Table S1. The regression models employed in describing the dose-response curves in this study

Regression model	Function
Gompertz	$E(c) = \alpha \cdot exp(-exp\left(\dfrac{-c-\gamma}{\beta}\right))$
Hill	$E(c) = \dfrac{\alpha}{1 + \left(\dfrac{\gamma}{c}\right)^{\beta}}$
Chapman	$E(c) = \dfrac{\alpha}{1 + \left(\dfrac{\gamma}{c}\right)^{\beta}}$

$E(c)$: the fractional effect elicited at concentration c; $\alpha, \beta,\ and\ \gamma$: parameters of regression models (corresponding statistical estimates).

Table S2. Toxicological Information of Single Nano Metal Oxide

No.	Chemical	Engineered NPs size [nm]	EC_{10} [mM]	EC_{50} [mM]	RM [a]	Parameter α [b]	β [c]	γ [d]
1	SiO_2	8	19.673 (18.223-21.271)	N.A. [e]	Hill	32.270	1.882	30110
2	SiO_2 (Porous)	15-20	35.078 (24.423-26.061)	N.A.	Hill	38.510	2.446	53.838
3	SiO_2 (Spherical)	15-20	24.418 (31.829-38.715)	N.A.	Hill	42.122	1.974	44.105
4	SiO_2	20-30	64.131 (51.668-87.447)	N.A.	Hill	12.820	2.886	41.340
5	SiO_2	60-70	7.464 (7.417-7.932)	54.183 (54.172-54.394)	Hill	154.400	0.976	115.200
6	TiO_2 (Rutile)	30	16.154 (15.784-16.516)	318.642 (292.351-352.574)	Hill	54.580	1.303	50.860
7	TiO_2 (Anatase)	15	30.617 (30.416-31.075)	N.A.	Hill	14.150	0.112	10.380
8	TiO_2 (Anatase)	18	9.841 (9.786-9.902)	23.573 (23.298-23.854)	Hill	102.400	2.492	24.020
9	TiO_2 (Anatase)	30	58.042 (48.910-62.533)	N.A.	Hill	48.690	8.991	67.73
10	ZnO	10-30	0.021 (0.021-0.022)	0.039 (0.039-0.039)	Hill	98.490	69.78	9.800
11	ZnO	35-45	0.034 (0.033-0.034)	1.240 (1.189-1.295)	Hill	71.550	4.289	0.412
12	ZnO	80-200	0.022 (0.022-0.023)	0.079 (0.077-0.080)	Hill	88.200	1.774	0.067

[a] Regression models; [b] Height; [c] Slope; [d] Center point, and [e] Not detectable.

Table S3. Particle Characteristics of Binary Mixture Metal Oxide NPs

Mix No. [a]	Substance A		Substance B		Mixture Design	Specific surface area $[m^2/g]$	Hydrodynamic size in 2% NaCl [nm] [b]	Zeta-Potential [d] [mV]
	Chemical A	Size A [nm]	Chemical B	Size B [nm]				
1	SiO_2	8	$TiO_{2(Rutile)}$	30	$EC_{10+}EC_{10}$	1238.5	4613	-3.33
2	SiO_2	15-20 (porous)	$TiO_{2(Rutile)}$	30	$EC_{10+}EC_{10}$	1848.8	4135	1.03
3	SiO_2	15-20 (spherical)	$TiO_{2(Rutile)}$	30	$EC_{10+}EC_{10}$	1412.4	4411	-5.23
4	SiO_2	20-30	$TiO_{2(Rutile)}$	30	$EC_{10+}EC_{10}$	3306.4	1271	2.52
5	SiO_2	60-70	$TiO_{2(Rutile)}$	30	$EC_{10+}EC_{10}$	1073.2	6001	-5.70
6	SiO_2	8	$TiO_{2(Anatase)}$	15	$EC_{10+}EC_{10}$	2033.6	4718	-4.68
7	SiO_2	15-20 (porous)	$TiO_{2(Anatase)}$	15	$EC_{10+}EC_{10}$	2320.0	5670	-7.16
8	SiO_2	15-20 (spherical)	$TiO_{2(Anatase)}$	15	$EC_{10+}EC_{10}$	2089.7	5870	-10.07
9	SiO_2	20-30	$TiO_{2(Anatase)}$	15	$EC_{10+}EC_{10}$	3306.4	7850	-7.10
10	SiO_2	60-70	$TiO_{2(Anatase)}$	15	$EC_{10+}EC_{10}$	2136.5	6141	-5.70
11	SiO_2	8	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{10}$	1025.4	4920	-1.39
12	SiO_2	15-20 (porous)	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{10}$	1809.8	4602	-4.85
13	SiO_2	15-20 (spherical)	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{10}$	1267.8	4772	-8.32
14	SiO_2	20-30	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{10}$	3331.3	5614	-7.52
15	SiO_2	60-70	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{10}$	667.1	4145	-6.08
16	SiO_2	8	$TiO_{2(Anatase)}$	30	$EC_{10+}EC_{10}$	1409.9	4142	-3.78
17	SiO_2	15-20 (porous)	$TiO_{2(Anatase)}$	30	$EC_{10+}EC_{10}$	1927.7	5193	-2.85
18	SiO_2	15-20 (spherical)	$TiO_{2(Anatase)}$	30	$EC_{10+}EC_{10}$	1549.0	5130	-1.54
19	SiO_2	20-30	$TiO_{2(Anatase)}$	30	$EC_{10+}EC_{10}$	3192.0	6406	1.85
20	SiO_2	60-70	$TiO_{2(Anatase)}$	30	$EC_{10+}EC_{10}$	1330.5	3743	2.47

