Supporting information

Table S1 Maximum permitted tolerances for relative ion intensities using LC-MS/MS.

Relative intensity (% of base peak)	LC-MS/MS
＞50%	±20%
＞20% to 50%	±25%
＞10% to 20%	±30%
≤10%	±50%

Table S2 Measured ions, retention time (RT), Precursor ions, Product ions, declustering potential (DP), collision energy (CE) and collision cell exit potential (CXP) of the target compounds in the ultra-high-performance liquid chromatography tandem mass spectrometry system. The corresponding corrected internal standard (IS) for each analyte is also presented.

chemical	Measured ion	RT (min)	Precursor ion (m/z)	Product ion (m/z)	DP (V)	CE (V)	CXP (V)	IS correction
ampicillin	$[M+CH_3OH+H]^+$	2.81	382.3	333*/160.0	20	22/27	13	ampicillin-D_5
ampicillin	$[M+H]^+$	2.87	350.2	106.0*/160.0	65	30/18	13	ampicillin-D_5
cefotaxime	$[M+H]^+$	2.75	456	166.9*/125.0	60	28/70	14	cephalexin-D_5
cloxacillin	$[M+CH_3OH+H]^+$	5.6	468.2	160.0*/178.0	50	23/39	13	penicillin V-D_5
cloxacillin	$[M+H]^+$	5.39	436.1	160.0*/277.0	76	18/19	13	penicillin V-D_5
nafcillin	$[M+H]^+$	5.62	415.2	199.0*/170.9	115	22/53	10	sulfamethazine-$^{13}C_6$
oxacillin	$[M+CH_3OH+H]^+$	5.36	434.2	160.0*/144.0	20	24	13	penicillin V-D_5
oxacillin	$[M+H]^+$	5.25	402.2	160.0*/243.0	80	19/19	13	penicillin V-D_5
penicillin G	$[M+CH_3OH+H]^+$	4.3	367.3	160.0*/217.0	30	21/28	13	penicillin G-D_5
penicillin G	$[M+H]^+$	4.42	335.2	176.0*/160.0	68	16/19	13	penicillin G-D_5
penicillin V	$[M+CH_3OH+H]^+$	4.78	383.1	160.0*/114.0	50	23/54	13	penicillin V-D_5
penicillin V	$[M+H]^+$	4.92	351.2	160.0*/114.0	74	14/46	13	penicillin V-D_5
ceftiofur	$[M+H]^+$	4.05	524.3	241.1*/210.1	180	23/29	13	trimethoprim-$^{13}C_3$
cinoxacin	$[M+H]^+$	4.3	263.1	217.1*/189.0	60	30/37	13	levofloxacin-D_8
ciprofloxacin	$[M+H]^+$	3.1	332.1	288.1*/245.1	80	25/33	13	ciprofloxacin-D_8
clinafloxacin	$[M+H]^+$	3.4	366.2	305.1*/236.1	20	29/50	13	ciprofloxacin-D_8
enrofloxacin	$[M+H]^+$	3.31	360	316.1*/245.1	80	25/35	13	enrofloxacin-D_5
flumequine	$[M+H]^+$	5.05	262.1	202.1*/174.0	77	42/49	13	sulfamethoxazole-$^{13}C_6$
lomefloxacin	$[M+H]^+$	3.16	352	265.0*/308.1	80	33/28	13	levofloxacin-D_8
norfloxacin	$[M+H]^+$	3.02	320.1	276.1/233.1*	80	26/35	13	norfloxacin-D_5
ofloxacin	$[M+H]^+$	3.03	362.2	318.1*/261.1	80	26/38	13	levofloxacin-D_8
oxolinic acid	$[M+H]^+$	4.41	262	216.1/160.0*	70	40/47	13	sulfamethazine-$^{13}C_6$
sarafloxacin	$[M+H]^+$	3.68	386	342.3*/299.0	80	25/38	13	sarafloxacin-D_8
sulfachloropyridazine	$[M+H]^+$	3.51	285.1	156.0*/108.1	65	22/37	13	sulfamethazine-$^{13}C_6$
sulfadiazine	$[M+H]^+$	2.59	251.1	156.0*/92.0	40	22/38	13	sulfadiazine-$^{13}D_6$
sulfadoxin	$[M+H]^+$	3.62	311.1	156.1*/108.2	70	30/37	13	sulfamethoxazole-$^{13}C_6$
sulfamerazine	$[M+H]^+$	2.78	265.2	156.1*/172.1	82	25/25	13	sulfamethoxazole-$^{13}C_6$
sulfamethazine	$[M+H]^+$	2.9	279.1	186.1*/156.0	60	23/27	13	sulfamethazine-$^{13}C_6$

