

Supporting Information

Table S1. Geographic positioning system (GPS) coordinates of the sampling sites for wastewater treatment plant (WWTP) influent and effluent and Zarqa River (ZR) water. Data from Shigei et al. (2020)

No.	Sampling site	North	East
1	Assamra WWTP influent	32° 08.875'N	36° 10.139' E
2	Assamra WWTP effluent	32° 08.728'N	36° 10.345'E
3	ZR-Sukhna station	32° 06.902'N	36° 03.487'E
4	ZR, Twahin Eledwan station	32° 12.240'N	35° 59.245'E
5	ZR, Military station	32° 12.923' N	35° 53.44' E
6	Jerash stream	32° 12.898'N	35° 53.287'E

Table S2. List of pharmaceutically active compounds (PhACs, including antibiotics) targeted in analysis of liquid samples and their chemical and physical properties (chemical formula, molecular weight (MW), logarithmic octanol-water distribution coefficient (log K_{ow}), organic carbon-water partition coefficient (K_{oc}), logarithmic dissociation constant (pKa), and water solubility at 25 °C(mg/L). Values without any reference superscript (+) were modeled and taken from ChemSpider (2020)

Compounds	Formula	MW	Log K_{ow}	K_{oc}	pKa ⁺⁺	Water solubility ⁺
Anti-epileptic and serotonin suppressive re-uptake inhibitory PhACs						
Carbamazepine	C ₁₅ H ₁₂ N ₂ O	236.30	2.45	3871	13.9	17.66
Citalopram	C ₂₀ H ₂₁ FN ₂ O	324.39	3.74 ⁺	25370	9.78	31.09
Fluoxetine	C ₁₇ H ₁₈ F ₃ NO	309.33	4.05	2.07E+05	9.8	38.35
Oxazepam	C ₁₅ H ₁₁ ClN ₂ O ₂	286.71	3.34	1207	1.55, 10.9	20.71
Sertraline	C ₁₇ H ₁₇ Cl ₂ N	306.23	5.29 ⁺	3.42E+05	9.16	3.517
Risperidone	C ₂₃ H ₂₇ FN ₄ O ₂	410.5	3.49 ⁺	4.42E+06	8.76	2.763
Stimulant						
Caffeine	C ₈ H ₁₀ N ₄ O ₂	194.19	-0.07	10	14	2632
Anti-fungal						
Ketoconazole	C ₂₆ H ₂₈ Cl ₂ N ₄ O ₄	531.43	4.34	3000	4.6	0.29 ⁺⁺⁺⁺
Antidiabetic						
Metformin	C ₄ H ₁₁ N ₅	129.16	-1.40 ⁺	140.9	12.4	1.00 × 10 ⁶
Beta-blockers						
Atenolol	C ₁₄ H ₂₂ N ₂ O ₃	266.34	0.16	148.1	9.6	685.2
Amlodipine	C ₂₀ H ₂₅ ClN ₂ O ₅	408.90	3.00	3334	9.4	75.32
Metoprolol	C ₁₅ H ₂₅ NO ₃	267.36	1.88	62.24	9.7	4777
Bisoprolol	C ₁₈ H ₃₁ NO ₄	311.40	1.87	32.85	9.5	2240
Propranolol	C ₁₆ H ₂₁ NO ₂	259.34	3.48	1218	9.42	228
Anti-inflammatory						
Paracetamol	C ₈ H ₉ NO ₂	151.16	0.46	61.72	-4.4	3.04 × 10 ⁴
Antibiotics						
Ciprofloxacin	C ₁₇ H ₁₈ FN ₃ O ₃	331.34	0.28	35.51	6.09	1.148 × 10 ⁴
Clarithromycin	C ₃₈ H ₆₉ NO ₁₃	747.95	3.16	150	8.99	1.693
Clindamycin	C ₁₈ H ₃₃ ClN ₂ O ₅ S	424.98	2.16	58.59	7.79	30.61
Doxycycline	C ₂₂ H ₂₄ N ₂ O ₈	444.44	-0.02	64.63	3.09	312.9

Erythromycin	C ₃₇ H ₆₇ NO ₁₃	733.93	3.06	570	8.88	4.2
Ofloxacin	C ₁₈ H ₂₀ FN ₃ O ₄	361.37	-2.00 ⁺	44.44	5.97, 9.28	6.762 × 10 ⁵
Linezolid	C ₁₆ H ₂₀ FN ₃ O ₄	337.35	1.26 ⁺	243.3	1.8	613.5
Metronidazole	C ₆ H ₉ N ₃ O ₃	171.15	-0.02	10	2.38	2.573 × 10 ⁴
Moxifloxacin	C ₂₁ H ₂₄ FN ₃ O ₄	401.43	0.95 ⁺	158.6	5.69, 9.42	1146
Norfloxacin	C ₁₆ H ₁₈ FN ₃ O ₃	319.33	-1.03	92.05	6.34, 8.75	1.779 × 10 ⁵
Tetracycline	C ₂₂ H ₂₄ N ₂ O ₈	444.44	-1.30	57.59	3.3	3877
Trimethoprim	C ₁₄ H ₁₈ N ₄ O ₃	290.32	0.91	905	7.12	2334
Amoxicillin	C ₁₆ H ₁₉ N ₃ O ₅ S	365.40	0.87	865.5	3.2, 11.7	3433
Ampicillin	C ₁₆ H ₁₉ N ₃ O ₄ S	349.41	1.35	534.4	2.5, 7.3	439.3
Benzylpenicillin	C ₁₆ H ₁₈ N ₂ O ₄ S	334.39	1.83	421.4	2.74	210.4
Fusidic acid ⁺⁺⁺	C ₃₁ H ₄₈ O ₆	516.71	6.75 ⁺	–	5.35	0.002376
Rifampicin	C ₄₃ H ₅₈ N ₄ O ₁₂	822.41	4.24 ⁺	–	1.7, 7.9	1400
Sulfamethoxazole	C ₁₀ H ₁₁ N ₃ O ₃ S	253.28	0.89	1531	1.6, 5.7	3942

⁺ Data estimated by EPI and obtained from www.Chemspider.com, access date 6 April 2020.

