

Supplementary Material

Particle Size Effect of Cyetpyrafen Formulation in the Pesticide Transmission Process and Its Impact on Biological Activity

Lu Yu^{1,2}, He Liu¹, Miao Yu¹, Qi Zhang^{1,*}, Jingyu Chou^{2,*}, Yuanhua Wu^{1,*}

¹Plant Protection college, Shenyang Agricultural University, Shenyang 110866, China

²Shenyang Sinochem Agrochemicals R&D Co. Ltd, State Laboratory of the Discovery and Development of Novel Pesticide, Shenyang 110021, China

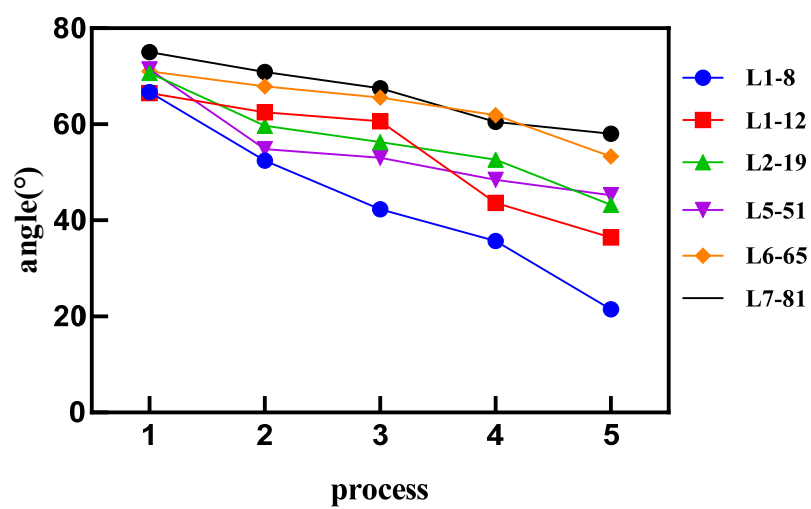


Figure S1. Contact angle value within 10 seconds

<p>Equation Group</p> <ul style="list-style-type: none"> Add discrete amounts of Imidacloprid in ml to Library 1 (A1:C4) in ml Add discrete amounts of S200 in ml to Library 1 (A1:C4) in ml Add discrete amounts of SK-20TX in ml to Library 1 (A1:C4) in ml Add discrete amounts of SK-560EP in ml to Library 1 (A1-B4) in ml Add discrete amounts of YUS-CH7000 in ml to Library 1 (A1)(B1-C4) in ml Add discrete amounts of water in ml to Library 1 (A1:C4) in ml Add discrete amounts of Greenmul 5810 in ml to Library 1 (A2)(B4) in ml Add discrete amounts of Atlas G-1086 in ml to Library 1 (A3)(C1) in ml Add discrete amounts of Emulsogen EL 360 in ml to Library 1 (A4)(C2) in ml Add discrete amounts of AEO-3 in ml to Library 1 (B1)(C3) in ml Add discrete amounts of 500# in ml to Library 1 (B2)(C4) in ml Add discrete amounts of 600# in ml to Library 1 (B3) in ml 	<p>Equation Group</p> <ul style="list-style-type: none"> Add discrete amounts of Imidacloprid in ml to Library 2 (A1:C4) in ml Add discrete amounts of S200 in ml to Library 2 (A1:C4) in ml Add discrete amounts of SK-20TX in ml to Library 2 (A1:C4) in ml Add discrete amounts of YUS-CH7000 in ml to Library 2 (A1) in ml Add discrete amounts of 600# in ml to Library 2 (A1)(B2-C2) in ml Add discrete amounts of water in ml to Library 2 (A1:C4) in ml Add discrete amounts of Greenmul 5810 in ml to Library 2 (A1-B4) in ml Add discrete amounts of Atlas G-1086 in ml to Library 2 (A2)(B3-B4)(C1-C2) in ml Add discrete amounts of Emulsogen EL 360 in ml to Library 2 (A3-C4) in ml Add discrete amounts of AEO-3 in ml to Library 2 (A4-B4)(C3) in ml Add discrete amounts of 500# in ml to Library 2 (B1-C1)(C4) in ml 	<p>Equation Group</p> <ul style="list-style-type: none"> Add discrete amounts of Imidacloprid in ml to Library 3 (A1:C4) in ml Add discrete amounts of S200 in ml to Library 3 (A1:C4) in ml Add discrete amounts of SK-20TX in ml to Library 3 (A1-A4) in ml Add discrete amounts of Emulsogen EL 360 in ml to Library 3 (A1)(B3)(C4) in ml Add discrete amounts of 600# in ml to Library 3 (A1)(A3) in ml Add discrete amounts of water in ml to Library 3 (A1-C4) in ml Add discrete amounts of AEO-3 in ml to Library 3 (A2-A3)(B4) in ml Add discrete amounts of 500# in ml to Library 3 (A2)(A4)(C1) in ml Add discrete amounts of 600# in ml to Library 3 (A4)(C2) in ml Add discrete amounts of SK-560EP in ml to Library 3 (B1-C4) in ml Add discrete amounts of YUS-CH7000 in ml to Library 3 (B1-C4) in ml Add discrete amounts of Greenmul 5810 in ml to Library 3 (B1)(C3-C4) in ml Add discrete amounts of Atlas G-1086 in ml to Library 3 (B2)(C3) in ml