chemical	Measured ion	RT (min)	Precursor ion (m/z)	Product ion (m/z)	DP (V)	CE (V)	CXP (V)	IS correction
sulfamethizole	$[M+H]^+$	3.14	271	156.1*/108.0	65	21/36	13	sulfamethoxazole-$^{13}C_6$
sulfamethoxazole	$[M+H]^+$	3.83	254.1	156.0*/108.0	65	22/36	13	sulfamethoxazole-$^{13}C_6$
sulfanilamide	$[M+H]^+$	1.2	173	93.0*/76.0	60	28/52	13	acetaminophen-$^{13}C_2$-^{15}N
sulfapyridine	$[M+H]^+$	2.65	250.1	156.1*/108.0	40	23/32	13	sulfamethazine-$^{13}C_6$
sulfathiazole	$[M+H]^+$	2.69	256	156.0*/108.0	40	22/32	13	sulfamethazine-$^{13}C_6$
sulfaphenazole	$[M+H]^+$	4.5	315	156.0*/108.0	90	27/40	13	sulfamethazine-$^{13}C_6$
sulfameter	$[M+H]^+$	3.21	281.2	108.1*/92.1	120	37/37	13	sulfadiazine-D_6
clarithromycin	$[M+H]^+$	4.97	748.5	590.4*/158.0	40	29/40	13	erythromycin-^{13}C-D_3
erythromycin	$[M+H]^+$	4.26	734.5	576.4/158.0*	30	26/36	13	erythromycin-^{13}C-D_3
tylosin	$[M+H]^+$	4.55	916.3	772.4/174.1*	40	41/49	13	thiabendazole-D_4
clindamycin	$[M+H]^+$	3.36	425.3	126.1*/377.1	50	32/27	13	clindamycin-D_3
lincomycin	$[M+H]^+$	2.42	407.3	126.1*/359.2	30	32/27	13	lincomycin-D_3
carbadox	$[M+H]^+$	2.8	263.2	231.0*/145.0	40	19/29	13	trimethoprim-$^{13}C_3$
ormetoprim	$[M+H]^+$	2.85	275.2	259.1*/123.0	40	38/31	13	trimethoprim-$^{13}C_3$
trimethoprim	$[M+H]^+$	2.73	291.1	230.1*/123.1	95	33/34	13	trimethoprim-$^{13}C_3$
caffeine	$[M+H]^+$	2.69	195	138.0*/110.0	75	27/31	13	sulfadiazine-D_6
carbamazepine	$[M+H]^+$	4.51	237	193.9*/192.9	66	29/47	16	sulfadiazine-D_6
codeine	$[M+H]^+$	2.45	300.2	215.0*/152.0	40	33/85	13	trimethoprim-$^{13}C_3$
digoxigenin	$[M+H]^+$	3.37	391.2	355.2*/337.2	101	21/27	8	sulfamethazine-$^{13}C_6$
diltiazem	$[M+H]^+$	4.78	415.1	178.0/149.8*	71	33/61	12	erythromycin-^{13}C-D_3
1,7-dimethylxanthine	$[M+H]^+$	2.45	181	123.9*/69.0	81	27/43	10	sulfamethazine-$^{13}C_6$
thiabendazole	$[M+H]^+$	2.6	202.2	175.0*/130.9	60	37/48	13	thiabendazole-D_4
sarafloxacin-D_8	$[M+H]^+$	3.65	394.3	350.3*	94	27	13	-
erythromycin-^{13}C-D_3	$[M+H]^+$	4.26	738.4	162.1*	30	36	13	-
trimethoprim-$^{13}C_3$	$[M+H]^+$	2.73	294.1	231.0*	95	33	13	-
sulfamethoxazole-$^{13}C_6$	$[M+H]^+$	3.81	260.2	114.1*	150	36	13	-
sulfamethazine-$^{13}C_6$	$[M+H]^+$	2.9	285.3	186.0*	118	23	13	-
lincomycin-D_3	$[M+H]^+$	2.38	410.2	129.2*	120	47	13	-
sulfadiazine-D_6	$[M+H]^+$	2.6	257.1	162.0*	80	20	13	-
levofloxacin-D_8	$[M+H]^+$	3.02	370.3	326.2*	130	26	13	-
clindamycin-D_3	$[M+H]^+$	3.36	428.3	129.2*	50	32	13	-
enrofloxacin-D_5	$[M+H]^+$	3.3	365.2	321.3*	60	28	13	-
norfloxacin-D_5	$[M+H]^+$	3.01	325.3	238.1*	80	34	13	-
ampicillin -D_5	$[M+H]^+$	2.5	355.2	179.2*	76	22	13	-
penicillin G-D_5	$[M+H]^+$	4.41	342.2	160.1*	30	19	13	-
penicillin V-D_5	$[M+CH_3OH+H]^+$	4.77	388.1	160.1*	50	23	13	-
ciprofloxacin-D_8	$[M+H]^+$	3.09	340.2	296.1*	70	25	13	-
thiabendazole-D_4	$[M+H]^+$	2.59	206	179.0*	60	35	13	-

* Quantitative ion

Table S3 Instrumental performance and validation data, including linearity, instrument detection limit (IDL), instrument quantification limit (IQL), method detection limit (MDL), method quantification limit (MQL).

chemical class	chemical	Linearity (r^2)	IDL (pg)	IQL (pg)	MDL (ng/L)	MQL (ng/L)
β-lactams	ampicillin	0.9990	1	4	0.4	1.5
	cefotaxime	0.9935	1.5	5	0.2	0.6
	cloxacillin	0.9963	0.1	0.3	0.01	0.03
	nafcillin	0.9948	1	3	0.08	0.25
	oxacillin	0.9963	0.1	0.3	0.01	0.03
	penicillin G	0.9990	0.1	0.3	0.01	0.03
	penicillin V	0.9964	0.1	0.3	0.01	0.03
	ceftiofur	0.9987	1	3	0.3	1
quinolones	cinoxacin	0.9916	1	3	0.15	0.5
	ciprofloxacin	0.9961	0.5	1.5	0.1	0.3
	clinafloxacin	0.9981	0.1	0.3	0.02	0.1
	enrofloxacin	0.9985	0.1	0.3	0.02	0.1
	flumequine	0.9954	0.2	0.6	0.02	0.06
	lomefloxacin	0.9959	0.2	0.6	0.05	0.2
	norfloxacin	0.9954	0.5	2	0.08	0.25
	ofloxacin	0.9957	0.1	0.5	0.03	0.1
	oxolinic acid	0.9953	0.5	1.5	0.04	0.15
	sarafloxacin	0.9956	0.1	0.3	0.03	0.1
sulfonamides	sulfachloropyridazine	0.9968	0.2	0.6	0.03	0.1
	sulfadiazine	0.9925	0.2	0.6	0.04	0.15
	sulfadoxin	0.9935	0.1	0.3	0.02	0.06
	sulfamerazine	0.9957	0.5	1.5	0.08	0.25
	sulfamethazine	0.9974	0.5	1.5	0.08	0.25
	sulfamethizole	0.9976	0.2	0.6	0.03	0.1
	sulfamethoxazole	0.9965	0.2	0.6	0.04	0.15
	sulfapyridine	0.9934	0.2	0.6	0.04	0.15
	sulfaquinoxaline	0.9957	0.5	1.5	0.08	0.25
	sulfathiazole	0.9969	0.5	1.5	0.1	0.4
	sulfaphenazole	0.9953	0.5	1.5	0.08	0.25
	sulfameter	0.9940	0.5	1.5	0.08	0.25
macrolactones	clarithromycin	0.9974	0.05	0.15	0.02	0.08
	erythromycin	0.9979	0.1	0.3	0.04	0.15
	tylosin	0.9950	1	3	0.2	0.8
lincosamides	clindamycin	0.9990	1	3	0.15	0.5
	lincomycin	0.9975	0.1	0.3	0.01	0.04
feed supplement	carbadox	0.9946	0.5	3	0.15	0.5

chemical class	chemical	Linearity (r^2)	IDL (pg)	IQL (pg)	MDL (ng/L)	MQL (ng/L)
	ormetoprim	0.9949	0.05	0.15	0.02	0.08
neurological drugs	caffeine	0.9973	0.2	0.6	0.01	0.05
	carbamazepine	0.9993	0.1	0.3	0.01	0.03
	codeine	0.9967	1	3	0.2	0.6
cardiovascular drugs	digoxigenin	0.9989	1	3	0.3	0.9
metabolites	1,7-dimethylxanthine	0.9912	0.5	1.5	0.05	0.15
bactericide	thiabendazole	0.9975	0.02	0.06	0.01	0.04
	trimethoprim	0.9960	0.2	0.6	0.05	0.15

Table S4 The mean absolute recovery (AR) and relative standard deviation (n=6, RSD) of each target analyte with a 20ng/L spiked level in ultrapure water at different adsorbent amount.