⁺⁺Data obtained from ????, access date 6 April 2020.

⁺⁺⁺ Data obtained from echa.europa.eu, access date 6 April 2020.

⁺⁺⁺⁺Data obtained from pubchem.ncbi.nlm.nih.gov/, water solubility at 20°C, access date 6 April 2020.

– Data not available

Table S3. Concentrations of total suspended solids (TSS), total solids (TS) and chemical oxygen demand (COD) samples (n=1 per site) in Assamra wastewater treatment plant (WWTP) influent and effluent and Zarqa River (ZR) water at Sukhna station, Twahin Eledwan station, Military station, and Jerash stream. Data from Shigei et al. (2020)

	Assamra WWTP influent	Assamra WWTP effluent	ZR- Sukhna Station	ZR- Twahin Eldewan station	ZR- Military station	Jerash stream
pH (SU)	7.26	7.72	8.32	7.96	8.52	7.86
TSS (mg L ⁻¹)	520	10	40	<2	40	14
TS (mg L ⁻¹)	1550	1000	1400	840	1250	4600
COD (mg L ⁻¹)	950	40	110	10	30	4.0

Table S4. Concentrations of pharmaceutically active compounds (PhACs, excluding antibiotics) in samples of Assamra wastewater treatment plant (WWTP) influent and effluent, and in Zarqa River (ZR) water at Sukhna station, Twahin Eledwan station, Military station, and Jerash stream

PhACs	Assamra WWTP influent		Assamra WWTP effluent		ZR-Sukhna station		ZR-Twahin Eledwan station		ZR- Military station		Jerash stream	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Atenolol	1952	1723	110	81	519	572	6.5	14	25.0	69	1.1	1.2
Amlodipine	11	5.8	6.4	2.2	2.7	2.8	<1	<1	1.0	3.5	<1	<1
Bisprolol	35	16	217	222	8.7	8.3	15	28	49	86	<1	<1
Carbamazepine	3020	2365	3352	3138	1940	1637	799	798	1414	2695	1.4	1.3
Citalopram	4.3	2.5	44	41	2.1	3.5	5.9	8.5	8.9	15.3	<1	<1
Diazinon	1.3	1.3	3.5	3.9	ND	1.0	<1	<1	1.1	2.5	ND	ND
Fluoxetine	1.5	<1	2.8	2.9	<1	<1	<1	<1	<1	<1	<1	<1
Ketoconazole	298	187	39	37	7.6	4.7	1.9	2.3	2.4	3.1	<1	<1
Metformin	1398	851	31	21	83	85	2.3	13	10	18	<1	<1
Metoprolol	18	496	438	406	658	7.8	35	49	97	170	<1	<1
Oxazepam	427	125	6.1	ND	47	38	48	50	ND	ND	ND	ND
Paracetamol	24309	14891	68	7.9	4871	5916	45	58	39	71	ND	ND
propranolol	<1	1.0	60	55	<1	<1	10	10	11	20	<1	<1
Risperidone	1.3	1.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sertraline	5.7	3.0	15	16	1.1	1.5	1.8	1.9	<1	1.1	<1	<1
ΣPhACs	31485	20668	4394	4032	8141	8278	970	1033	1657	3154	2.5	2.5
Caffeine	53223	27737	273	64	25646	20916	822	755	694	1287	16	18

Table S5. Concentrations of antibiotics in samples of Assamra wastewater treatment plant (WWTP) influent and effluent, and in Zarqa River (ZR) water at Sukhna station, Twahin Eledwan station, Military station, and Jerash stream

	Assamra WWTP influent		Assamra WWTP effluent		ZR-Sukhna station		ZR-Twahin Eledwan station		ZR- Military station		Jerash stream	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Fluoroquinolones												
Ciprofloxacin	ND	ND	51	44	ND	ND	3.7	2.5	3.1	5.3	ND	ND
Moxifloxacin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Norfloxacin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ofloxacin	326	116	1696	1982	34	7.0	234	119	334	595	ND	ND
Macrolides												
Clarithromycin	370	247	64	100	82	91	14	10	12	23	ND	ND
Clindamycin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Erythromycin	81	57	291	339	30	35	48	42	64	129	ND	ND
Lincomycin												
Linezolid	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Antiprotozoal												
Metronidazole	74	86	172	96	22	11	17	10	25	47	ND	ND
Tetracyclines												
Doxycycline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetracycline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sulfonamides												
Trimetoprim	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Penicilin												
Amoxicilin	ND	-	ND	ND	ND	ND	-	ND	ND	ND	ND	ND
Ampicillin	ND	-	ND	ND	ND	ND	-	ND	ND	ND	ND	ND
Benzylpenicillin	ND	-	ND	ND	ND	ND	-	ND	ND	ND	ND	ND
Others												
Fusidic acid	ND	-	ND	ND	ND	ND	-	ND	ND	ND	ND	ND
Rifampicin	ND	-	ND	ND	ND	ND	-	ND	ND	ND	ND	ND
Sulfamethoxazole	11	-	24	20	-	-	-	<1	15	20	12.5	<1
∑Antibiotics	860	510	2300	2600	170	140	320	190	450	820	12.5	<1

ND = Not detected.

(-) = could not be measured.