Mix No.[a]	Substance A		Substance B		Mixture Design	Specific surface area [	Hydrodynamic size in 2% NaCl [nm][b]	Zeta-Potential[d] [mV]
	Chemical A	Size A [nm]	Chemical B	Size B [nm]				
21	SiO_2	8	ZnO	10-30	$EC_{10+}EC_{10}$	1180.2	751.5	1.70
22	SiO_2	15-20 (porous)	ZnO	10-30	$EC_{10+}EC_{10}$	2177.7	557.4	-4.95
23	SiO_2	15-20 (spherical)	ZnO	10-30	$EC_{10+}EC_{10}$	1514.6	1276	-4.75
24	SiO_2	20-30	ZnO	10-30	$EC_{10+}EC_{10}$	3851.2	743.2	-3.46
25	SiO_2	60-70	ZnO	10-30	$EC_{10+}EC_{10}$	445.1	669.2	4.47
26	SiO_2	8	ZnO	35-45	$EC_{10+}EC_{10}$	1180.2	1361	4.39
27	SiO_2	15-20 (porous)	ZnO	35-45	$EC_{10+}EC_{10}$	2177.7	486.4	2.71
28	SiO_2	15-20 (spherical)	ZnO	35-45	$EC_{10+}EC_{10}$	1514.6	648	-0.80
29	SiO_2	20-30	ZnO	35-45	$EC_{10+}EC_{10}$	3851.2	1251	-1.19
30	SiO_2	60-70	ZnO	35-45	$EC_{10+}EC_{10}$	445.1	877.8	-0.07
31	SiO_2	8	ZnO	80-200	$EC_{10+}EC_{10}$	1180.2	584.6	-3.39
32	SiO_2	15-20 (porous)	ZnO	80-200	$EC_{10+}EC_{10}$	2177.7	473.6	-3.95
33	SiO_2	15-20 (spherical)	ZnO	80-200	$EC_{10+}EC_{10}$	1514.6	1181	-4.55
34	SiO_2	20-30	ZnO	80-200	$EC_{10+}EC_{10}$	3851.2	704	-4.78
35	SiO_2	60-70	ZnO	80-200	$EC_{10+}EC_{10}$	445.1	1047	-3.76
36	ZnO	10-30	$TiO_{2(Rutile)}$	30	$EC_{10+}EC_{10}$	1288.4	1122	-2.03
37	ZnO	35-45	$TiO_{2(Rutile)}$	30	$EC_{10+}EC_{10}$	1290.0	1123	1.55
38	ZnO	80-200	$TiO_{2(Rutile)}$	30	$EC_{10+}EC_{10}$	1288.5	881.3	1.82
39	ZnO	10-30	$TiO_{2(Anatase)}$	15	$EC_{10+}EC_{10}$	2443.4	2120	-2.08
40	ZnO	35-45	$TiO_{2(Anatase)}$	15	$EC_{10+}EC_{10}$	2445.1	1094	-12.33
41	ZnO	80-200	$TiO_{2(Anatase)}$	15	$EC_{10+}EC_{10}$	2443.5	2326	-12.60
42	ZnO	10-30	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{10}$	789.7	2068	-8.61

Mix No. [a]	Substance A		Substance B		Mixture Design	Specific surface area [	Hydrodynamic size in 2% NaCl [nm] [b]	Zeta-Potential [d] [mV]
	Chemical A	Size A [nm]	Chemical B	Size B [nm]				
43	ZnO	35-45	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{10}$	791.3	1421	2.07
44	ZnO	80-200	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{10}$	789.8	2103	0.79
45	ZnO	10-30	$TiO_{2(Anatase)}$	30	$EC_{10+}EC_{10}$	1578.6	1920	-2.74
46	ZnO	35-45	$TiO_{2(Anatase)}$	30	$EC_{10+}EC_{10}$	1580.4	2652	-3.12
47	ZnO	80-200	$TiO_{2(Anatase)}$	30	$EC_{10+}EC_{10}$	1580.4	1373	2.50
48	$TiO_{2(Rutile)}$	30	SiO_2	60-70	$EC_{10+}EC_{10}$	1073.2	4757	2.72
49	$TiO_{2(Anatase)}$	15	SiO_2	60-70	$EC_{10+}EC_{50}$	2136.5	6706	0.69
50	$TiO_{2(Anatase)}$	18	SiO_2	60-70	$EC_{10+}EC_{50}$	667.1	5858	-6.94
51	$TiO_{2(Anatase)}$	30	SiO_2	60-70	$EC_{10+}EC_{50}$	1330.5	5537	-1.97
52	ZnO	10-30	SiO_2	60-70	$EC_{10+}EC_{50}$	445.1	1470	-1.34
53	ZnO	35-45	SiO_2	60-70	$EC_{10+}EC_{50}$	446.7	1749	-0.81
54	ZnO	80-200	SiO_2	60-70	$EC_{10+}EC_{50}$	445.2	1546	-1.94
55	SiO_2	8	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{50}$	1025.4	8070	-2.96
56	SiO_2	15-20 (porous)	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{50}$	1809.8	6265	-0.99
57	SiO_2	15-20 (spherical)	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{50}$	1267.8	5991	-3.20
58	SiO_2	20-30	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{50}$	3331.3	7403	0.22
59	SiO_2	60-70	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{50}$	667.1	4061	-1.80
60	ZnO	10-30	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{50}$	789.7	3442	-2.69
61	ZnO	35-45	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{50}$	791.3	4557	-4.68
62	ZnO	80-200	$TiO_{2(Anatase)}$	18	$EC_{10+}EC_{50}$	789.8	4134	-4.46
63	$TiO_{2(Anatase)}$	15	ZnO	10-30	$EC_{10+}EC_{50}$	2443.4	3616	-5.07
64	$TiO_{2(Anatase)}$	18	ZnO	10-30	$EC_{10+}EC_{50}$	789.7	3920	-5.16

Mix No. [a]	Substance A		Substance B		Mixture Design	Specific surface area [	Hydrodynamic size in 2% NaCl [nm] [b]	Zeta-Potential [d] [mV]
	Chemical A	Size A [nm]	Chemical B	Size B [nm]				
65	$TiO_{2(Anatase)}$	30	ZnO	10-30	$EC_{10+}EC_{50}$	1578.5	3020	-5.26
66	SiO_2	8	ZnO	10-30	$EC_{10+}EC_{50}$	1180.2	745.9	-5.14
67	SiO_2	15-20 (porous)	ZnO	10-30	$EC_{10+}EC_{50}$	2177.7	441.1	-5.93
68	SiO_2	15-20 (spherical)	ZnO	10-30	$EC_{10+}EC_{50}$	1514.6	597	-5.95
69	SiO_2	20-30	ZnO	10-30	$EC_{10+}EC_{50}$	3851.2	528.7	-5.58
70	SiO_2	60-70	ZnO	10-30	$EC_{10+}EC_{50}$	445.1	1724	-5.16
71	$TiO_{2(Anatase)}$	15	ZnO	35-45	$EC_{10+}EC_{50}$	2445.1	9255	-6.87
72	$TiO_{2(Anatase)}$	18	ZnO	35-45	$EC_{10+}EC_{50}$	791.3	3568	-7.44
73	$TiO_{2(Anatase)}$	30	ZnO	35-45	$EC_{10+}EC_{50}$	1580.2	3306	-7.22
74	SiO_2	8	ZnO	35-45	$EC_{10+}EC_{50}$	1181.9	597.9	-5.51
75	SiO_2	15-20 (porous)	ZnO	35-45	$EC_{10+}EC_{50}$	1180.3	466.7	-5.25
76	SiO_2	15-20 (spherical)	ZnO	35-45	$EC_{10+}EC_{50}$	1182.1	797.7	-6.32
77	SiO_2	20-30	ZnO	35-45	$EC_{10+}EC_{50}$	1182.1	648.1	-5.51
78	SiO_2	60-70	ZnO	35-45	$EC_{10+}EC_{50}$	1182.1	2226	-5.07
79	$TiO_{2(Anatase)}$	15	ZnO	80-200	$EC_{10+}EC_{50}$	2443.5	3908	-4.22
80	$TiO_{2(Anatase)}$	18	ZnO	80-200	$EC_{50+}EC_{50}$	789.8	5231	-4.62
81	$TiO_{2(Anatase)}$	30	ZnO	80-200	$EC_{50+}EC_{50}$	1578.6	5824	-4.71
82	SiO_2	8	ZnO	80-200	$EC_{50+}EC_{50}$	1180.3	747.4	-4.90
83	SiO_2	15-20 (porous)	ZnO	80-200	$EC_{50+}EC_{50}$	2177.8	453.7	-4.92
84	SiO_2	15-20 (spherical)	ZnO	80-200	$EC_{50+}EC_{50}$	1514.7	734.7	-4.83
85	SiO_2	20-30	ZnO	80-200	$EC_{50+}EC_{50}$	3851.3	688.7	-4.77
86	SiO_2	60-70	ZnO	80-200	$EC_{50+}EC_{50}$	445.2	1616	-4.81