	Amount of GCHM							
	1000mg		500mg		200mg		50mg	
chemical	AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)
ampicillin	66.6	9.2	65.7	3.1	62.0	3.7	45.6	9.4
cefotaxime	71.2	7.8	72.3	2.8	67.0	5.7	65.5	2.9
cloxacillin	96.4	5.4	99.5	10.0	87.1	4.6	83.3	4.2
nafcillin	93.2	3.4	92.3	7.0	92.6	8.4	80.7	6.1
oxacillin	90.6	7.1	91.5	4.3	98.9	2.5	84.6	10.6
penicillin G	99.3	4.8	97.5	3.0	100.2	4.2	92.4	9.1
penicillin V	88.5	9.2	82.3	5.7	84.2	6.2	83.7	2.8
ceftiofur	76.6	7.7	75.4	7.6	70.2	3.8	70.1	3.3
cinoxacin	95.7	10.8	95.4	10.1	92.6	5.7	79.5	5.4
ciprofloxacin	78.8	5.1	58.6	5.0	62.7	6.1	65.5	10.3
clinafloxacin	53.5	11.0	47.9	8.9	56.6	3.9	47.8	10.1
enrofloxacin	73.6	10.2	55.3	7.7	52.1	5.9	47.7	8.2
flumequine	95.7	6.4	92.3	7.5	96.9	7	90.2	9.7
lomefloxacin	56.7	4.8	56.1	8.6	51.9	6.9	43.5	7.1
norfloxacin	92.2	9.1	85.5	4.9	81.5	5.6	68.2	7.5
ofloxacin	56	8.3	59.5	10.9	55.9	5.4	38.6	9.8
oxolinic acid	112.3	10.4	107.5	11.1	105.2	6.7	77.2	10.9
sarafloxacin	57.4	9.3	52.2	3.4	52.6	6.3	37.5	6.6
sulfachloropyridazine	95.6	7.1	92.3	9.5	88.4	7.1	70.9	9.2
sulfadiazine	87.6	3.2	90.1	4.4	88.9	7.9	65	6.8
sulfadoxin	89	8.7	88.2	6.1	87.8	6.8	85.9	9.1
sulfamerazine	82.5	6.3	83.4	7.9	89.9	9	84.2	5.8
sulfamethazine	58.7	2.8	59.2	7.5	61.5	2.1	50.3	9.0

chemical	Amount of GCHM							
	1000mg		500mg		200mg		50mg	
	AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)
sulfamethizole	92.5	3.2	91.6	10.5	85.1	4.1	80.6	5.8
sulfamethoxazole	93.2	4.1	91.9	3.9	80.3	5.8	85.3	4.5
sulfanilamide	75.7	5.8	78.3	7.0	78.9	8	72.5	8.6
sulfapyridine	81.1	8.9	78.6	9.2	79.2	10.3	77.9	6.3
sulfathiazole	76.3	10.8	77.5	2.8	75.5	7.1	66.4	8.9
sulfaphenazole	90.4	6.7	92.5	4.1	90.8	2.9	73.6	3.4
sulfameter	92.4	6.4	83.7	6.3	85.6	9.5	62.4	3.8
clarithromycin	78.5	7.3	62.7	5.5	45.2	4.7	47.6	9.6
erythromycin	52.4	10.9	48.7	8.6	50.6	4.5	32	4.6
tylosin	57	4.7	45.5	9.5	46.7	4.5	37.2	5.5
clindamycin	75.6	6.3	72.3	4.4	70.1	1.1	58.4	4.5
lincomycin	78.5	10.0	72.5	4.4	88.1	5.6	72	7.3
carbadox	65.6	6.1	66.3	10.8	60.4	7.3	51.5	11.0
ormetoprim	56.4	7.8	59.3	9.8	61.2	4.7	53.5	5.0
trimethoprim	77.9	6.5	72	7.8	75.9	4.5	73.2	9.0
caffeine	111.2	8.0	97.6	10.8	107.3	5.6	95.5	8.4
carbamazepine	97.3	5.8	95.6	8.5	97.9	9.6	92.2	8.9
codeine	67.5	8.0	64.3	11.0	62.6	5.6	52.2	5.5
digoxigenin	77.8	4.9	78.5	10.9	77.6	9.3	67.1	8.0
1,7-dimethylxanthine	98.6	8.2	97.2	7.7	100.8	10	92.1	7.5
thiabendazole	73.3	9.6	75.7	2.8	53.8	7.7	51.2	6.0

Table S5 The mean absolute recovery (AR) and relative standard deviation (n=6, RSD) of each target analyte with a 20 ng/L spiked level in ultrapure water as a function of pH.

