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Supplementary Information

Investigation of the Environmental Transport of Human Pharmaceuticals to Surface Water: A Case Study of Persistence of Pharmaceuticals in Effluent of Sewage Treatment Plants and Hospitals in Malaysia

Fouad F. Al-Qaim,[a,b] Md P. Abdullah,*[,a,c] Mohamed R. Othman,[a,c] Zainab H. Mussa,[a] Zuriati Zakaria,[d] Jalifah Latip[a] and Wan M. Afiq[a]

[a]*School of Chemical Sciences and Food Technology, Faculty of Science and Technology, Universiti Kebangsaan Malaysia (UKM), 43600 Bangi, Selangor, Malaysia*

[b]*Department of Chemistry, Faculty of Sciences for Women, Babylon University, PO Box 4, 51001 Hilla, Iraq*

[c]*Centre for Water Research and Analysis (ALIR), Faculty of Science and Technology, Universiti Kebangsaan Malaysia (UKM), 43600 Bangi, Selangor, Malaysia*

[d]*Environmental and Green Technology, Malaysia-Japan International Institute of Technology (MJIIT), Universiti Teknologi Malaysia, 54100 Kuala Lumpur, Malaysia*

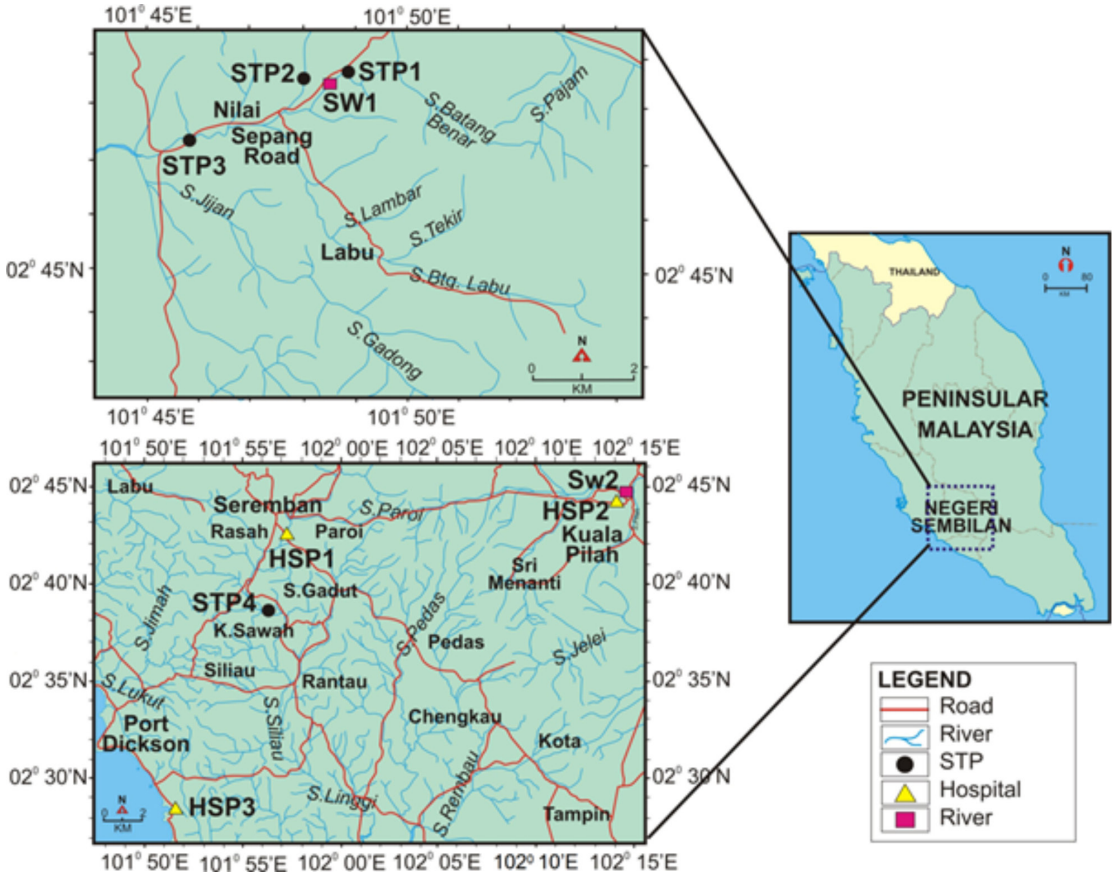

Figure S1. Map describing sampling points.

*e-mail: mpauzi@ukm.edu.my

Table S1. Absolute recoveries (AR, in %) of the studied pharmaceuticals reported in the literature and absolute and relative recoveries (RR, %, relative to the internal standard) in the present study

Compound	AR[a] ± SD, n = 6 / % RR[b] ± SD / %					
	DIW	SW	INF HSP	EFF HSP	INF STP	EFF STP
Caffeine	96 ± 19 101 ± 10	65 ± 8 121 ± 12	56 ± 5 118 ± 1	55 ± 7 118 ± 5	50 ± 11 84 ± 5	53 ± 9 115 ± 4
Prazosin	86 ± 19	57 ± 13	84 ± 9	52 ± 21	97 ± 19	52 ± 12
Enalapril	87 ± 15	79 ± 5	86 ± 20	32 ± 13	18 ± 3	73 ± 14
Carbamazepine	89 ± 18	36 ± 9	68 ± 18	25 ± 13	65 ± 4	51 ± 15
Nifedipine	32 ± 14	10 ± 4	36 ± 9	3 ± 1.4	2 ± 1.1	7 ± 4
Levonorgestrel	90 ± 19	36 ± 13	90 ± 32	53 ± 13	79 ± 8	56 ± 19
Simvastatin	58 ± 11 100 ± 9	23 ± 19 88 ± 10	80 ± 13 116 ± 8	40 ± 22 96 ± 4	14 ± 11 90 ± 24	56 ± 28 101 ± 14
Hydrochlorothiazide	50 ± 9	73 ± 16	45 ± 10	42 ± 3	42 ± 18	95 ± 3
Gliclazide	101 ± 4	53 ± 10	60 ± 18	32 ± 20	24 ± 8	56 ± 7
Diclofenac-Na	81 ± 3 93 ± 20	53 ± 14 82 ± 9	179 ± 20 104 ± 21	24 ± 7 100 ± 14	32 ± 6 96 ± 10	41 ± 8 122 ± 16
Mefenamic acid	84 ± 16	44 ± 24	58 ± 25	24 ± 1	63 ± 31	69 ± 19