<p>Equation Group</p> <ul style="list-style-type: none"> Add discrete amounts of Imidacloprid in ml to Library 4 (A1:C4) in ml Add discrete amounts of S200 in ml to Library 4 (A1:C4) in ml Add discrete amounts of SK-560EP in ml to Library 4 (A1:C4) in ml Add discrete amounts of Greenmul 5810 in ml to Library 4 (A1-A3) in ml Add discrete amounts of AEO-3 in ml to Library 4 (A1-B1)(B3-C4) in ml Add discrete amounts of water in ml to Library 4 (A1:C4) in ml Add discrete amounts of 500# in ml to Library 4 (A2-B2)(C1)(C3) in ml Add discrete amounts of 600# in ml to Library 4 (A3-B3)(C2)(C4) in ml Add discrete amounts of Atlas G-1086 in ml to Library 4 (A4)(B1-B3) in ml Add discrete amounts of Emulsogen EL 360 in ml to Library 4 (A4-B4)(C1-C2) in ml 	<p>Equation Group</p> <ul style="list-style-type: none"> Add discrete amounts of Imidacloprid in ml to Library 5 (A1:C4) in ml Add discrete amounts of S200 in ml to Library 5 (A1:C4) in ml Add discrete amounts of SK-560EP in ml to Library 5 (A1) in ml Add discrete amounts of 500# in ml to Library 5 (A1)(C1-C4) in ml Add discrete amounts of 600# in ml to Library 5 (A1)(B2-C2) in ml Add discrete amounts of water in ml to Library 5 (A1:C4) in ml Add discrete amounts of YUS-CH7000 in ml to Library 5 (A1-C4) in ml Add discrete amounts of Greenmul 5810 in ml to Library 5 (A1-B4) in ml Add discrete amounts of Atlas G-1086 in ml to Library 5 (A2)(B3-B4)(C1-C2) in ml Add discrete amounts of Emulsogen EL 360 in ml to Library 5 (A3-C4) in ml Add discrete amounts of AEO-3 in ml to Library 5 (A4-B4)(C3) in ml 	
<p>Equation Group</p> <ul style="list-style-type: none"> Add discrete amounts of Imidacloprid in ml to Library 6 (A1:C4) in ml Add discrete amounts of S200 in ml to Library 6 (A1:C4) in ml Add discrete amounts of YUS-CH7000 in ml to Library 6 (A1-A4) in ml Add discrete amounts of Emulsogen EL 360 in ml to Library 6 (A1-C3) in ml Add discrete amounts of 600# in ml to Library 6 (A1)(A3-B4)(C3) in ml Add discrete amounts of water in ml to Library 6 (A1:C4) in ml Add discrete amounts of AEO-3 in ml to Library 6 (A2-B3)(C1)(C4) in ml Add discrete amounts of 500# in ml to Library 6 (A2)-(C4) in ml Add discrete amounts of Greenmul 5810 in ml to Library 6 (B1-C4) in ml Add discrete amounts of Atlas G-1086 in ml to Library 6 (B1-B4) in ml 	<p>Equation Group</p> <ul style="list-style-type: none"> Add discrete amounts of Imidacloprid in ml to Library 7 (A1:C4) in ml Add discrete amounts of S200 in ml to Library 7 (A1:C4) in ml Add discrete amounts of Greenmul 5810 in ml to Library 7 (A1-A2) in ml Add discrete amounts of AEO-3 in ml to Library 7 (A1)(A1-C3)(C4) in ml Add discrete amounts of 600# in ml to Library 7 (A1-B2)(B2-C4) in ml Add discrete amounts of water in ml to Library 7 (A1:C4) in ml Add discrete amounts of 500# in ml to Library 7 (A2-B2)(A3-C4)(C1) in ml Add discrete amounts of Atlas G-1086 in ml to Library 7 (A1-B4) in ml Add discrete amounts of Emulsogen EL 360 in ml to Library 7 (A3-A4)(B1-C3) in ml 	