chemical	pK_a	pH									
		3		5		7		9		11	
		AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)
ampicillin	3.24	57.7	7.5	61.2	6.7	62.0	3.7	60.3	4.0	62.4	10.2
cefotaxime	3.18	69.8	2.9	66.5	5.1	67.0	5.7	70.6	3.5	71.3	6.3
cloxacillin	3.75	72.5	5.8	69.3	10.7	87.1	4.6	88.9	3.4	77.4	6.2
nafcillin	3.31	69.5	9.4	87.3	10.1	92.6	8.4	87.8	4.3	90.4	6.7
oxacillin	3.75	83.6	10.3	78.9	9.2	98.9	2.5	101.7	3.9	90.6	3.2
penicillin G	3.53	103.4	9.7	87.4	9.3	100.2	4.2	92.5	9.8	102.3	10.4
penicillin V	3.39	77.5	8.9	68.7	4.2	84.2	6.2	89.3	8.5	81.5	6.2
ceftiofur	2.62	71.3	7.5	68.4	8.0	70.2	3.8	82	8.5	69.7	9.9
cinoxacin	4.93	69.6	6.4	97.5	3.6	92.6	5.7	85.6	8.9	83.5	9.8
ciprofloxacin	5.76	34.7	8.7	47.2	3.1	62.7	6.1	58.5	8.8	63.8	4.9

chemical	pK_a	pH									
		3		5		7		9		11	
		AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)
clinafloxacin	5.45	37.2	7.2	65.3	7.1	56.6	3.9	58.1	9.6	38.1	7.8
enrofloxacin	6.43	57.3	7.3	82.5	2.9	52.1	5.9	56.6	4.2	39.1	5.3
flumequine	6	77.2	8.3	83.2	9.4	96.9	7	90.3	9.3	78.5	7.5
lomefloxacin	5.64	56.7	8.3	58.5	11.1	51.9	6.9	38.6	5.9	37.8	10.5
norfloxacin	5.77	73.5	5.0	81.1	7.9	81.5	5.6	78.3	10.7	76.9	3.2
ofloxacin	5.45	37.2	9.5	44.6	3.6	55.9	5.4	52.8	6.0	45.7	11.1
oxolinic acid	5.58	88.9	8.7	79.6	6.1	105.2	6.7	83.4	2.8	89.7	8.8
sarafloxacin	5.74	39.8	8.3	67.5	6.2	52.6	6.3	53.4	5.5	39.5	5.2
sulfachloropyridazine	6.6	81.2	3.5	79.4	5.1	88.4	7.1	86.4	4.5	59.3	6.2
sulfadiazine	6.99	76.2	8.1	85.5	3.9	88.9	7.9	82.4	10.9	76.2	3.7
sulfadoxin	6.12	90.3	7.7	92.5	4.2	87.8	6.8	79.3	6.2	79.1	11.0
sulfamerazine	6.99	83.4	9.4	82.1	8.8	89.9	9	79.9	6.5	92.2	10.5
sulfamethazine	6.99	38.5	3.3	57.2	5.8	61.5	2.1	45.3	4.2	53.6	5.3
sulfamethizole	6.71	80.3	4.2	86.5	4.2	85.1	4.1	78.3	5.3	77.4	4.9
sulfamethoxazole	6.16	67.7	10.5	52.5	3.6	80.3	5.8	53.4	6.8	51.2	4.9
sulfanilamide	6.24	66.6	8.2	73.9	10.4	78.9	8	82.5	8.0	57.3	8.1
sulfapyridine	5.1	57.8	8.8	77.7	5.6	79.2	10.3	71.2	3.3	58.9	9.6
sulfathiazole	6.93	59.3	4.2	54.6	3.9	75.5	7.1	70	3.6	55.6	5.5
sulfaphenazole	6.82	79.4	4.2	94.3	6.0	90.8	2.9	92.1	4.6	78.9	9.0
sulfameter	7.06	83.3	5.9	79.4	6.0	85.6	9.5	83.9	7.8	90.8	8.4
clarithromycin	12.46	34.2	5.0	41.8	6.9	45.2	4.7	52.5	4.1	37.4	11.1
erythromycin	12.44	43.4	10.8	40.5	11.1	50.6	4.5	45.7	8.0	72.5	3.8
tylosin	12.45	28.4	8.9	36.5	4.8	46.7	4.5	36.4	2.9	57.8	5.7
clindamycin	12.41	45.4	4.9	61.2	9.9	70.1	1.1	68.4	5.3	71.1	3.4
lincomycin	3.24	85.3	4.2	88.9	9.3	88.1	5.6	78.2	7.3	76.5	8.2
carbadox	10.51	35.6	10.2	48.9	2.9	60.4	7.3	65.4	3.0	55.7	4.6
ormetoprim	7.11	45.6	4.4	37.2	6.0	61.2	4.7	57.6	7.8	52.5	3.0
trimethoprim	17.33	57.5	10.3	62.6	4.6	75.9	4.5	73.2	5.0	77.7	9.2
caffeine	13.4	67.4	5.2	76.8	10.8	107.3	5.6	78.2	8.7	85.7	8.2
carbamazepine	14.7	82.5	7.0	88.6	9.2	97.9	9.6	93.5	5.5	92.1	8.1
codeine	13.78	43.5	5.4	62.2	7.0	62.6	5.6	77.4	7.5	54.7	3.4
digoxigenin	14.44	65.6	6.9	71.2	7.0	77.6	9.3	73.5	7.9	78.9	10.8
1,7-dimethylxanthine	8.5	92.5	9.1	81.7	8.6	100.8	10	78.9	6.7	79.4	11.0
thiabendazole	10.28	43.7	9.1	39.5	8.1	53.8	7.7	55.7	6.6	51.2	9.6

Table S6 The mean absolute recovery (AR) and relative standard deviation (n=6, RSD) of each target analyte with a 20 ng/L spiked level in ultrapure water at different loading speeds.