Mix No. [a]	Substance A		Substance B		Mixture Design	Specific surface area [	Hydrodynamic size in 2% NaCl [nm] [b]	Zeta-Potential [d] [mV]
	Chemical A	Size A [nm]	Chemical B	Size B [nm]				
87	SiO_2	60-70	TiO_2(Anatase)	18	$EC_{50+}EC_{50}$	667.1	7389	-4.59
88	SiO_2	60-70	ZnO	10-30	$EC_{50+}EC_{50}$	445.1	1663	-4.56
89	SiO_2	60-70	ZnO	35-45	$EC_{50+}EC_{50}$	446.7	1701	-5.25
90	SiO_2	60-70	ZnO	80-200	$EC_{50+}EC_{50}$	445.2	1136	-6.73
91	TiO_2(Anatase)	18	ZnO	10-30	$EC_{50+}EC_{50}$	1288.4	2669	-7.91
92	TiO_2(Anatase)	18	ZnO	35-45	$EC_{50+}EC_{50}$	1290.0	5759	-7.52
93	TiO_2(Anatase)	18	ZnO	80-200	$EC_{50+}EC_{50}$	1288.5	2879	-6.03

[a] Denomination of binary mixture. [b] All DLS measurements were performed in triplicate. [c] Polydispersity index (PdI), a size distribution parameter derived from the coefficient of the correlation function.

Table S4. Binary Mixture Designs and Parameters of Regression Models for Dose-response Curves of Binary Mixtures of Nano Metal Oxide

| Mix No. | RM [a] | r^2 | Parameter | | | Concentration Addition (CA) model | | | | | | | |
| | | | | | | EC_{10} Ratio | | | | EC_{50} Ratio | | | |
			α [b]	β [c]	γ [d]	Observed EC_{10} [mM]	Predicted EC_{10} [mM]	MDR [a]	Type [b]	Observed EC_{50} [mM]	Predicted EC_{50} [mM]	MDR	Type
1	Hill	0.987	41.240	1.038	32.070	10.700 (9.901-11.512)	18.086	1.690	Add	n.a [i].	n.a.	n.a.	n.a.
2	Hill	0.976	38.220	1.487	25.660	12.768 (12.494-13.026)	29.247	2.291	Ant [f]	n.a.	n.a.	n.a.	n.a.
3	Hill	0.927	37.590	1.317	25.650	11.869 (11.276-12.493)	21.193	1.786	Add	n.a.	n.a.	n.a.	n.a.
4	Hill	0.958	49.390	1.549	32.170	13.276 (12.904-13.654)	54.621	4.114	Ant	n.a.	n.a.	n.a.	n.a.
5	Hill	0.907	23.040	4.375	12.850	12.089 (11.875-12.314)	13.414	1.110	Add	n.a.	n.a.	n.a.	n.a.
6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
7	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
9	Hill	0.912	15.500	3.957	37.790	43.954 (41.631-46.313)	23.210	0.528	Add	n.a.	n.a.	n.a.	n.a.
10	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
11	Hill	0.813	21.680	58.790	13.650	13.617 (13.559-13.682)	16.379	1.203	Add	n.a.	n.a.	n.a.	n.a.
12	Hill	0.973	43.590	2.440	28.670	17.449 (16.114-18.798)	29.663	1.700	Add	n.a.	n.a.	n.a.	n.a.
13	Hill	0.954	30.380	3.662	19.550	16.094 (15.895-16.293)	20.308	1.262	Add	n.a.	n.a.	n.a.	n.a.
14	Hill	0.948	28.040	3.972	37.180	32.050 (31.370-	56.864	1.774	Add	n.a.	n.a.	n.a.	n.a.