Figure S2. Ternary adjuvant systems of HTPS

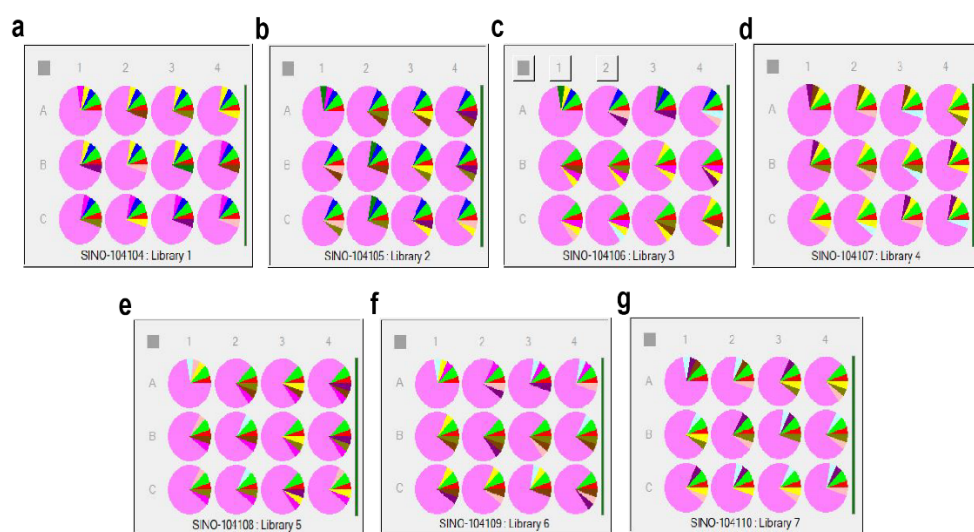


Figure S3. Distribution of adjuvant systems in HTTPS: (a~g) 84 ternary adjuvant systems plates.