	Loading speed (mL/min)									
	3		5		10		20		30	
chemical	AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)
ampicillin	79.4	5.7	80	4.8	62.0	3.7	58.7	3.2	48.7	4.6
cefotaxime	90.1	5.1	91.1	4.8	67.0	5.7	52.6	8.7	55.4	5.3
cloxacillin	83.7	3.7	88.3	7.3	87.1	4.6	86	4.9	79.5	7.8
nafcillin	90	8.5	77.3	5.9	92.6	8.4	89.5	9.3	86.4	2.7
oxacillin	117.7	7.2	127.2	4.1	98.9	2.5	81.7	5.9	83.7	8.3
penicillin G	112.1	4.7	105.6	7.9	100.2	4.2	105.3	4.3	98.6	4.5
penicillin V	102	6.3	109.4	9.4	84.2	6.2	101.1	3.5	95.7	3.5
ceftiofur	79.7	7.5	73.3	5.6	70.2	3.8	60.8	4.5	49.8	3.5
cinoxacin	98.4	4.5	77.7	2.7	92.6	5.7	97.3	8.3	97.6	6.1
ciprofloxacin	56.2	6.3	54.6	7.2	62.7	6.1	56.6	8.2	54.6	6.7
clinafloxacin	76.9	3	54.9	5.7	56.6	3.9	49.1	5.1	51.2	3.6
enrofloxacin	59.4	6.8	53.3	8.2	52.1	5.9	55.5	5.2	47.4	10.9
flumequine	86.4	6.1	110.2	6.2	96.9	7	93.1	6.2	88.7	7.2
lomefloxacin	49	9.2	60.3	7.1	51.9	6.9	61.4	4.7	63.5	6.3
norfloxacin	76.8	4.2	77.3	2.9	81.5	5.6	65.7	6.4	51.4	2.4
ofloxacin	48.3	5.1	63.2	4.8	55.9	5.4	65.4	8	62.2	4.6
oxolinic acid	98.6	4.3	105.1	6	105.2	6.7	100.5	7.4	88.8	7.3
sarafloxacin	55.9	6.7	47.9	5.4	52.6	6.3	54.4	7	52.4	4.4
sulfachloropyridazine	88.7	4.2	88.4	5.5	88.4	7.1	79.4	6.1	78.8	5.1
sulfadiazine	85.1	5	109.7	5.3	88.9	7.9	87.6	4.3	78.9	3.8
sulfadoxin	88.8	5.6	92.3	5.1	87.8	6.8	92.2	5.8	69.8	4.2
sulfamerazine	90.7	4	101.2	8	89.9	9	92.2	5.7	90.1	3.7
sulfamethazine	79.6	5.5	98	4.9	58.5	2.1	72.9	3	66.6	3.9
sulfamethizole	93.4	5.1	105.1	3.9	85.1	4.1	92.5	5.9	87.8	6.5
sulfamethoxazole	82.2	4.5	79.4	5.2	80.3	5.8	86.2	4.9	81.6	5.3
sulfanilamide	85.1	4.6	79.1	9.6	78.9	8	67.2	10.8	57.5	2.7
sulfapyridine	71.5	5.8	85.5	4.1	81.2	10.3	76.3	6.2	75.5	9.5
sulfathiazole	84	7.3	94.1	5.5	75.5	7.1	83.4	5.2	81.2	11.2
sulfaphenazole	94.3	5.7	89.2	4.9	90.8	2.9	96.1	4.5	95.5	2.4
sulfameter	89.2	8.4	94.2	4.2	85.6	9.5	90.3	7.2	83.5	5.3
clarithromycin	64.7	4.6	58.4	3.2	45.2	4.7	45.4	5.4	47.4	3.3
erythromycin	56.2	8.3	49.9	6.4	50.6	4.5	55.6	8.4	45.6	5
tylosin	43.7	5.9	48.3	9.8	46.7	4.5	56.4	1.5	46.7	5.7
clindamycin	69.7	6.5	61.1	3.9	70.1	1.1	74.8	2.5	71.3	3.7
lincomycin	96	7.3	99.8	8.9	88.1	5.6	94.7	5.9	88.9	5.4

	Loading speed (mL/min)									
	3		5		10		20		30	
chemical	AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)	AR (%)	RSD (%)
carbadox	60.6	2.6	72.8	5.3	60.4	7.3	67.6	5.2	57	8.9
ormetoprim	70.1	4.6	57.8	8.1	61.2	4.7	63	10.9	60.1	11.6
trimethoprim	77.9	4.6	78.9	5.7	75.9	4.5	79.2	8.5	76.5	10.1
caffeine	116.2	6.2	114.2	6.7	107.3	5.6	127.7	5.7	87.8	7.8
carbamazepine	86.1	5.4	89.1	6.3	97.9	9.6	93.5	7.7	91.2	7.6
codeine	59.6	4.3	63	3.6	62.6	5.6	66.3	8	61.6	5.4
digoxigenin	89	8.6	84.7	5.7	77.6	9.3	87.3	7.4	80.7	6.6
1,7-dimethylxanthine	85.7	5.6	103.9	12.4	100.8	10	85.2	8.4	112.4	9
thiabendazole	40.4	7.1	40.3	3.5	53.8	7.7	42.8	6.5	33.2	7.7

Table S7 The corrected recovery (CR) (n=6, intra- or inter-day variations) of PPCPs for GCHM in surface water and groundwater.

chemical	Surface water									Groundwater								
	Mean corrected recovery (%)			Intra-day precision (%)			Inter-day precision (%)			Mean corrected recovery (%)			Intra-day precision (%)			Inter-day precision (%)		
	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L
ampicillin	-[a]	89.3	89.6	-[a]	3.7	4.8	-[a]	6.4	0.4	-[a]	92.5	93.5	-[a]	4.2	5.4	-[a]	3.2	0.4
cefotaxime	107.8	107	100.2	5.8	6.1	4.9	11.4	9.8	10.7	100.7	115.5	108.9	3.1	2.6	7.2	2.3	2.8	2.7
cloxacillin	97.2	93	94.7	10.1	6.7	5.6	5.8	4.5	7.7	106.3	89.2	91.5	6.2	1	2.1	0.6	3.9	3.5
nafcillin	103.1	104.9	98.9	8.9	8.7	7	8.7	5.2	11.2	102.4	94.9	98.9	6.1	2.5	5.1	1	2.8	1.2
oxacillin	95.3	92	92.7	5.8	4.3	3.9	8.3	3.1	5.5	107.1	97.6	97.6	3.1	2.4	2.4	2.8	1.4	3.5
penicillin G	93.5	95.9	96.3	4.6	2.4	1	7.9	1.2	3.9	95.9	94.8	96.8	1.5	1.8	0.2	3.7	0.4	3.9
penicillin V	92	92.7	95.2	5	2.5	3.9	6.6	3.8	5.6	95.6	92.4	89.1	2.1	0.8	2.7	3.8	4.1	2.6
ceftiofur	98.7	96.1	94.5	8.4	6.1	5.3	12.3	4.5	2.1	100.8	96.4	93.5	5.3	1.6	3.9	1.8	3.5	2.1
cinoxacin	94.2	92.3	91.8	4.6	6.3	5.9	9.8	3.7	0.7	108	93.4	92.2	2.2	3.8	2.8	2.5	0.8	0.7
ciprofloxacin	100.3	103.3	102	8.4	3	5.5	6	10	4	96.4	100.0	98.3	5.1	4.2	3.6	2	2.2	4
clinafloxacin	98.4	97.2	93.8	7.7	5.8	3.8	9	11.8	9.4	105.5	98.4	97.9	4.3	3	4.6	3.2	16	4.4
enrofloxacin	100.8	103.6	106.3	5.6	6.8	6	1.9	9.8	3.9	106.5	92.6	97.1	3.1	4.7	3.7	2.9	1.2	3.9
flumequine	91.3	91.7	95.8	9	5.2	4.5	10	5.2	4.9	99.4	96.5	97.1	5.8	1.2	2.8	1.8	2.4	4.9
lomefloxacin	94.6	97.1	94.4	6.9	7	5.7	5.3	7.8	3.9	116.5	95.8	96.6	3.7	6.6	4.8	1.1	4.2	3.9
norfloxacin	100.5	102.4	106.1	2.9	5	4.5	4.5	3.8	4.7	92.9	96.6	97.1	1.1	3.8	2.5	0.5	1.3	4.7
ofloxacin	99.2	91	93.4	5.2	6.5	3.5	4.5	4.4	5.6	95.4	95.3	95.3	2	2.9	4.1	1	1.8	3.6
oxolinic acid	102.4	108.1	100.3	5.7	5.5	5.3	7.5	5.3	6.2	105.2	95.0	95.5	2.8	5.4	2.5	3.5	2.7	4.2
sarafloxacin	106.1	89.4	96.4	4	7.3	3.4	3.5	4.2	5.9	108.3	97.1	97.9	1.6	1.4	4.5	3.1	2.5	3.9
sulfachloropyridazi	107.7	102.2	97.4	6.8	2.4	6.1	5.6	6.5	3.7	109.3	97.4	98.1	4.3	3.8	4.8	1	4.4	3.7