Mix No.	RM [a]	Parameter				Concentration Addition (CA) model							
		r^2	α [b]	β [c]	γ [d]	EC_{10} Ratio				EC_{50} Ratio			
						Observed EC_{10} [μM]	Predicted EC_{10} [μM]	MDR [a]	Type [b]	Observed EC_{50}	Predicted EC_{50}	MDR	Type
15	Hill	0.839	45.080	2.187	14.440	32.734) 8.135 (7.524-8.732)	8.822	1.084	Add	n.a.	n.a.	n.a.	n.a.
16	Hill	0.941	50.090	2.432	46.420	26.221 (25.627-26.812)	48.357	1.844	Add	n.a.	n.a.	n.a.	n.a.
17	Hill	0.933	32.460	2.624	44.010	32.329 (30.047-34.718)	49.231	1.523	Add	n.a.	n.a.	n.a.	n.a.
18	Hill	0.923	37.100	2.944	42.800	30.507 (30.226-30.796)	47.879	1.569	Add	n.a.	n.a.	n.a.	n.a.
19	Hill	0.930	59.450	1.788	42.970	1.938 (1.877-1.998)	n.a.	n.a.	n.a.	11.184 (11.133-11.239)	n.a.	n.a.	n.a.
20	Hill	0.958	66.060	1.998	37.740	15.927 (15.121-16.822)	52.317	3.285	Ant	66.635 (63.820-69.365)	52.317	0.785	Add
21	Hill	0.934	42.070	2.017	8.924	5.008 (4.694-5.344)	19.651	3.924	Ant	n.a.	n.a.	n.a.	n.a.
22	Hill	0.940	47.410	2.109	15.350	8.215 (8.030-8.409)	35.056	4.268	Ant	n.a.	n.a.	n.a.	n.a.
23	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	24.389	0.185	Ant	n.a.	24.389	0.001	Ant
24	Hill	0.973	47.290	1.441	32.820	13.167 (12.671-13.660)	64.110	3.832	Ant	n.a.	n.a.	n.a.	n.a.
25	Hill	0.900	25.530	1.802	3.704	2.901 (2.884-2.916)	7.443	2.566	Ant	n.a.	n.a.	n.a.	n.a.
26	Hill	0.981	22.330	1.047	0.377	0.309 (0.277-0.342)	19.667	63.717	Ant	n.a.	n.a.	n.a.	n.a.
27	Hill	0.979	42.290	0.627	5.769	0.888 (0.777-1.000)	35.066	39.486	Ant	n.a.	n.a.	n.a.	n.a.
28	Hill	0.959	23.230	1.749	7.117	6.064 (5.628-6.472)	24.410	4.025	Ant	n.a.	n.a.	n.a.	n.a.
29	Hill	0.939	26.770	1.918	24.350	18.596 (18.055-19.133)	64.110	3.447	Ant	n.a.	n.a.	n.a.	n.a.
30	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Mix No.	RM [a]	Parameter				Concentration Addition (CA) model							
						EC_{10} Ratio				EC_{50} Ratio			
		r^2	α [b]	β [c]	γ [d]	Observed EC_{10} [μM]	Predicted EC_{10} [μM]	MDR [a]	Type [b]	Observed EC_{50}	Predicted EC_{50}	MDR	Type
31	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
32	Hill	0.945	41.330	1.492	11.950	5.559 (5.202-5.950)	35.058	6.307	Ant	n.a.	n.a.	n.a.	n.a.
33	Hill	0.907	37.700	1.445	10.160	5.017 (4.813-5.242)	24.404	4.865	Ant	n.a.	n.a.	n.a.	n.a.
34	Hill	0.956	108.900	1.505	75.950	16.561 (16.199-16.917)	64.110	3.871	Ant	68.124 (65.801-71.038)	64.110	0.941	Add
35	Hill	0.849	31.170	2.043	3.790	2.626 (2.560-2.694)	7.443	2.835	Ant	n.a.	n.a.	n.a.	n.a.
36	Hill	0.995	90.280	2.543	5.204	2.294 (2.271-2.318)	16.131	7.030	Ant	5.666 (5.634-5.697)	16.131	2.847	Syn
37	Hill	0.995	88.140	2.767	4.745	2.257 (2.199-2.316)	16.131	7.146	Ant	5.233 (5.149-5.319)	16.131	3.082	Syn
38	Hill	0.993	88.150	2.905	4.925	2.427 (2.400-2.455)	16.132	6.647	Ant	5.406 (5.341-5.471)	16.132	2.984	Syn
39	Hill	0.994	90.420	2.091	7.000	2.583 (2.500-2.671)	30.594	11.844	Ant	7.749 (7.539-7.965)	30.594	3.948	Syn
40	Hill	0.994	88.580	2.537	5.272	2.339 (2.327-2.352)	30.615	13.088	Ant	5.840 (5.776-5.905)	30.615	5.242	Syn
41	Gompertz	0.996	91.160	4.178	3.781	0.467 (0.438-0.503)	30.595	65.485	Ant	5.911 (5.671-6.160)	30.595	5.176	Syn
42	Chapman	0.983	25670	0.000	0.671	0.501 (0.499-0.503)	9.818	6.450	Ant	5.521 (5.342-5.700)	9.818	2.470	Syn
43	Hill	0.984	111.600	2.076	6.021	1.971 (1.834-2.113)	9.839	4.993	Ant	5.445 (5.362-5.521)	9.839	1.807	Add
44	Hill	0.992	106.800	1.848	8.237	2.412 (2.370-2.451)	9.819	4.072	Ant	7.689 (7.677-7.702)	9.819	1.277	Add
45	Hill	0.992	91.390	2.106	8.329	3.078 (2.972-3.188)	58.019	18.849	Ant	9.111 (8.876-9.351)	58.019	6.368	Syn
46	Hill	0.991	87.470	2.479	6.109	2.675 (22.637-2.714)	58.019	21.691	Ant	6.864 (6.751-6.980)	58.019	8.453	Syn
47	Hill	0.985	86.995	2.331	7.938	3.307 (3.179-3.441)	58.021	17.544	Ant	9.034 (8.744-9.333)	58.021	6.423	Syn
48	Hill	0.883	34.840	3.034	35.480	26.286 (25.780-26.792)	9.466	0.360	Ant	n.a.	n.a.	n.a.	n.a.

Mix No.	RM [a]	r^2	α [b]	β [c]	γ [d]	Concentration Addition (CA) model							
						$EC_{10}\ Ratio$				$EC_{50}\ Ratio$			
						Observed EC_{10}	Predicted [EC_{10}]	MDR [a]	Type [b]	Observed EC_{50}	Predicted [EC_{50}]	MDR	Type
49	Hill	0.749	19.050	2.488	33.320	34.690 (31.142-38.144)	15.843	0.457	Ant	n.a.	n.a.	n.a.	n.a.
50	Hill	0.942	40.750	2.459	33.190	21.018 (20.799-21.241)	7.833	0.373	Ant	n.a.	n.a.	n.a.	n.a.
51	Hill	0.937	104.000	1.214	153.500	24.243 (23.343-25.159)	33.718	1.391	Add	144.186 (136.209-154.157)	56.186	0.390	Ant
52	Hill	0.854	26.730	1.541	28.760	20.591 (19.818-21.435)	7.461	0.362	Ant	n.a.	n.a.	n.a.	n.a.
53	Hill	0.854	27.500	3.056	29.520	24.579 (23.548-25.580)	7.464	0.304	Ant	n.a.	n.a.	n.a.	n.a.
54	Hill	0.949	38.810	2.183	29.230	18.003 (17.692-18.318)	7.461	0.414	Ant	n.a.	n.a.	n.a.	n.a.
55	Hill	0.983	80.460	3.242	28.550	15.633 (14.621-16.673)	14.320	0.916	Add	33.266 (32.318-34.322)	21.797	0.655	Add
56	Hill	0.982	69.140	3.180	35.610	20.365 (20.205-20.527)	25.152	1.235	Add	48.165 (47.158-49.422)	30.553	0.634	Add
57	Hill	0.941	57.740	4.158	27.250	18.708 (17.314-20.325)	17.387	0.929	Add	42.665 (41.264-43.917)	24.010	0.563	Add
58	Hill	0.975	52.540	3.125	45.800	28.820 (28.535-29.111)	49.564	1.720	Add	118.817 (114.443-124.002)	53.248	0.448	Ant
59	Hill	0.946	74.345	2.592	21.443	10.455 (9.725-11.201)	9.270	0.887	Add	28.307 (27.406-29.423)	19.702	0.696	Add
60	Hill	0.912	71.680	2.205	20.330	8.905 (8.659-9.159)	9.831	1.104	Add	29.693 (29.212-30.174)	23.550	0.793	Add
61	Hill	0.962	75.370	8.756	13.190	10.645 (9.826-11.374)	9.840	0.924	Add	14.253 (12.667-15.716)	23.571	1.654	Add