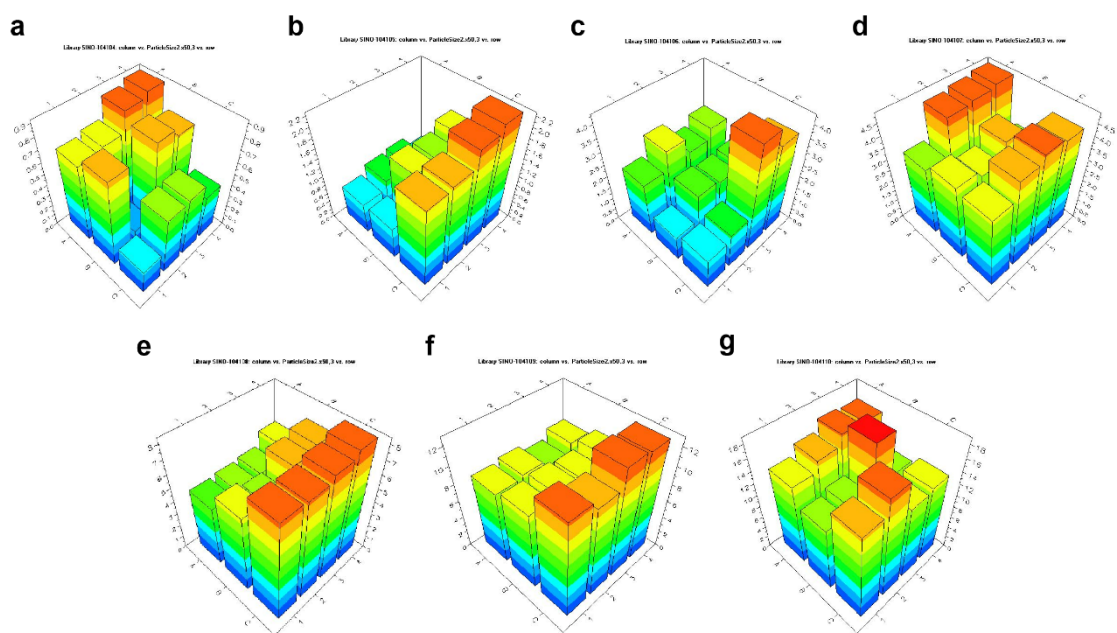


Figure S4. Relationship between different ternary adjuvant systems and particle size: (a) ternary library1 plate; (b) ternary library2 plate; (c) ternary library3 plate; (d) ternary library4 plate; (e) ternary library5 plate; (f) ternary library6 plate; (g) ternary library7 plate.

