Table S1 (a) Landfill leachate concentrations

Geographic area	Country	Reference	Sampling years	Concentration reported (ng/L)	Max Concentration (ng/L)	RQ
		[1]	-	6,900–143,000	143000	8.411764706
America	USA	[2]	2011	200-8,000	8000	0.470588235
		[3]	2009	43,700,000–52,800,000	52800000	3105.882353
	China	[4]		3,450	3450	0.202941176
		[5]	2020	2600–19,800	19800	1.164705882
Asia		[6]	2018, 2019	11,000–50,500	50500	2.970588235
	Singapore	[7]	2015	275–2,982	2982	0.175411765
	Poland	[8]	2012, 2013	11,410–202,420	202420	11.90705882
Europe	Italy	[9]		73,700	73700	4.335294118
	Greece	[10]	2018	<lod-261,100< td=""><td>261100</td><td>15.35882353</td></lod-261,100<>	261100	15.35882353

Table S1 (b) Surface water concentrations

Geographic area	Country	Reference	Sampling years	Concentration reported (ng/L)	Max Concentration (ng/L)	RQ
		[11]	2012	44.1–130	130	0.007647059
			2012	43–701 701	701	0.041235294
		[12]	2009, 2010	8–290	290	0.017058824
		[13]	2011-2013	352.5	352.5	0.020735294
		[14]	2011,2012	19	19	0.001117647
		[15]	2011,2012	7.2–110	110	0.006470588
	USA	[16]	2009,2010	ND (Not detected)-69	69	0.004058824
		[17]	2008	12–580	580	0.034117647
		[18]	2010-2013	22.813–85.393	85.393	0.005023118
America		[19]		2.2–67	67	0.003941176
				23.3±3.0–255.7±62.5	255.7	0.015041176
		[20]	2010,2011	180	180	0.010588235
		[21]	2009,2010	4.9–21.0	21	0.001235294
		[22]	2012,2013	4–17	17	0.001
		[23]		4.9	4.9	0.000288235
		[24]		< method quantification limit		0
		[25]	2009-2019	12–450	450	0.026470588
	Canada	nda [26]		10–20	20	0.001176471
				100–450	450	0.026470588
	Brazil	[27]		$2.38 \pm 0.04 – 26 \pm 5$	26	0.001529412
		[28]	2013	30.3–546	546	0.032117647
Asia	China	[29]	2012,2013	0.8–10.2	10.2	0.0006
		[30]		6.09±0.47-20.75±2.87	20.75	0.001220588

		[31]	2013	1.87–166	166	0.009764706
		[32]	2009,2010	4–16	16	0.000941176
		[33]	2012	464±85.4	464	0.027294118
		[34]	2012	8.1	8.1	0.000476471
		[35]	2012,2013	0.24–69.74	464	0.027294118
		[36]	2015	2.5–1356.1	69.74	0.004102353
		[37]	2003-2022	2,643	2643	0.155470588
				30–24,000	24000	1.411764706
	Indonesia	[38]		<10-1,100	1100	0.064705882
	Indonesia	[39]	2008	4000	4000	0.235294118
		[40]	2018	ND-170	170	0.01
	a:	[41]	2012-2014	13.2–270	270	0.015882353
	Singapore-	[42]		55–3050	3050	0.179411765
	Korea	[43]	2008	15–88	88	0.005176471
	Denmark	[44]	2009	50	50	0.002941176
	Spain	[45]	2009,2010	5.7	5.7	0.000335294
		[46]	2012	25±10	25	0.001470588
		[47]	2008-2010	ND-140	140	0.008235294
	Germany	[48]	2011	310	310	0.018235294
		[49]	2009-2010	0.600–155.55	155.55	0.00915
Europe	Italy	[50]	2014	21.2 ± 4.4	21.2	0.001247059
		[51]	2011-2012	0.349–5.00	5	0.000294118
	Hungary	[52]	2019-2021	1,83–1,028	1028	0.060470588
	France	[53]	2022	12.8–35.4	35.4	0.002082353
		[54]	2022,2023	$24.3 \pm 5 - 132.0 \pm 4.3$	132	0.007764706
	UK	[55]	2019	25–61	61	0.003588235
	Czechia	[56]	2022,2023	141	141	0.008294118