Mix No.	RM [a]	r^2	α [b]	β [c]	γ [d]	Concentration Addition (CA) model							
						EC_{10} Ratio				EC_{50} Ratio			
						Observed EC_{10} [μM]	Predicted EC_{10} [μM]	MDR [a]	Type [b]	Observed EC_{50}	Predicted EC_{50}	MDR	Type
62	Hill	0.935	42.360	25.09	12.110	11.553 (11.536-11.569)	9.832	0.851	Add	n.a.	n.a.	n.a.	n.a.
63	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Ant	n.a.	n.a.	n.a.	n.a.
64	Hill	0.866	35.350	2.183	6.443	4.207 (4.076-4.345)	9.801	2.330	Ant	n.a.	n.a.	n.a.	n.a.
65	Hill	0.969	28.220	0.987	10.490	5.716 (4.800-6.757)	58.002	10.148	Ant	n.a.	n.a.	n.a.	n.a.
66	Hill	0.996	344.400	0.991	66.930	1.938 (1.877-1.998)	19.634	10.129	Ant	11.184 (11.133-11.239)	19.634	1.755	Add
67	Hill	0.996	1554	0.554	19190	2.149 (2.013-2.297)	35.040	16.304	Ant	41.174 (40.008-42.351)	35.040	0.851	Add
68	Hill	0.988	23130	0.588	1003000	1.900 (1.799-2.028)	24.380	12.831	Ant	29.447 (29.139-29.743)	24.380	0.828	Add
69	Hill	0.939	55.230	1.640	31.430	12.520 (11.733-13.351)	64.091	5.119	Ant	124.476 (114.416-138.130)	64.091	0.515	Add
70	Hill	0.915	143.600	1.576	12.540	2.420 (2.363-2.478)	7.425	3.068	Ant	8.425 (8.407-8.443)	7.425	0.881	Add
71	Hill	0.831	16.470	2.532	14.090	16.732 (14.475-19.843)	30.486	1.822	Add	n.a.	n.a.	n.a.	n.a.
72	Hill	0.919	57.330	2.352	6.735	3.478 (3.411-3.545)	9.713	2.792	Ant	15.232 (13.924-17.410)	9.713	0.638	Add
73	Hill	0.880	23.060	1.575	12.420	10.478 (9.848-11.140)	57.911	5.527	Ant	n.a.	n.a.	n.a.	n.a.
74	Hill	0.984	118.100	1.532	11.440	2.421 (2.367-2.474)	19.545	8.074	Ant	9.356 (9.252-9.462)	19.545	2.089	Syn
75	Hill	0.999	181.300	0.976	37.580	2.044 (1.992-2.097)	34.954	17.104	Ant	13.973 (13.628-14.327)	34.954	2.502	Syn
76	Hill	0.999	163.300	1.058	20.600	1.563 (1.532-1.594)	24.294	15.547	Ant	9.513 (9.412-9.616)	24.294	2.554	Syn
77	Hill	0.976	95.770	1.817	32.030	9.812 (9.286-10.362)	64.002	6.523	Ant	33.628 (32.793-34.476)	64.002	1.903	Add
78	Hill	0.978	95.710	2.284	3.216	1.256 (1.244-1.267)	7.337	5.844	Ant	3.345 (3.298-3.393)	7.337	2.194	Syn

Mix No.	RM [a]	r^2	α [b]	β [c]	γ [d]	Observed EC_{10} [μM]	Predicted [μM]	MDR [a]	Type [b]	Observed EC_{50}	Predicted	MDR	Type

Concentration Addition (CA) model — EC_{10} Ratio / EC_{50} Ratio

Mix No.	RM [a]	r^2	α	β	γ	Observed EC_{10}	Predicted EC_{10}	MDR [a]	Type [b]	Observed EC_{50}	Predicted EC_{50}	MDR	Type
79	Hill	0.864	16.400	2.562	12.170	14.486 (12.717-16.252)	30.536	2.108	Ant	n.a.	n.a.	n.a.	n.a.
80	Hill	0.962	48.540	1.747	4.616	2.132 (2.087-2.177)	9.761	4.577	Ant	n.a.	n.a.	n.a.	n.a.
81	Hill	0.911	28.750	1.648	13.510	9.225 (8.282-10.291)	57.961	6.283	Ant	n.a.	n.a.	n.a.	n.a.
82	Hill	0.984	79.750	1.490	6.548	1.779 (1.737-1.820)	19.593	11.014	Ant	9.278 (9.091-9.535)	19.594	2.112	Syn
83	Hill	0.968	71.520	2.244	14.780	6.578 (6.375-6.785)	35.001	5.321	Ant	21.523 (21.255-21.778)	35.001	1.626	Add
84	Hill	0.965	82.150	2.276	11.330	4.753 (4.644-4.866)	24.341	5.121	Ant	13.751 (13.473-14.037)	24.341	1.770	Add
85	Hill	0.986	53.860	2.439	24.910	13.589 (12.727-14.490)	64.051	4.714	Ant	71.179 (67.508-75.322)	64.051	0.900	Add
86	Hill	0.991	90.590	2.392	3.643	1.522 (1.496-1.579)	7.385	4.851	Ant	3.974 (3.940-4.008)	7.385	1.858	Add
87	Hill	0.995	68.500	0.674	13.490	3.310 (3.179-3.441)	8.185	8.350	Ant	59.022 (58.001-60.012)	44.894	0.761	Add
88	Hill	0.997	94.160	0.800	15.740	1.099 (1.011-1.189)	7.459	6.790	Ant	18.379 (17.999-18.801)	54.143	2.946	Syn
89	Hill	0.994	93.520	1.661	16.070	4.476 (4.283-4.675)	7.446	7.089	Ant	17.472 (17.091-17.854)	54.057	3.094	Syn
90	Hill	0.991	83.580	1.753	20.150	6.453 (6.286-6.628)	7.453	1.155	Add	25.288 (24.877-25.699)	54.103	2.139	Syn
91	Hill	0.969	82.010	1.345	23.220	5.352 (5.064-5.652)	9.825	1.836	Add	32.348 (31.968-32.745)	23.533	0.728	Add
92	Hill	0.935	46.880	1.336	13.880	5.223 (5.046-5.388)	9.787	1.874	Add	n.a.	n.a.	n.a.	n.a.
93	Hill	0.831	16.470	2.532	11.020	13.084 (11.319-15.516)	9.808	0.750	Add	n.a.	n.a.	n.a.	n.a.