chemical	Surface water									Groundwater								
	Mean corrected recovery (%)			Intra-day precision (%)			Inter-day precision (%)			Mean corrected recovery (%)			Intra-day precision (%)			Inter-day precision (%)		
	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L
ne																		
sulfadiazine	98.8	99.3	96.1	6.9	6.4	1.7	2.9	0.9	2.8	95.4	97.9	97.9	3.9	5	1.6	2.1	4.8	2.8
sulfadoxin	89.3	91.4	94.4	1.1	3.1	3.7	4	4.9	4.6	101.8	91.8	91.4	1.2	3.7	3.7	1.5	2.4	4.6
sulfamerazine	97.5	95.1	94.5	8.6	5.1	4.4	5.6	6.6	4.9	93.8	98.3	98.3	5.9	1.6	2.7	0.3	2.9	4.9
sulfamethazine	106	98.7	100.4	4.4	5.8	2.8	5.4	5.3	4.4	101.5	103.5	101.2	2.8	6	0.4	1.1	4.2	4.4
sulfamethizole	90	93.1	96.2	6.2	5.7	4.2	3.8	6.8	1.2	105.1	102.5	101.2	3.9	3.6	4.8	0.4	3.5	1.2
sulfamethoxazole	98.3	91.7	90.5	2	4.6	2.3	6.7	5.1	5.6	107.2	95.7	101.4	3.4	2.4	2.2	2.7	3.6	3.6
sulfapyridine	105.6	91.1	95.5	9.1	5.7	4.2	7.7	6	9.6	101.1	101.8	99.5	6.2	1	7.4	0.2	3.4	4.1
sulfaquinoxaline	97.7	89.3	89.9	6.6	4.2	6.9	3.8	5.1	4.9	105.6	99.2	98.4	3.9	0.6	3.2	2.4	4.6	2.3
sulfathiazole	95.7	92.9	90.8	4.6	6.1	3.9	9.2	4.1	7.1	106.4	98.3	98.1	3	6.2	1.6	2.7	0.4	1.7
sulfaphenazole	107.7	101	97.6	3	4.1	5.3	4.8	2.4	1	104.2	101.5	95.6	2.1	4	6.6	6.2	5.8	1
sulfameter	94.8	93.8	94.7	8.8	10	4.1	5.3	7.5	4.2	96.3	95.7	96.7	3.9	5.7	2.5	1.1	6.8	4.2
clarithromycin	92.5	91.5	94.3	4.6	9.9	10.5	7.7	9.8	7.6	98.2	101.2	98.6	2.1	2.6	4.8	2	2.2	4.3
erythromycin	102.5	100.5	106.1	5	4.3	5.1	6.9	3.5	5.2	102.5	97.5	102.1	2.5	3.6	3.6	2.5	0.2	5.2
tylosin	110.2	101.3	100.6	12.7	4.9	2.8	8.6	5	3.9	109.4	108.5	101.2	8.4	7	1.4	3.8	1.6	3.9
clindamycin	107.8	107.8	100.5	6.1	4.7	2.8	9.7	1.8	4	102.5	106.1	101.4	2.9	3.6	2	3.6	2	4
lincomycin	107.3	100.5	106.3	6.1	7.8	7.9	4.3	5.1	4.1	104.7	107.4	98.4	3.2	6.2	3.8	0.6	0.2	4.1
carbadox	94.7	95.5	93.8	5.5	7.3	4.7	2.7	5.5	5.3	98.2	96.5	96.1	2.9	8.8	0.6	5.4	1.6	5.3
ormetoprim	97.8	93.2	93.9	8.1	6.1	4.5	2.4	6.2	3.5	96.5	98.4	97.8	4.7	2.8	2.6	4.9	2.7	3.5
caffeine	106.4	101.9	92.5	8.6	9	6.8	9.9	7.8	9	108.1	104.5	99.5	4.9	4.4	2.9	3	2.3	4.4
carbamazepine	92	91.3	97.6	8.4	7.8	6.3	5.2	5.1	3.5	94.5	98.7	101.2	5.1	5.4	2.7	1.8	2.1	3.5

chemical	Surface water									Groundwater								
	Mean corrected recovery (%)			Intra-day precision (%)			Inter-day precision (%)			Mean corrected recovery (%)			Intra-day precision (%)			Inter-day precision (%)		
	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L
codeine	96.8	93.5	90.6	7.8	4.4	5.9	3.6	4.2	5.3	102.8	101.6	102.5	4.8	0.8	1.1	2.3	3.5	3.9
digoxigenin	97.7	94.7	89.2	9.5	7.2	3.8	2.1	4.4	4.7	104.3	103.8	98.3	5.6	3.2	4.4	4.9	1.2	4.7
1,7-dimethylxanthine	106.1	100.5	94.6	4.3	4.4	6.8	8.5	7.6	5.4	109.2	105.9	97.5	2	4.8	3.5	4	3.9	3.4
thiabendazole	106.5	102.9	98.3	5.8	4.3	3.2	2	5.4	6.8	110.2	109.7	96.8	2.7	3.2	3.2	2.8	4.4	2.6
trimethoprim	107.6	103.8	106.2	8.7	3.5	3.2	1.6	3.8	2.8	104.7	103.8	102.3	5.7	4.4	2	3.4	1.2	2.8

a MQL was below spiked concentration

Table S8 The corrected recovery (CR) (n=6, intra- or inter-day variations) of PPCPs for GCHM in seawater and wastewater.