	Norway	[57]	2016,2017	<loq-50< th=""><th>50</th><th>0.002941176</th></loq-50<>	50	0.002941176
	Sweden	[58]	2017	0.78-8.5	8.5	0.0005
	[59]		2014	0.506–1.21	1.21	7.11765E–05
Africa	Kenya	[60]	2020,2021	569	569	0.033470588

Table S1 (c) Groundwater water concentrations

Geographic area	Location	Reference	Sampling years	Concentration reported (ng/L)	Max Concentration (ng/L)	RQ
America	USA	[23]		5.4	5.4	0.000317647
	Singapore	[42]		20–2570	2570	0.151176471
Asia	China	[5]	2020	<0.16–32.0	320	0.018823529
Asia	Sri Lanka	[61]	2017, 2018	11.8–647	647	0.038058824
	India	[62]	2022	0–94000	94000	5.529411765
	UK	[63]	2011, 2012	300	300	0.017647059
	UK			60	60	0.003529412
Europe	Czechia	[56]	2022, 2023	114	114	0.006705882
	Poland	[8]	2012, 2013	19–16901	16901	0.994176471
	[59]		2014	454	454	0.026705882
Africa	Zambia	[64]	2013, 2014	1,800	1800	0.105882353

Reference

- [1] Clarke BO, Anumol T, Barlaz M, Snyder SA. 2015. Investigating landfill leachate as a source of trace organic pollutants. *Chemosphere* 127:269–275. https://doi.org/10.1016/j.chemosphere.2015.02.030
- [2] Masoner JR, Kolpin DW, Furlong ET, Cozzarelli IM, Gray JL, et al. 2014. Contaminants of emerging concern in fresh leachate from landfills in the conterminous United States. *Environmental science. Processes & impacts* 16(10):2335–2354. https://doi.org/10.1039/c4em00124a
- [3] Andrews W, Masoner J, Cozzarelli I. 2012. Emerging contaminants at a closed and an operating landfill in Oklahoma. *Groundwater Monitoring & Remediation* 32:120–130. https://doi.org/10.1111/j.1745–6592.2011.01373.x
- [4] Wu, Y., Zhou, S., Ye, X., Chen, D., Zheng, K., Qin, F., 2011. Transformation of pollutants in landfill leachate treated by a combined sequence batch reactor, coagulation, Fenton oxidation and biological aerated filter technology. *Process Safety and Environmental Protection* 89, 112–120. https://doi.org/10.1016/j.psep.2010.10.005
- [5] Han Y, Hu L, Liu T, Liu J, Wang Y, et al. 2022. Non-target, suspect and target screening of chemicals of emerging concern in landfill leachates and groundwater in Guangzhou, South China. *Science of The Total Environment* 837:155705. https://doi.org/10.1016/j.scitotenv.2022.155705
- [6] Yu X, Sui Q, Lyu S, Zhao W, Wu D, et al. 2021. Rainfall Influences Occurrence of Pharmaceutical and Personal Care Products in Landfill Leachates: Evidence from Seasonal Variations and Extreme Rainfall Episodes. *Environmental Science* & Technology 55(8):4822–4830. https://doi.org/10.1021/acs.est.0c07588
- [7] Yi X, Tran NH, Yin T, He Y, Gin KY. 2017. Removal of selected PPCPs, EDCs, and antibiotic resistance genes in landfill leachate by a full–scale constructed wetlands system. Water research 121:46–60. https://doi.org/10.1016/j.watres.2017.05.008