[a] Regression models; [b] Height; [c] Slope; [d] Center point; [e] MDR, model deviation ratio; [f] Antagonism; [g] Additivity [h] Synergism, and [i] Not available.
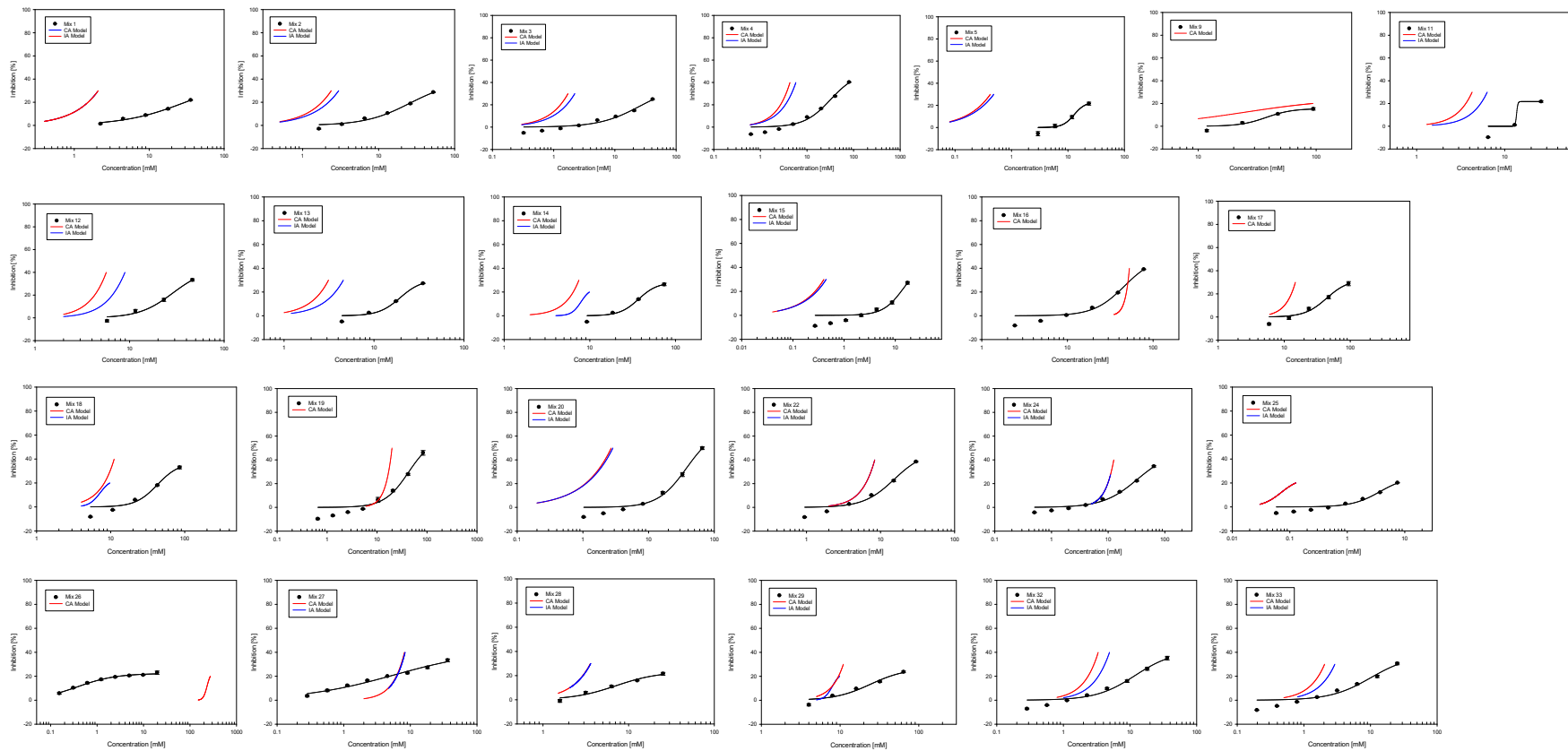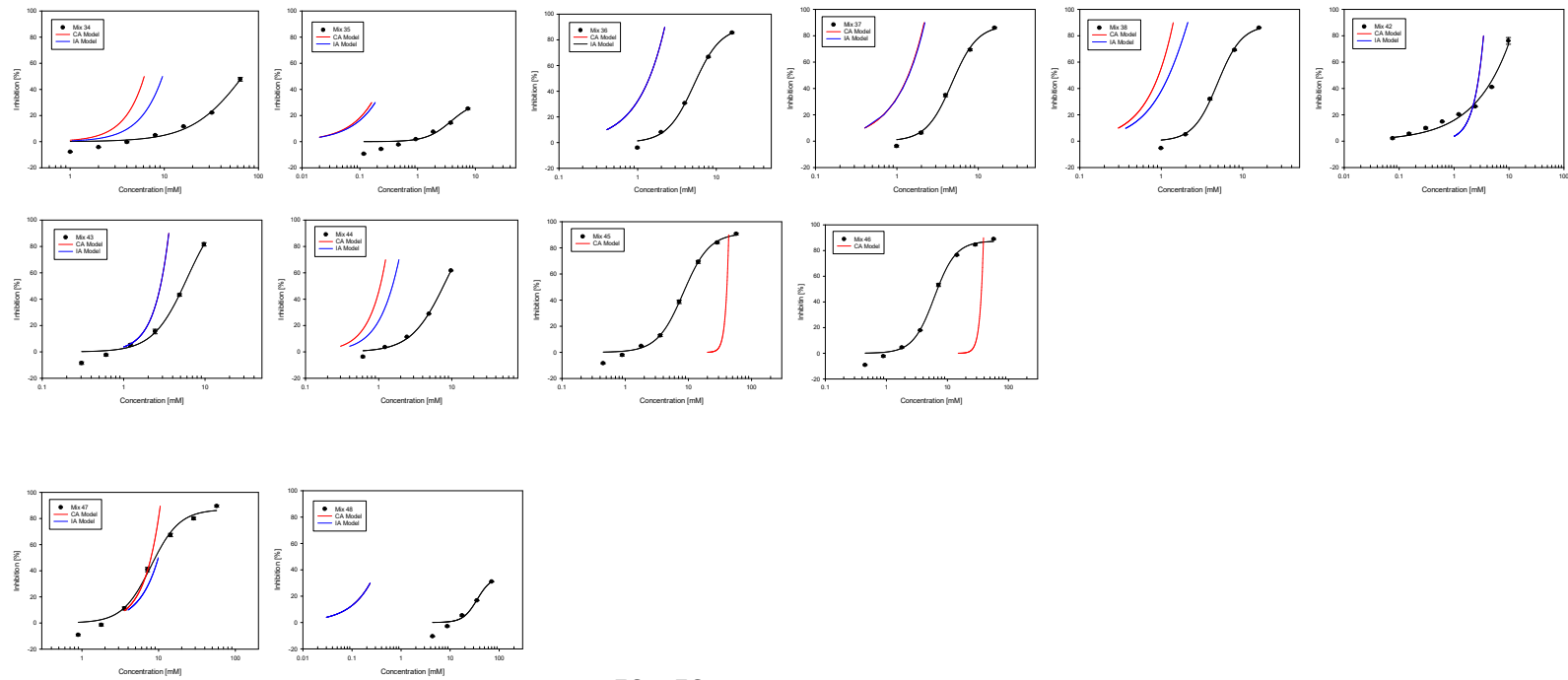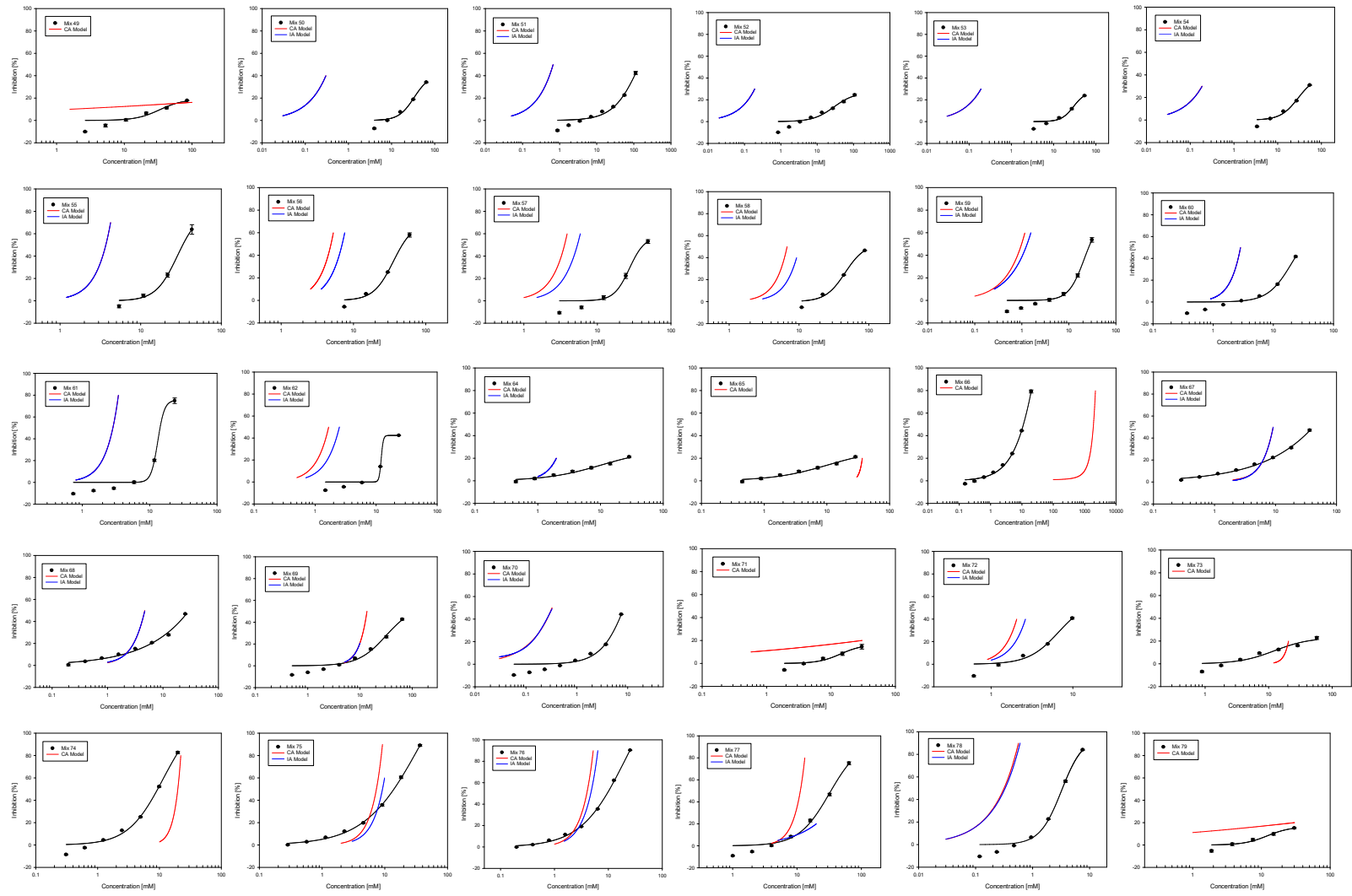
Figure S1. Comparison of dose-response curves at $EC_{10}+EC_{10}$ mixture derived from observed data and predicted data