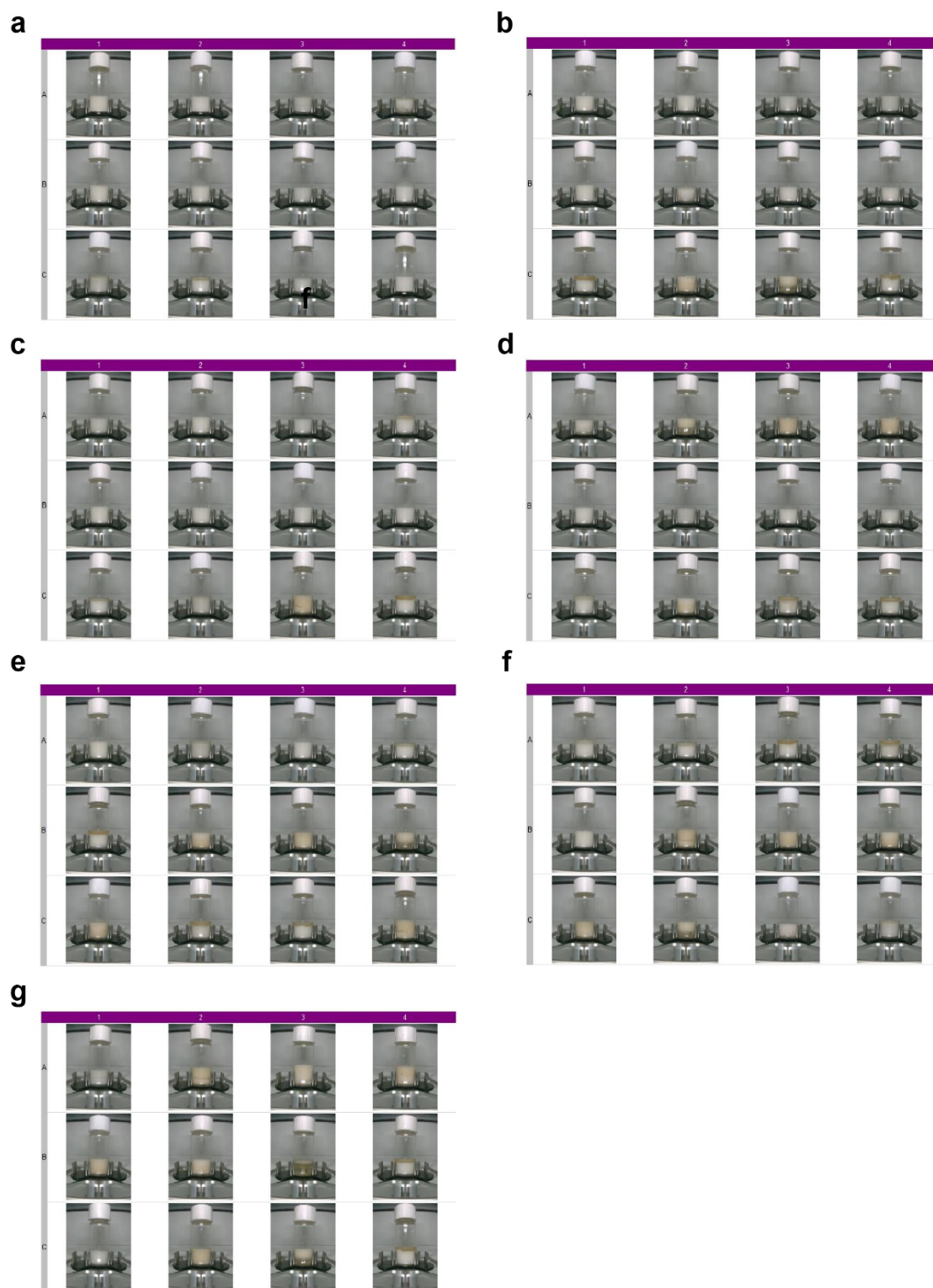


Figure S5. Appearance of 84 cyetpyrafen formulation samples prepared using HTPS: (a) appearance of samples from Library1-1 to Library1-12; (b) appearance of samples from Library2-1 to Library2-12; (c) appearance of samples from Library3-1 to Library3-12; (d) appearance of samples from Library4-1 to Library4-12; (e) appearance of samples from Library5-1 to Library5-12; (f) appearance of samples from Library6-1 to Library6-12; (g) appearance of samples from Library7-1 to Library7-12.

Table S1. The efficacy against the *Tetranychus cinnabarinus* of nine samples and reference sample.

Test sample	Particle size (μm)	Regression equation $y=a+bx$	LC50 (mg/L)	95% Confidence interval
Library 1-8	0.16	$7.6414+4.6719x$	0.2720	0.1663-0.3504
Library 1-11	0.22	$8.0858+5.8738x$	0.2983	0.1268-0.3978
Library 1-12	0.39	$8.3149+4.7872x$	0.2026	0.1554-0.2431
Library 2-19	1.48	$7.4809+4.8428x$	0.3074	0.2844-0.3715
Library 3-26	2.98	$6.8834+3.0926x$	0.3291	0.2872-0.4679
Library 4-43	3.98	$6.6932+4.0315x$	0.3802	0.3670-0.4886
Library 5-51	4.89	$5.7861+2.1163x$	0.4252	0.3935-0.5094
Library 6-65	9.33	$5.5572+2.7971x$	0.6321	0.4571-0.9604
Library 7-81	15.33	$5.2143+1.7394x$	0.7530	0.6304-0.9307
Reference SC	4.99	$5.8373+2.4073x$	0.4489	0.3935-0.5094

