63.8	ND	19.7	62.2	/	/	/		
Pearl River	/	/	24	/	11	14	/	/	/	2018	44
	/	/	22	/	15	6.7	/	/	/		
	/	/	20	/	17	5.3	/	/	/		
	/	/	49	/	18	6.6	/	/	/		

	/	/	17	/	17	4.2	/	/	/		
	/	/	18	/	15	5.2	/	/	/		
	/	/	14	/	14	5.1	/	/	/		
	/	/	26	/	15	9.1	/	/	/		
Songhua River	30.7	2.9	22.4	/	3.4	1.9	/	0.0	/	2019	45
China	14.6	799	10.2	ND	3.4	8.76	18.8	/	/	2019	46
	16.6	802	9.37	ND	12.1	9.92	16.4	/	/		
	11.2	606	5	ND	4.73	2.18	3.46	/	/		
	8.1	159	7.91	4.23	6.21	6.21	6.23	/	/		
	8.38	168	6.38	3.8	6.12	5.56	ND	/	/		
	0.83	5.18	3.61	ND	1.05	0.83	ND	/	/		
	2.72	53	3.48	1.1	2.14	2.23	ND	/	/		
	ND	ND	1.78	ND	0.26	0.59	ND	/	/		
	3.68	45.8	4.93	1.34	2.51	2.71	ND	/	/		
	2.6	48.9	5.61	0.84	1.86	1.92	ND	/	/		
	2.81	39	3.81	1.12	2.22	2.08	ND	/	/		
	2.47	42	3.57	0.94	1.89	1.87	ND	/	/		
	2.65	14.2	7.57	0.19	2.6	1.84	ND	/	/		
	2.22	17.8	8.62	0.11	2.82	1.72	ND	/	/		
	15.3	137	12.8	ND	6.53	3.12	2.74	/	/		
	14.6	193	9.81	ND	5.97	3.4	1.69	/	/		
	28.5	185	15.9	ND	5.85	5.33	ND	/	/		
	14.1	78.9	11.7	3.65	4.07	4.07	3.2	/	/		
	14.2	75.9	9.83	3.67	3.82	3.91	ND	/	/		
	13.2	77.4	9.18	2.9	4.15	4.27	ND	/	/		
	ND	3.15	3.94	ND	ND	1.4	ND	/	/		

	2.73	11.5	3.95	0.28	0.84	2	ND	/	/		
	ND	3.59	47.4	ND	ND	1.44	ND	/	/		
	2.84	11.8	9.54	0.38	1.13	2.07	ND	/	/		
	3.13	11.7	7.13	0.32	0.85	1.53	ND	/	/		
	2.86	10.2	7.47	0.29	1	1.58	ND	/	/		
	4.02	15.7	6.2	0.36	1.04	1.42	ND	/	/		
	3.18	13.5	6.28	0.38	0.43	1.51	ND	/	/		
	4.07	6.14	13.7	ND	2.16	2.07	ND	/	/		
	3.79	7.2	13.3	0.06	2.26	1.95	ND	/	/		
	3.7	6.15	12.9	0.06	1.79	1.8	ND	/	/		
China	9.1	/	78.3	ND	/	7.5	/	/	/	/	47
	ND	/	9.3	ND	/	ND	/	/	/		
	7.6	/	87.5	ND	/	10	/	/	/		
	11.3	/	49.8	ND	/	6.7	/	/	/		
China	1.79	2.54	1.25	ND	ND	ND	152.54	15.35	ND	2016	48
	7.12	392.56	1.33	0.42	1.2	33.57	7.52	34.27	ND		
	6.76	10.99	1.53	ND	71.05	2.78	5.05	27.54	ND		
	1.67	16.42	8.04	0.19	ND	25.49	11.5	39.08	ND		
	43.43	1022.2	30.9	3.07	1.55	5.67	672.9	81.92	1.06		
	8.99	26.26	73.28	1.67	ND	48.76	42.32	47.35	ND		
	1.81	27.44	7.41	0.1	5.04	3.14	30.21	21.07	ND		
	12.18	1.14	14.72	ND	3.63	3.95	ND	15.89	ND		
	1.34	4	3.11	ND	ND	0.27	6.93	21.14	ND		
	9.33	10.44	31.52	0.11	5.9	9.43	11.21	21.27	ND		
	6.98	ND	33.16	0.13	5.98	30.39	6.52	16.75	ND		
	2.78	4.66	7.39	0.84	2.6	2.16	6.74	15.78	ND		
	13.7	24.08	10.04	1.77	13.58	7.73	92.48	32.44	ND		