by CA, IA models. (the data points are geometric means $\pm$ standard deviation(SD) of observed data.)
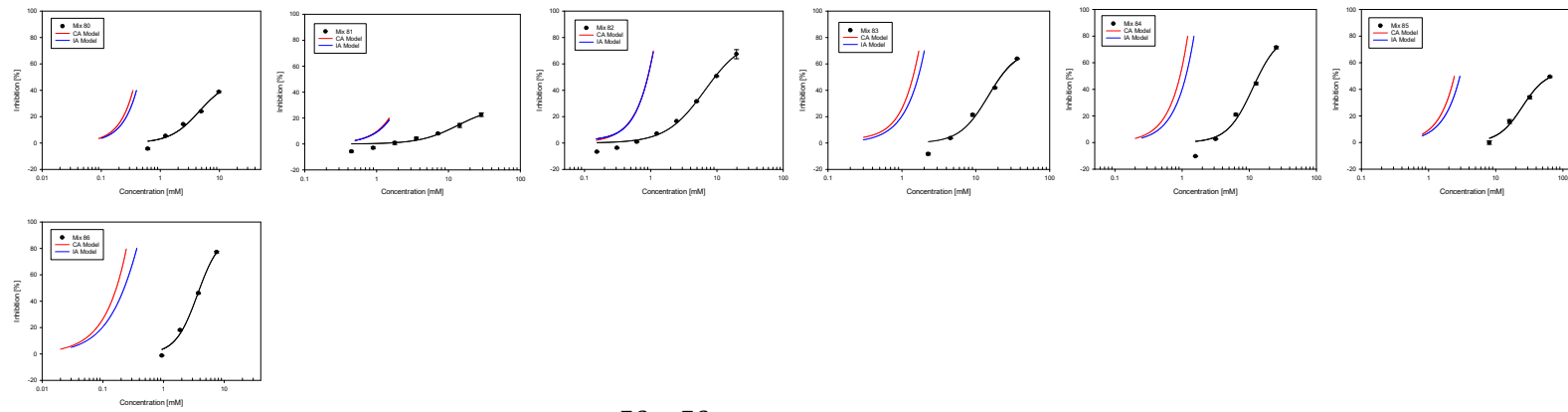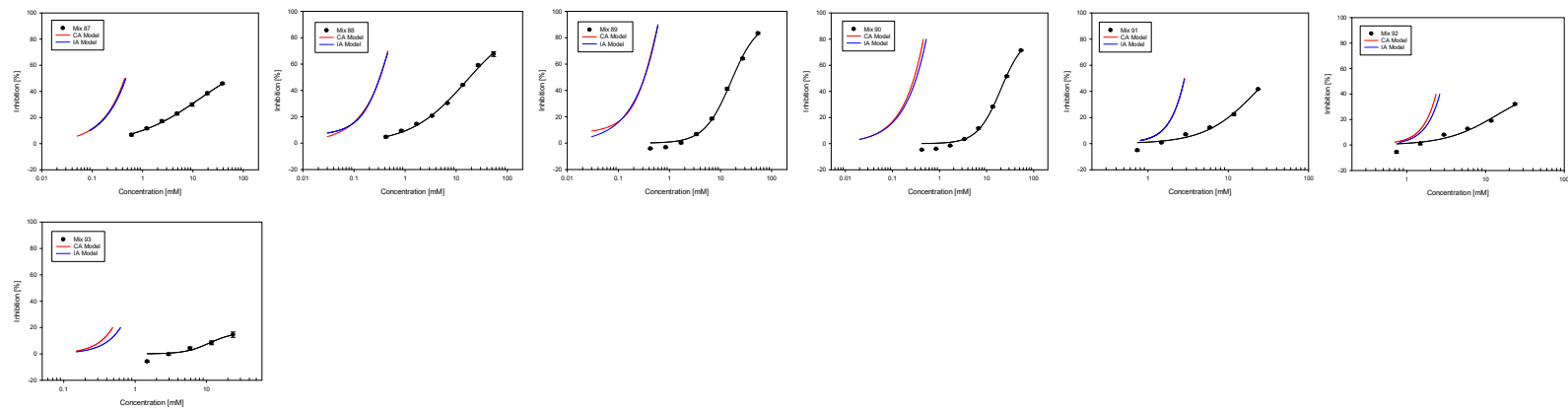
Figure S2. Comparison of dose-response curves at $EC_{10+}EC_{50}$ mixture derived from observed data and predicted data by CA, IA models. (the data points are geometric means $\pm$ standard deviation(SD) of observed data.)