Table S2. Deposition results

	Fraction coverage (percentage)	Droplet density (per square centimeter)	Droplet rate (microliters per square centimeter)
L1-8	9.12 \pm 0.06a	37.75 \pm 0.25a	0.98 \pm 0.05a
L1-12	6.32 \pm 0.08b	34.93 \pm 0.50b	0.73 \pm 0.03b
L2-19	6.00 \pm 0.05bc	32.79 \pm 0.12b	0.52 \pm 0.06c
L5-51	5.64 \pm 0.12c	30.30 \pm 0.80c	0.51 \pm 0.03c
L6-65	4.26 \pm 0.09d	23.90 \pm 0.10d	0.44 \pm 0.02cd
L7-81	3.25 \pm 0.03e	20.47 \pm 0.73e	0.34 \pm 0.03d

The data analysis was conducted using SPSS 17.0 software. Univariate analysis of variance was employed to test for differences under the condition of a significance level of 95%.

Table S3. List of source of adjuvant

NO.	Adjuvant	Manufacturer	No.	Adjuvant	Manufacturer
1	SK-551	SK. AgroThink	49	Lissapol PA	Croda International Plc.
2	SK-560EP	(Shanghai) Corp.	50	Atlox4838B	
3	SK-273F1		51	Atlas G5000	
4	SK-5050		52	Cresplus DP	
5	SK-33SC		53	Cresmer SC947	
6	SK-01JK		54	Creslox 3484	
7	SK-34SC		55	Creslox 3418	
8	SK-20TX		56	Creslox 793	
9	SK-92FS1		57	3478N/803	
10	SK-24		58	Atlox 3416	
11	SK-21K		59	Creslox SC565	
12	SK-24R		60	Creslox SC802	
13	SK-25CH		61	Creslox SC671	

14	YUS-FS3000	Takemoto Oil & Fat Co., Ltd.	62	Arlatone TV	Clariant International Ltd.
15	YUS-WG4		63	Atlas G-1086	
16	YUS-207K		64	Atlas G5000	
17	YUS-TXC		65	Atlas G5002L	
18	YUS-RXB		66	Atlox 4896	
19	YUS-CH7000		67	Atlox 4894	
20	PICO-SC50Q		68	Atlox 4894A	
21	PICO-SC25P		69	Cresmer A5	
22	YUS-FS7PG		70	Synperonic 13/5	
23	YUS-FS1		71	Synperonic91/6	
24	YUS-SXC		72	Cresmer SC157	
25	YUS-LXC		73	Phenylsulfonat CA	
26	YUS-135B		74	Phenylsulfonat CAL	
27	YUS-2011CX		75	Emulsogen 3510	
28	YUS-2010CX		76	Emulsogen EL360	
29	YUS-D625		77	Emulsogen TS160	
30	YUS-D935		78	Emulsogen MP1	
31	YUS-D3020		79	SP27001	Jiangsu SinvoChem S&T Co. Ltd.
32	YUS-5050PB		80	SPOF3468	
33	YUS-CP120		81	SVA-116B	Dow Chemical (Shanghai) Co., Ltd.
34	YUS-EP70G		82	OD-3310	
35	YUS-A41B		83	W600	
36	YUS-110		84	D800/D865	
37	Greenmul 5038	Beijing Green-times Technology Co., Ltd.	85	TRITO GR-7M	Xingtai Yancheng Chemical Auxiliaries Co., Ltd.
38	Greenmul 5800		86	DOWFA 2A1	
39	Greenmul 5810		87	AEO-3	
40	Greenmul 5816		88	300#	
41	Greenmul 5860		89	500#	
42	Greenmul 8500		90	600#	
43	Greenmul 8600		91	700#	
44	Greenmul EF81		92	1600#	
45	Greenmul EF83		93	201	
46	TERMUL5030		94	0201B	
47	TERMUL200	Indorama Ventures Mobility Trading Co.,Ltd.	95	0203B	Nanjing Jierun Sci. Tech. Co., Ltd
48	TERMUL128x		96	EthylanNS-500LQ	