chemical	Seawater									Wastewater								
	Mean corrected recovery (%)			Intra-day precision (%)			Inter-day precision (%)			Mean corrected recovery (%)			Intra-day precision (%)			Inter-day precision (%)		
	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L
ampicillin	-[a]	74.5	73.5	-[a]	6.4	7.9	-[a]	8.4	7.5	-[a]	64.9	66.1	-[a]	8.2	8.4	-[a]	7.7	7.0
cefotaxime	68.5	69.0	65.5	3.7	7.0	3.5	4.7	8.0	8.2	62.8	59.2	60.1	5.8	7.0	8.0	4.8	8.6	9.2
cloxacillin	76.8	74.2	73.6	6.8	3.2	7.9	10.1	6.5	5.4	69.6	71.1	68.7	4.0	3.9	6.5	7.9	4.6	5.7
nafcillin	75.1	78.9	74.7	6.7	4.8	6.4	8.2	6.3	6.6	66.5	71.3	69.4	3.5	4.8	6.3	4.5	4.9	3.5
oxacillin	64.3	71.3	72.2	3.7	3.4	4.7	3.9	3.6	2.6	58.8	66.5	68.4	4.2	3.8	3.6	4.0	4.5	5.4
penicillin G	73.2	68.5	75.8	3.0	3.7	6.5	2.9	2.8	8.7	69.9	66.5	73.6	8.1	3.7	3.8	9.0	7.4	12.0
penicillin V	89.6	78.6	81.0	5.7	4.6	4.6	2.8	4.7	2.8	86.7	75.1	76.1	6.4	4.6	4.7	6.3	4.5	4.3
ceftiofur	71.6	74.8	76.0	5.9	4.2	6.2	9.7	8.0	7.7	64.7	69.3	70.9	5.7	4.2	8.0	9.3	9.5	11.0
cinoxacin	66.6	70.7	70.8	2.8	5.8	5.8	4.9	7.9	4.9	60.6	64.1	66.2	6.7	5.8	7.9	4.6	4.7	9.5
ciprofloxacin	71.6	72.4	74.8	5.7	5.6	7.7	7.4	7.3	5.3	62.3	64.6	68.4	5.9	5.6	7.3	4.2	6.0	4.7
clinafloxacin	63.9	68.5	61.3	4.9	8.4	8.7	5.4	8.9	5.1	56.6	60.9	42.3	11.7	8.4	8.9	11.2	8.2	7.5
enrofloxacin	62.4	74.2	69.0	3.7	7.2	7.2	3.5	7.0	3.5	54.6	65.8	63.1	10.9	7.2	7.0	11.1	10.7	14.4
flumequine	65.5	74.0	70.4	6.4	1.6	5.2	7.9	3.1	4.3	58.5	70.0	66.8	5.1	7.8	9.3	6.6	7.7	11.9
lomefloxacin	56.3	59.5	56.5	4.3	7.2	6.7	4.7	7.6	5.2	46.0	48.1	45.7	9.2	7.2	7.6	8.8	6.3	8.5
norfloxacin	59.4	65.1	61.2	7.7	5.0	4.2	3.4	6.7	4.2	54.5	58.8	56.1	5.8	5.0	6.7	9.1	8.5	11.7
ofloxacin	58.7	62.6	65.7	2.6	5.2	3.7	5.3	7.9	6.8	53.8	55.6	61.0	3.6	5.2	7.9	9.8	8.1	8.3
oxolinic acid	67.0	69.8	64.6	3.4	5.2	6.1	2.6	4.4	3.7	58.8	61.9	56.5	8.7	5.2	4.4	9.5	6.9	9.4
sarafloxacin	92.9	90.1	97.3	5.2	3.4	1.1	5.5	6.7	7.8	89.9	84.2	93.4	8.2	12.6	15.9	4.9	8.7	11.5
sulfachloropyridazi	80.6	79.5	82.4	4.9	4.2	4.3	6.1	5.4	6.0	72.5	70.9	74.2	4.4	4.2	5.4	7.6	8.1	10.8