Figure S3. Comparison of dose-response curves at $EC_{50}+EC_{50}$ mixture derived from observed data and predicted data by CA, IA models. (the data points are geometric means $\pm$ standard deviation(SD) of observed data.)
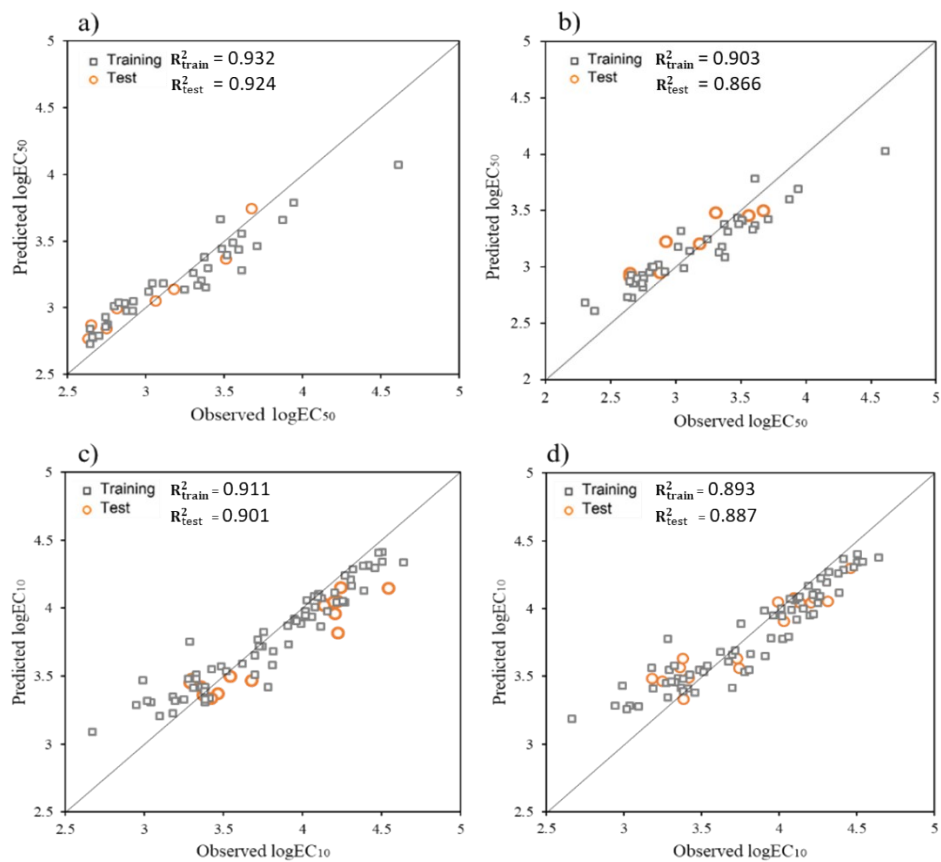
Figure S4. Observed-predicted plots of the RF-based models for predicting $\log EC_{50}$ Figures S4a and S4b) and $\log EC_{10}$ (Figures S4c and S4d). All descriptor-based models (Figures S4a and S4c) and calculated descriptor-based models (Figures S4b and S4d).

Table S5. Y-randomization for RF-model (calculated descriptor-based) built from $\log EC_{50}$

Iteration	Random forest model	
	$R^2_{train\ (rand)}$	
1	0.8628	
2	0.8633	
3	0.8643	$\overline{R}^2_{train\ (rand)} = 0.8655$
4	0.8648	$R^2_{train\ (val)} = 0.903$
5	0.8650	$\sigma_{rand} = 0.0018$
6	0.8653	$Z_{score} = 15.66$
7	0.8671	
8	0.8674	
9	0.8677	
10	0.8679	

Table S6. Y-randomization for RF-model (calculated descriptor-based) built from $\log EC_{10}$

Iteration	Random forest model	
	$R^2_{train\,(rand)}$	
1	0.8750	
2	0.8780	
3	0.8792	$\overline{R}^2_{train\,(rand)} = 0.8801$
4	0.8801	$R^2_{train\,(val)} = 0.893$
5	0.8804	$\sigma_{rand} = 0.0020$
6	0.8812	$Z_{score} = 6.31$
7	0.8815	
8	0.8816	
9	0.8818	
10	0.8819	