Table S4. Unitary adjuvant systems (Library 1 plate)

1	2	3	4	5	6
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A	SK-551	SK-5050	SK-01JK	SK-20TX	SK-24	SK-24R
B	SK-560EP	SK-33SC	SK-34SC	SK-92FS1	SK-21K	SK-25CH
C	SK-273F1	YUS-FS3000	YUS-WG4	YUS-207K	YUS-TXC	YUS-RXB
D	YUS-CH7000	PICO-SC50Q	PICO-SC25P	YUS-FS7PG	YUS-FS1	YUS-SXC

Table S5. Unitary adjuvant systems (Library 2 plate)

	1	2	3	4	5	6
A	YUS-LXC	TERMUL5030	TERMUL200	TERMUL128x	Greenmul 5038	Greenmul 5800
B	Greenmul 5810	Greenmul 5816	Greenmul 5860	Greenmul 8500	Greenmul 8600	Greenmul EF81
C	Greenmul EF83	Arlatone TV	Atlas G-1086	Atlas G5000	Atlas G5002L	Atlox 4896
D	Atlox 4894	Atlox 4894A	Cresmer A5	Synperonic 13/5	Synperonic91/6	Cresmer SC157

Table S6. Unitary adjuvant systems (Library 3 plate)

	1	2	3	4	5	6
A	Lissapol PA	Atlox4838B	Atlas G5000	Cresplus DP	Cresmer SC947	Creslox 3484
B	Creslox 3418	Creslox 793	3478N/803	Atlox 3416	YUS-135B	YUS-2011CX
C	YUS-2010CX	YUS-D625	YUS-D935	YUS-D3020	YUS-5050PB	YUS-CP120
D	YUS-EP70G	YUS-A41B	YUS-110	Ethylan 500LQ	NS- Phenylsulfonat CA	Phenylsulfonat CAL

Table S7. Unitary adjuvant systems (Library 4 plate)

	1	2	3	4	5	6
A	Emulsogen 3510	Emulsogen EL360	Emulsogen TS160	Emulsogen MP1	SPOF3468	SVA-116B
B	AEO-3	OD-3310	W600	D800/D865	TRITO GR-7M	DOWFA 2A1
C	300#	500#	600#	700#	1600#	0201
D	0201B	0203B	Creslox SC565	Creslox SC802	Creslox SC671	SP27001

Table S8. Ternary adjuvant systems (Library 1 plate)

	1	2	3	4
	SK-20TX	SK-20TX	SK-20TX	SK-20TX
A	SK-560EP	SK-560EP	SK-560EP	SK-560EP
	YUS-CH7000	Greenmul 5810	Atlas G-1086	Emulsogen EL360
	SK-20TX	SK-20TX	SK-20TX	SK-20TX
B	SK-560EP	SK-560EP	SK-560EP	YUS-CH7000
	AEO-3	500#	600#	Greenmul 5810

	SK-20TX	SK-20TX	SK-20TX	SK-20TX
C	YUS-CH7000	YUS-CH7000	YUS-CH7000	YUS-CH7000
	Atlas G-1086	Emulsogen EL360	AEO-3	500#

Table S9. Ternary adjuvant systems (Library 2 plate)

	1	2	3	4
	SK-20TX	SK-20TX	SK-20TX	SK-20TX
A	YUS-CH7000	Greenmul 5810	Greenmul 5810	Greenmul 5810
	600#	Atlas G-1086	Emulsogen EL360	AEO-3
	SK-20TX	SK-20TX	SK-20TX	SK-20TX
B	Greenmul 5810	Greenmul 5810	Atlas G-1086	Atlas G-1086
	500#	600#	Emulsogen EL360	AEO-3
	SK-20TX	SK-20TX	SK-20TX	SK-20TX
C	Atlas G-1086	Atlas G-1086	Emulsogen EL360	Emulsogen EL360
	500#	600#	AEO-3	500#