- [8] Kapelewska J, Kotowska U, Wiśniewska K. 2016. Determination of personal care products and hormones in leachate and groundwater from Polish MSW landfills by ultrasound–assisted emulsification microextraction and GC–MS. Environmental Science and Pollution Research International 23(2):1642–1652. https://doi.org/10.1007/s11356–015–5359–99
- [9] Baderna D, Maggioni S, Boriani E, Gemma S, Molteni M, et al. 2011. A combined approach to investigate the toxicity of an industrial landfill's leachate: chemical analyses, risk assessment and in vitro assays. *Environmental Research* 111(4):603–613. https://doi.org/10.1016/j.envres.2011.01.015
- [10] Nika MC, Ntaiou K, Elytis K, Thomaidi VS, Gatidou G, et al. 2020. Wide–scope target analysis of emerging contaminants in landfill leachates and risk assessment using Risk Quotient methodology. *Journal of Hazardous Materials* 394:122493. https://doi.org/10.1016/j.jhazmat.2020.122493
- [11] Coes AL, Paretti NV, Foreman WT, Iverson JL, Alvarez DA. 2014. Sampling trace organic compounds in water: a comparison of a continuous active sampler to continuous passive and discrete sampling methods. *Science of The Total Environment* 473–474:731–741. https://doi.org/10.1016/j.scitotenv.2013.12.082
- [12] Veach AM, Bernot MJ. 2011. Temporal variation of pharmaceuticals in an urban and agriculturally influenced stream. *Science of The Total Environment* 409(21):4553–4563. https://doi.org/10.1016/j.scitotenv.2011.07.022
- [13] Dong B, Kahl A, Cheng L, Vo H, Ruehl S, et al. 2015. Fate of trace organics in a wastewater effluent dependent stream. *Science of The Total Environment* 518–519:479–490. https://doi.org/10.1016/j.scitotenv.2015.02.074
- [14] Kolpin DW, Blazer VS, Gray JL, Focazio MJ, Young JA, et al. 2013. Chemical contaminants in water and sediment near fish nesting sites in the Potomac River basin: determining potential exposures to smallmouth bass (Micropterus dolomieu). *Science of The Total Environment* 44:700–716. https://doi.org/10.1016/j.scitotenv.2012.09.063
- [15] Fairbairn DJ, Karpuzcu ME, Arnold WA, Barber BL, Kaufenberg EF, et al. 2015.

- Sediment water distribution of contaminants of emerging concern in a mixed use watershed. Science of The Total Environment 505:896 904. https://doi.org/10.1016/j.scitotenv.2014.10.046
- [15] De Gerónimo E, Aparicio VC, Bárbaro S, Portocarrero R, Jaime S, et al. 2014. Presence of pesticides in surface water from four sub–basins in Argentina. *Chemosphere* 107:423–431. https://doi.org/10.1016/j.chemosphere.2014.01.039
- [16] Alvarez DA, Maruya KA, Dodder NG, Lao W, Furlong ET, 2014. Smalling KL. Occurrence of contaminants of emerging concern along the California coast (2009–10) using passive sampling devices. *Marine Pollution Bulletin* 81(2):347–354. https://doi.org/10.1016/j.marpolbul.2013.04.022
- [17] Writer JH, Barber LB, Brown GK, Taylor HE, Kiesling RL, et al. 2010. Anthropogenic tracers, endocrine disrupting chemicals, and endocrine disruption in Minnesota lakes. *Science of The Total Environment* 409(1):100–111. https://doi.org/10.1016/j.scitotenv.2010.07.018
- [18] Zenobio JE, Sanchez BC, Leet JK, Archuleta LC, Sepúlveda MS. 2015. Presence and effects of pharmaceutical and personal care products on the Baca National Wildlife Refuge, Colorado. *Chemosphere* 120:750–755. https://doi.org/10.1016/j.chemosphere.2014.10.050
- [19] Oppenheimer J, Eaton A, Badruzzaman M, Haghani AW, Jacangelo JG. 2011. Occurrence and suitability of sucralose as an indicator compound of wastewater loading to surface waters in urbanized regions. *Water Research* 45(13):4019–4027. https://doi.org/10.1016/j.watres.2011.05.014
- [20] Bernot MJ, Smith L, Frey J. 2013. Human and veterinary pharmaceutical abundance and transport in a rural central Indiana stream influenced by confined animal feeding operations (CAFOs). *Science of The Total Environment* 445–446:219–230. https://doi.org/10.1016/j.scitotenv.2012.12.039
- [21] Klosterhaus SL, Grace R, Hamilton MC, Yee D. 2013. Method validation and