chemical	Seawater									Wastewater								
	Mean corrected recovery (%)			Intra-day precision (%)			Inter-day precision (%)			Mean corrected recovery (%)			Intra-day precision (%)			Inter-day precision (%)		
	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L
ne																		
sulfadiazine	78.1	78.5	78.9	4.5	1.8	4.7	6.2	3.5	3.3	69.2	71.9	69.1	5.3	6.8	8.5	6.6	9.3	10.1
sulfadoxin	58.2	57.6	56.9	7.8	5.0	3.1	6.1	9.3	8.0	53.3	50.2	50.8	4.2	7.2	11.5	9.1	9.5	7.5
sulfamerazine	77.7	72.4	75.1	6.5	1.4	5.2	8.1	3.0	4.3	70.2	68.1	70.6	4.5	7.4	9.0	5.7	6.6	11.8
sulfamethazine	70.5	69.5	72.5	3.4	2.2	5.2	2.4	4.2	5.6	61.7	63.1	62.3	5.0	4.3	5.3	6.0	6.2	9.1
sulfamethizole	58.5	57.0	57.5	4.5	4.9	4.6	7.8	8.2	8.1	44.0	48.6	50.4	5.7	8.9	12.2	7.9	9.5	6.8
sulfamethoxazole	68.3	67.4	64.5	4.0	1.0	2.8	4.4	5.4	5.6	62.5	62.8	58.5	6.6	8.2	8.6	6.2	7.8	7.0
sulfapyridine	70.2	63.6	75.0	12.8	7.9	9.8	9.5	4.6	6.6	63.0	55.2	70.6	7.2	6.9	4.6	9.5	12.1	19.6
sulfaquinoxaline	60.8	58.4	62.0	4.5	4.8	6.1	6.7	7.0	5.4	56.3	54.6	56.8	4.2	4.8	7.0	12.0	3.9	10.8
sulfathiazole	81.7	80.6	85.5	3.6	7.4	9.4	5.5	9.3	3.5	72.5	72.8	78.9	11.3	7.4	9.3	9.4	7.5	5.7
sulfaphenazole	68.5	61.0	63.5	2.7	4.8	0.9	4.4	6.5	8.3	62.4	50.4	53.7	4.3	4.8	6.5	8.3	9.8	13.1
sulfameter	84.3	86.4	85.5	4.5	1.4	3.4	4.8	3.7	4.8	74.7	78.2	73.0	4.3	5.7	6.0	5.0	7.1	10.2
clarithromycin	72.8	72.4	74.0	2.7	5.2	3.1	8.1	10.6	10.2	68.1	65.0	69.2	6.4	11.4	16.8	11.0	12.3	7.8
erythromycin	64.5	79.0	71.5	8.1	7.0	6.5	6.9	10.8	7.4	58.4	71.8	67.7	6.6	7.0	10.8	6.8	5.7	9.5
tylosin	83.5	85.9	82.3	9.0	6.8	12.4	9.4	7.2	3.8	68.1	77.5	73.7	9.8	6.8	7.2	9.4	12.0	16.8
clindamycin	53.9	56.2	54.5	3.5	3.6	5.1	3.0	3.1	3.5	47.4	50.6	48.9	5.7	4.6	5.1	6.2	5.6	8.1
lincomycin	82.6	74.3	76.0	3.8	9.8	9.8	3.5	9.5	3.5	73.2	64.3	69.6	11.6	5.3	5.0	11.9	10.1	15.2
carbadox	103.5	98.7	99.9	7.5	7.8	10.7	8.9	13.2	6.0	91.8	89.3	89.5	9.6	7.8	13.2	4.2	5.3	9.6
ormetoprim	75.6	79.2	74.8	5.3	2.7	5.4	7.1	4.5	4.4	68.1	73.8	69.3	7.1	8.8	10.6	5.3	3.6	9.4
caffeine	57.5	63.0	56.5	5.5	5.0	7.6	6.6	6.1	4.0	48.2	55.7	49.8	6.0	5.0	6.1	4.9	6.5	6.9
carbamazepine	73.3	68.5	77.7	10.7	8.7	9.4	7.9	5.9	7.2	62.8	60.4	70.2	10.2	8.7	5.9	13.0	12.2	18.5

chemical	Seawater									Wastewater								
	Mean corrected recovery (%)			Intra-day precision (%)			Inter-day precision (%)			Mean corrected recovery (%)			Intra-day precision (%)			Inter-day precision (%)		
	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L	1 ng/L	10 ng/L	20 ng/L
codeine	74.4	68.7	71.0	5.4	3.6	7.9	6.9	5.1	2.6	68.8	66.8	66.7	4.6	5.6	5.1	8.1	6.4	7.7
digoxigenin	90.2	97.4	90.6	6.2	6.4	8.2	7.7	7.9	5.9	81.4	89.8	86.2	6.9	6.4	7.9	5.4	6.7	5.5
1,7-dimethylxanthine	75.4	81.8	89.5	6.6	4.4	3.5	8.9	10.7	9.8	68.6	73.5	80.8	11.0	14.3	17.9	7.4	11.2	4.5
thiabendazole	100.3	95.4	96.5	3.3	2.0	2.1	4.0	2.7	3.9	94.4	89.0	88.9	9.2	11.1	11.8	8.5	11.4	9.9
trimethoprim	94.2	96.2	93.2	6.3	5.2	9.5	9.8	8.7	5.5	84.1	89.8	87.6	4.9	5.2	8.7	6.9	6.0	8.3

a MQL was below spiked concentration.

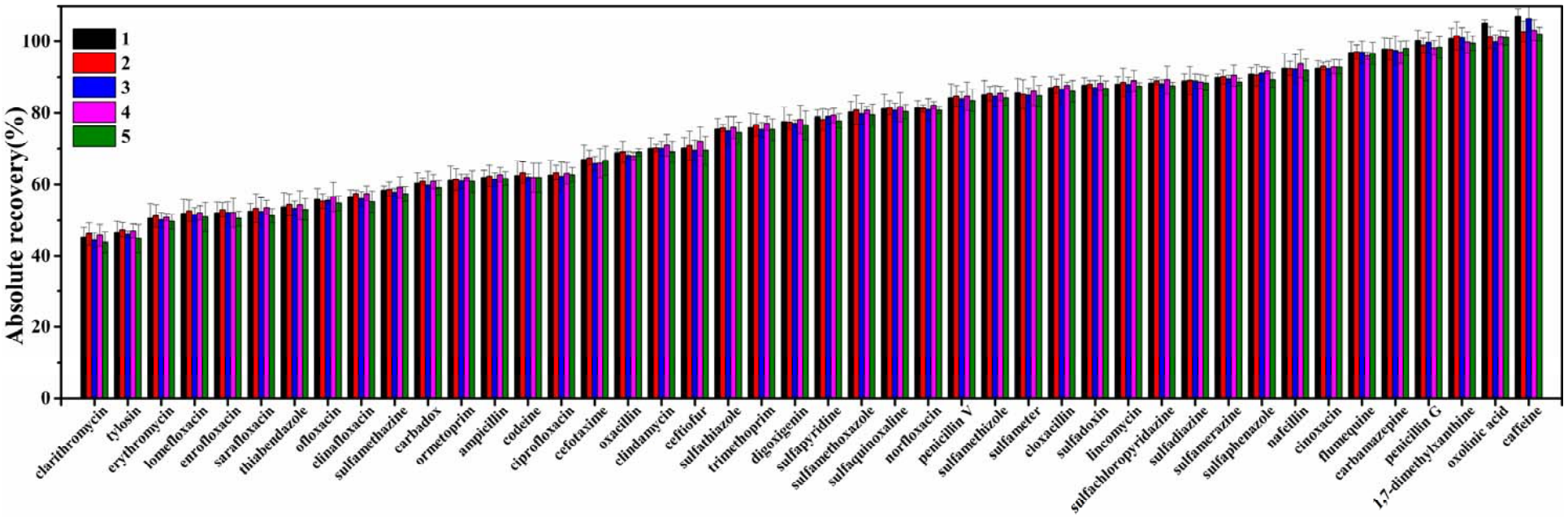

Fig. S1 Absolute recoveries of PPCPs for GCHM with five batches. Error bars represent one standard deviation of six duplicates.