	27.31	166.93	31.72	1.08	93.86	0.77	400.31	68.23	ND		
	13.83	39.75	22.64	0.62	35.98	ND	173.18	41.04	ND		
	95.85	73.77	354.86	3.84	2.76	118.49	55.44	47.45	ND		
	1.17	12.22	0.86	0.08	ND	ND	6.18	22.86	ND		
	8.93	10.72	9.34	0.84	5.12	11.46	18.06	23.94	ND		
	3.21	ND	38.98	ND	2.44	12.61	110.03	32.65	ND		
	1.58	2.47	65.11	ND	5.81	26.36	2	24.68	ND		
	22.63	274.24	36.27	1.37	14.43	9.77	291.51	32.57	ND		
	15.04	7.48	84.52	ND	16.08	43.11	95.62	17.87	ND		
	6.71	11.4	33.35	ND	2.64	23.28	12.64	16.11	ND		
	6.82	ND	8.91	0.62	6.1	3.84	ND	15.4	ND		
	7.7	25.99	14.55	0.49	ND	4.61	136.31	21.57	ND		
	2.65	2.54	15.91	0.34	ND	4.56	8.15	16.58	ND		
	16.2	7.02	72.86	3.24	6.9	73.42	18.71	15.34	ND		
	6.52	10.7	17.7	0.02	1.31	2.27	13.03	15.68	ND		
	10.29	6.15	12.82	0.67	2.46	15.25	ND	17.3	ND		
	17.64	84.2	31.7	0.63	2.93	5.35	120.16	35.04	ND		
	14.72	6.45	24.54	0.43	ND	1.35	5.22	15.23	ND		
	28.89	44.35	77.69	1.31	9.61	4.13	41.75	38.61	ND		
China	30.4	/	24.9	0.67	18.1	24.7	/	/	/	2017	49
	29.4	/	33.9	0.9	13.9	18.4	/	/	/		
	35.2	/	32.5	0.4	23.3	9.42	/	/	/		
	79.5	/	36.5	0.59	49.7	12.3	/	/	/		
China	32.1	12.1	6.6	0.3	9.9	2.9	ND	0.3	/	2022	50
China	10.0	/	9.9	/	1.3	/	0.0	ND	/	2019	51
China	2.93	2.1	3.12	/	0.54	0.35	1.62	1.22	0.98	2021	52
	14.8	3.36	4.62	/	0.91	0.5	2.32	1.46	0.91		

	29.06	7.01	8.58	/	2.13	0.93	3.99	2.71	2.26		
	7.97	1.27	6.07	/	0.9	0.28	0.82	0.4	1.14		
	2.93	1.06	1.32	/	0.91	0.37	1.07	0.56	3.65		
Qinhai	1.0	0.6	8.1	0.1	0.6	1.0	0.0	0.3	0.0	2021	[53]
Wuhan	11.3	0.7	18.8	0.1	2.2	7.4	1.3	/	/	2018	[54]
Guangzhou	43.8	/	29.1	0.15	22.4	25	/	/	/	2017	[55]
	25.5	/	14.8	0.011	12.8	21.3	/	/	/		
	58.3	/	41.4	0.6	30.1	27.1	/	/	/		
Guangzhou	3.63	1.24	6.46	0.21	2.65	39.88	1.71	/	/	2020-2021	[56]
	0.77	0.39	8.48	ND	0.14	100.42	ND	/	/		
Zhejiang	4.8	2.4	11.9	ND	7.6	17.6	1.6	/	/	2017-2018	[57]
Zhejiang	18.8	32.3	262.1	/	/	9.16	108.4	/	/	2021-2022	[58]
	31.07	59	17.15	/	/	6.3	105.6	/	/		
	23.42	310.1	24.91	/	/	7.36	97.8	/	/		
	22.68	98	19.58	/	/	7.29	93.3	/	/		
	28.17	50.8	26.76	/	/	9.87	78	/	/		
	30.04	300.7	22.84	/	/	17.03	78.6	/	/		
	28.2	210.5	30.3	/	/	14.26	92.6	/	/		
	23.92	37.3	34.43	/	/	20.13	104.8	/	/		
Shandong	558.78	/	635.7	/	703.73	/	/	/	/	2020-2021	[59]
	719.72	/	1041.21	/	832.1	/	/	/	/		
	599.61	/	787.71	/	685.05	/	/	/	/		
	333.83	/	330.47	/	221.56	/	/	/	/		
Beijing	3.46	272.75	92.45	0.80	2.94	18.11	1.20	45.12	1.54	2020-2021	[60]
	5.37	349.97	132.11	0.16	5.70	6.30	1.99	9.86	13.44		
Hainan	200.0	90.0	1360.0	20.0	130.0	410.0	3.0	40.0	/	2021-2022	[61]

Table S9. Pesticide (insecticide) usage in different countries (tons).