- reconnaissance of pharmaceuticals, personal care products, and alkylphenols in surface waters, sediments, and mussels in an urban estuary. *Environment International* 54:92–99. https://doi.org/10.1016/j.envint.2013.01.009
- [22] Merel S, Nikiforov AI, Snyder SA. 2015. Potential analytical interferences and seasonal variability in diethyltoluamide environmental monitoring programs. *Chemosphere* 127:238–245. https://doi.org/10.1016/j.chemosphere.2015.02.025
- [23] Anumol T, Snyder SA. 2015. Rapid analysis of trace organic compounds in water by automated online solid–phase extraction coupled to liquid chromatography–tandem mass spectrometry. *Talanta* 132:77–86. https://doi.org/10.1016/j.talanta.2014.08.011
- [24] Bargar TA, Garrison VH, Alvarez DA, Echols KR. 2013. Contaminants assessment in the coral reefs of Virgin Islands National Park and Virgin Islands Coral Reef National Monument. *Marine Pollution Bulletin* 70(1–2):281–288. https://doi.org/10.1016/j.marpolbul.2013.03.001
- [25] Elliott SM, King KA, Krall AL, VanderMeulen DD. 2024. Trace organic contaminants in U.S. national park surface waters: Prevalence and ecological context. *Environmental Pollution* 362:125006. https://doi.org/10.1016/j.envpol.2024.125006
- [26] Lawrence JR, Waiser MJ, Swerhone GDW, Roy JL, Paule A, et al. 2019. N,N-Diethyl-m-Toluamide Exposure at an Environmentally Relevant Influences Microbial Concentration River Community Development. 38(11):2414-2425. Environmental *Toxicology* and Chemistry https://doi.org/10.1002/etc.4550
- [27] Sodré FF, Santana JS, Sampaio TR, Brandão CC. 2018. Seasonal and spatial distribution of caffeine, atrazine, atenolol and DEET in surface and drinking waters from the Brazilian Federal District. *Journal of the Brazilian Chemical Society* 29(9), 1854-1865. https://doi.org/10.21577/0103-5053.20180061

- [28] Dai G, Wang B, Huang J, Dong R, Deng S, et al. 2015. Occurrence and source apportionment of pharmaceuticals and personal care products in the Beiyun River of Beijing, China. *Chemosphere* 119:1033–1039. https://doi.org/10.1016/j.chemosphere.2014.08.056
- [29] Sun J, Luo Q, Wang D, Wang Z. 2015. Occurrences of pharmaceuticals in drinking water sources of major river watersheds, China. *Ecotoxicology and Environmental Safety* 117:132–140. https://doi.org/10.1016/j.ecoenv.2015.03.032
- [30] Zhu S, Chen H, Li J. 2013. Sources, distribution and potential risks of pharmaceuticals and personal care products in Qingshan Lake basin, Eastern China. *Ecotoxicology and Environmental Safety* 96:154–159. https://doi.org/10.1016/j.ecoenv.2013.06.033
- [31] Liu W, Zhao J, Liu Y, Chen Z, Yang Y, et al. 2015. Biocides in the Yangtze River of China: spatiotemporal distribution, mass load and risk assessment. Environmental Pollution 200:53–63. https://doi.org/10.1016/j.envpol.2015.02.013
- [32] Qi W, Müller B, Pernet-Coudrier B, Singer H, Liu H, et al. 2014. Organic micropollutants in the Yangtze River: seasonal occurrence and annual loads. Science of The Total Environment 472:789–799. https://doi.org/10.1016/j.scitotenv.2013.11.019
- [33] Chen ZF, Ying GG, Liu YS, Zhang QQ, Zhao JL, et al. 2014. Triclosan as a surrogate for household biocides: an investigation into biocides in aquatic environments of a highly urbanized region. *Water Research* 58:269–279. https://doi.org/10.1016/j.watres.2014.03.072
- [34] Wang Z, Zhang X, Huang Y, Wang H. 2015. Comprehensive evaluation of pharmaceuticals and personal care products (PPCPs) in typical highly urbanized regions across China. *Environmental Pollution* 204:223–232. https://doi.org/10.1016/j.envpol.2015.04.021
- [35] Zhang NS, Liu YS, Van den Brink PJ, Price OR, Ying GG. 2015. Ecological risks