Table S10. Ternary adjuvant systems (Library 3 plate)

	1	2	3	4
	SK-20TX	SK-20TX	SK-20TX	SK-20TX
A	Emulsogen EL360	AEO-3	AEO-3	500#
	600#	500#	600#	600#
	SK-560EP	SK-560EP	SK-560EP	SK-560EP
B	YUS-CH7000	YUS-CH7000	YUS-CH7000	YUS-CH7000
	Greenmul 5810	Atlas G-1086	Emulsogen EL360	AEO-3
	SK-560EP	SK-560EP	SK-560EP	SK-560EP
C	YUS-CH7000	YUS-CH7000	Greenmul 5810	Greenmul 5810
	500#	600#	Atlas G-1086	Emulsogen EL360

Table S11. Ternary adjuvant systems (Library 4 plate)

	1	2	3	4
	SK-560EP	SK-560EP	SK-560EP	SK-560EP
A	Greenmul 5810	Greenmul 5810	Greenmul 5810	Atlas G-1086
	AEO-3	500#	600#	Emulsogen EL360
	SK-560EP	SK-560EP	SK-560EP	SK-560EP
B	Atlas G-1086	Atlas G-1086	Atlas G-1086	Emulsogen EL360
	AEO-3	500#	600#	AEO-3
	SK-560EP	SK-560EP	SK-560EP	SK-560EP
C	Emulsogen EL360	Emulsogen EL360	AEO-3	AEO-3
	500#	600#	500#	600#

Table S12. Ternary adjuvant systems (Library 5 plate)

	1	2	3	4
A	SK-560EP	YUS-CH7000	YUS-CH7000	YUS-CH7000

	500#	Greenmul 5810	Greenmul 5810	Greenmul 5810
	600#	Atlas G-1086	Emulsogen EL360	AEO-3
	YUS-CH7000	YUS-CH7000	YUS-CH7000	YUS-CH7000
B	Greenmul 5810	Greenmul 5810	Atlas G-1086	Atlas G-1086
	500#	600#	Emulsogen EL360	AEO-3
	YUS-CH7000	YUS-CH7000	YUS-CH7000	YUS-CH7000
C	Atlas G-1086	Atlas G-1086	Emulsogen EL360	Emulsogen EL360
	500#	600#	AEO-3	500#

Table S13. Ternary adjuvant systems (Library 6 plate)

	1	2	3	4
	YUS-CH7000	YUS-CH7000	YUS-CH7000	YUS-CH7000
A	Emulsogen EL360	AEO-3	AEO-3	500#
	600#	500#	600#	600#
	Greenmul 5810	Greenmul 5810	Greenmul 5810	Greenmul 5810
B	Atlas G-1086	Atlas G-1086	Atlas G-1086	Atlas G-1086
	Emulsogen EL360	AEO-3	500#	600#
	Greenmul 5810	Greenmul 5810	Greenmul 5810	Greenmul 5810
C	Emulsogen EL360	Emulsogen EL360	Emulsogen EL360	AEO-3
	AEO-3	500#	600#	500#

Table S14. Ternary adjuvant systems (Library 7 plate)

	1	2	3	4
	Greenmul 5810	Greenmul 5810	Atlas G-1086	Atlas G-1086
A	AEO-3	500#	Emulsogen EL360	Emulsogen EL360
	600#	600#	AEO-3	500#
	Atlas G-1086	Atlas G-1086	Atlas G-1086	Atlas G-1086
B	Emulsogen EL360	AEO-3	AEO-3	500#
	600#	500#	600#	600#
	Emulsogen EL360	Emulsogen EL360	Emulsogen EL360	AEO-3
C	AEO-3	AEO-3	500#	500#
	500#	600#	600#	600#