[a]AR: absolute recovery at spiking level; 0.5, 1, 2 and 5 μg L^{-1} for 1000 mL DIW, 500 mL SW, 250 mL effluent STP and HSP and 100 mL influent STP and HSP, respectively; [b]RR: relative recovery for previous studies.[1-6]

Table S2. Method validation parameters

Compound	Linearity range (No. points)	Equation	R^2	IQL / (μg L^{-1})	LOQ / (ng L^{-1})					
					DW	SW	STP INF	STP EFF	HSP INF	HSP EFF
CAF	5 μg L^{-1}-1 mg L^{-1} (6)	Y = 763.873X + 9400.4	0.999	5	3	7	38	15	32	22
PRZ	1.5 μg L^{-1}-3 mg L^{-1} (9)	Y = 2311.4X – 2485.35	0.999	1.5	1	1.7	11	6.9	20	3
ENL	0.8-400 μg L^{-1} (5)	Y = 7547.75X – 3244.21	0.998	0.8	0.4	1.7	36	2.2	5	2.8
CBZ	1.5 μg L^{-1}-0.8 mg L^{-1} (7)	Y = 4064.14X – 21190.1	0.993	1.5	0.7	1.6	22	4	19	2.9
NFD	0.8-125 μg L^{-1} (8)	Y = 8463.44X – 3538.7	0.998	0.8	2	11	98	20	267	28
GLC	0.3 μg L^{-1}-3 mg L^{-1} (10)	Y = 2687.3X – 9402.3	0.993	0.3	1.4	4	21	6	27	10
LNG	5 μg L^{-1}-5 mg L^{-1} (9)	Y = 811.38X – 299.341	0.991	5	2.4	6.8	24	10	28	10
SMV	0.8-125 μg L^{-1} (8)	Y = 14930.1X – 49270.9	0.997	0.8	0.6	2	15	4	11	5.3
HYD	3 μg L^{-1}-1.5 mg L^{-1} (7)	Y = 267.49X + 670.409	0.992	3	1.6	7.4	40	19	47	15
DIC-Na	5-400 μg L^{-1} (4)	Y = 276.641X – 248.757	0.999	5	3	12	182	46	111	15
MEF	1.5-20 μg L^{-1} (5)	Y = 1811.11X + 69.6	0.993	1.5	1	4	61	5	13	21

CAF: caffeine; PRZ: prazosin; ENL: enalapril; CBZ: carbamazepine; NFD: nifedipine; LNG: levonorgestrel; SMV: simvastatin; HYD: hydrochlorothiazide; GLC: gliclazide; DIC-Na: diclofenac-Na; MEF: mefenamic acid.

Table S3. Effect of injection volume, lab movement and mobile phase flow on the robustness of LC method

Robustness parameter	Retention time / min										
	CAF	PRZ	ENL	CBZ	NFD	LNG	SMV	HYD	GLC	DIC-Na	MEF
10 µL	6.47	6.95	7.44	–	9.28	10.12	11.57	6.63	9.69	10.4	10.96
20 µL	6.47	6.97	7.67	8.52	9.29	10.14	11.58	6.64	9.71	10.41	10.97
30 µL	6.44	6.96	7.68	8.51	9.28	10.14	11.56	6.67	9.68	10.4	10.98
40 µL	6.45	6.95	7.65	8.52	9.27	10.12	11.58	6.69	9.69	10.41	10.98
Lab1	6.51	6.95	7.62	8.51	9.27	10.13	11.59	6.65	9.71	10.4	10.98
Lab2	6.51	6.93	7.6	8.49	9.29	10.11	11.57	6..71	9.72	10.38	10.89
0.29 mL min^{-1}	6.63	7.11	7.83	8.68	9.44	10.31	11.87	6.81	9.92	10.61	11.20
0.3 mL min^{-1}	6.4	6.94	7.65	8.49	9.26	10.09	11.58	6.66	9.70	10.39	11.00
0.31 mL min^{-1}	6.26	6.76	7.46	8.25	8.95	9.82	11.29	6.43	9.42	9.96	10.62
Average	6.46	6.95	7.62	8.50	9.26	10.11	11.58	6.65	9.69	10.37	10.95
Standard deviation	0.10	0.09	0.12	0.12	0.13	0.13	0.15	0.10	0.13	0.17	0.15
Relative standard deviation / %	1.5	1.3	1.7	1.5	1.5	1.3	1.4	1.5	1.3	1.6	1.4

CAF: caffeine; PRZ: prazosin; ENL: enalapril; CBZ: carbamazepine; NFD: nifedipine; LNG: levonorgestrel; SMV: simvastatin; HYD: hydrochlorothiazide; GLC: gliclazide; DIC-Na: diclofenac-Na; MEF: mefenamic acid; Lab 1, Lab 2: instrument has been moved to another place.

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