Domain Code	Area	Element	Item	Year	Unit	Value	Flag Description
RP	China, mainland	Agricultural Use	Insecticides	2020	t	66800.76	Official figure
RP	China, mainland	Agricultural Use	Insecticides	2021	t	63035.9	Official figure
RP	Italy	Agricultural Use	Insecticides	2020	t	10400	Official figure
RP	Italy	Agricultural Use	Insecticides	2021	t	9174	Official figure
RP	France	Agricultural Use	Insecticides	2020	t	6372.12	Official figure
RP	France	Agricultural Use	Insecticides	2021	t	6843.72	Official figure
RP	Norway	Agricultural Use	Insecticides	2020	t	17	Official figure
RP	Norway	Agricultural Use	Insecticides	2021	t	16	Official figure
RP	Spain	Agricultural Use	Insecticides	2020	t	8165.12	Estimated value
RP	Spain	Agricultural Use	Insecticides	2021	t	9882.32	Estimated value
RP	U.K	Agricultural Use	Insecticides	2020	t	316.75	Official figure
RP	U.K	Agricultural Use	Insecticides	2021	t	325.58	Official figure
RP	Fiji	Agricultural Use	Insecticides	2020	t	320.89	Imputed value
RP	Fiji	Agricultural Use	Insecticides	2021	t	383.86	Imputed value
RP	New Zealand	Agricultural Use	Insecticides	2020	t	303	Imputed value
RP	New Zealand	Agricultural Use	Insecticides	2021	t	303	Imputed value
RP	Canada	Agricultural Use	Insecticides	2020	t	3143	Official figure
RP	Canada	Agricultural Use	Insecticides	2021	t	3143	Imputed value
RP	Chile	Agricultural Use	Insecticides	2020	t	2064.33	Estimated value
RP	Chile	Agricultural Use	Insecticides	2021	t	2311.71	Estimated value

Data source: Food and Pesticides Organization of the United Nations (FAO, https://www.fao.org/faostat/en/#data/RP).

TableS10. Pearson's correlation between pesticide (insecticide) use and neonicotinoid residues in bottled water by country.

		ACE	IMID	THIA	NEOs	Insecticides
ACE	Cor. Coef.	1				
	Sig (two-tailed)					
IMID	Cor. Coef.	-0.486	1			
	Sig (two-tailed)	0.269				
THIA	Cor. Coef.	0.174	-0.650	1		
	Sig (two-tailed)	0.710	0.162			
NEOs	Cor. Coef.	**.794****	-0.451	0.088	1	
	Sig (two-tailed)	**0.006**	0.310	0.850		
Insecticides	Cor. Coef.	**.923****	-0.577	0.077	**.688***	1
	Sig (two-tailed)	**0.000**	0.175	0.870	**0.028**	

** Correlations are significant at the 0.01 level (two-tailed). * Correlation is significant at the 0.05 level (two-tailed).

Table S11. Mean concentrations (ng/L) of NEOs in drinking water other than bottled water measured in other reports.

Location	Year	Water type	ACE	IMI	CLO	THI	THIA	DIN	NIT	IMID	Reference
Canada	2017	Tap water	n.a	0.43	6	n.a	10	n.a	n.a	n.a	[24]
Canada	2015	Drinking water	n.a	3.97	n.a	n.a	43.58	n.a	n.a	n.a	[25]
Iowa,USA	2018	Tap water	n.a	1.29	8.08	n.a	0.48	n.a	n.a	n.a	[62]
Iowa,USA	2016	Tap water	n.a	6.81	13.99	n.a	1.22	n.a	n.a	n.a	[63]
Zhejiang,China	2017	Tap water	5.8	4	0.6	n.d	n.d	1.8	2.5	n.a	[57]
Wuhan,China	2018	Tap water	5.19	12.30	2.02	0.05	7.92	2.47	2.10	n.a	[54]
China	2017-2019	Tap water	13.2	16.2	15.5	12.2	15.6	32.2	n.a	n.a	[64]
China	2019	Tap water	1.75	5.63	3.22	0.08	6.68	0.72	0.05	0.01	[65]
China	2019	groundwater	0.22	1.88	2.11	0.03	9.09	0.23	0.03	0.002	[65]
China	2018	Tap water + Well water + Direct drinking water + Bottled water	1.78	7.14	4.71	0.11	10.1	n.a	n.a	n.a	[66]

Table S12. Mean dietary NEOs concentrations (ng/g) measured in other reports.

Location	Year	Food type	ACE	IMI	CLO	THI	THIA	DIN	NIT	IMID	Reference
Boston, USA	2012	fruits + vegetables	40.3	1.66	0.7	7.8	2.49	17.45	n.d	n.a	[67]
USA	2015	fruits + vegetables	3.93	2.67	3.39	0.16	5.44	3.33	0.24	n.a	[68]
China	2012	cereals	n.d	35.5	n.d	n.d	50.25	n.d	n.d	n.a	[69]
hangzhou,China	2015	fruits + vegetables	19.87	29.33	3.05	1.21	9.77	11.54	3.79	n.a	[68]
hangzhou,China	2017	vegetables	21.57	22.81	3.17	9.63	1.75	11.79	n.a	0.67	[70]
hangzhou,China	2017	fruits	12.33	25.27	2	10.67	0.1	14.13	n.a	n.d	[70]
China	2019	fruits + vegetables + eggs + milk + grains + meat	6.38	3.44	2.45	0.19	3.7	1.29	0.51	n.a	[71]
China	2009-2012		5.06	2.08	0.72	0.54	n.a	0.39	0.21	n.a	[72]
China	2009-2012	cereals + meat + eggs+vegetables + fruits, etc.	3.423	1.586	0.1	0.426	0.003	0.007	0.015	0.005	[73]
China	2015-2018		2.589	0.915	0.486	0.989	0.01	0.024	0.037	0.008	[73]

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