- of home and personal care products in the riverine environment of a rural region in South China without domestic wastewater treatment facilities. *Ecotoxicology and Environmental Safety* 122:417–425. https://doi.org/10.1016/j.ecoenv.2015.09.004
- [36] Ma R, Wang B, Yin L, Zhang Y, Deng S, et al. 2017. Characterization of pharmaceutically active compounds in Beijing, China: Occurrence pattern, spatiotemporal distribution and its environmental implication. *Journal of Hazardous Materials* 323:147–155. https://doi.org/10.1016/j.jhazmat.2016.05.030
- [37] Zhang L, Zhang X, Liu C, Ma D, Wang H, 2024. Distribution and ecological risks of pharmaceuticals and personal care products with different anthropogenic pressures in typical watersheds in China. *Science of The Total Environment* 957:177573. https://doi.org/10.1016/j.scitotenv.2024.177573
- [38] Dsikowitzky, L., Dwiyitno, Heruwati, E., Ariyani, F., Irianto, H.E., Schwarzbauer, J., 2014. Exceptionally high concentrations of the insect repellent N,N-diethyl-m-toluamide (DEET) in surface waters from Jakarta, Indonesia. *Environmental Chemistry Letters* 12, 407–411. https://doi.org/10.1007/s10311-014-0462-6
- [39] Dsikowitzky L, Nordhaus I, Jennerjahn TC, Khrycheva P, Sivatharshan Y, et al. 2011. Anthropogenic organic contaminants in water, sediments and benthic organisms of the mangrove–fringed Segara Anakan Lagoon, Java, Indonesia.

 Marine Pollution** Bulletin** 62(4): 851–862. https://doi.org/10.1016/j.marpolbul.2011.02.023
- [40] Sudaryanto, A., Witama RO, Nosaki K, Tanoue R, Suciati F, et al. 2023. Occurrence of emerging contaminants in Jakarta Bay, Indonesia: pharmaceuticals and personal care products. *IOP Conference Series: Earth and Environmental* Science 1137, 012050. https://doi.org/10.1088/1755-1315/1137/1/012050
- [41] You L, Nguyen VT, Pal A, Chen H, He Y, et al. 2015. Investigation of

- pharmaceuticals, personal care products and endocrine disrupting chemicals in a tropical urban catchment and the influence of environmental factors. *Science of The Total Environment* 536:955–963. https://doi.org/10.1016/j.scitotenv.2015.06.041
- [42] Tran NH, Hu J, Ong SL. 2013. Simultaneous determination of PPCPs, EDCs, and artificial sweeteners in environmental water samples using a single–step SPE coupled with HPLC–MS/MS and isotope dilution. *Talanta* 113:82–92. https://doi.org/10.1016/j.talanta.2013.03.072
- [43] Yoon Y, Ryu J, Oh J, Choi BG, Snyder SA. 2010. Occurrence of endocrine disrupting compounds, pharmaceuticals, and personal care products in the Han River (Seoul, South Korea). Science of The Total Environment 408(3):636–643. https://doi.org/10.1016/j.scitotenv.2009.10.049
- [44] Rasmussen JJ, Baattrup-Pedersen A, Wiberg-Larsen P, McKnight US, Kronvang, B. 2011. Buffer strip width and agricultural pesticide contamination in Danish lowland streams: Implications for stream and riparian management. *Ecological Engineering* 37:1990–1997. https://doi.org/10.1016/j.ecoleng.2011.08.016
- [45] Robles–Molina J, Gilbert–López B, García–Reyes JF, Molina–Díaz A. 2014. Monitoring of selected priority and emerging contaminants in the Guadalquivir River and other related surface waters in the province of Jaén, South East Spain. Science of The Total Environment 479–480:247–257. https://doi.org/10.1016/j.scitotenv.2014.01.121
- [46] Pintado–Herrera MG, González–Mazo E, Lara–Martín PA. 2014. Atmospheric pressure gas chromatography–time–of–flight–mass spectrometry (APGC–ToF–MS) for the determination of regulated and emerging contaminants in aqueous samples after stir bar sorptive extraction (SBSE). *Analytica Chimica Acta* 851:1–13. https://doi.org/10.1016/j.aca.2014.05.030
- [47] Dsikowitzky L, Botalova O, Illgut S, Bosowski S, Schwarzbauer J. 2015.

- Identification of characteristic organic contaminants in wastewaters from modern paper production sites and subsequent tracing in a river. *Journal of Hazardous Materials* 300:254–262. https://doi.org/10.1016/j.jhazmat.2015.07.001
- [48] Ruff M, Mueller MS, Loos M, Singer HP. 2015. Quantitative target and systematic non-target analysis of polar organic micro-pollutants along the river Rhine using high-resolution mass-spectrometry—Identification of unknown sources and compounds. *Water Research* 87:145–154. https://doi.org/10.1016/j.watres.2015.09.017
- [49] Calza P, Medana C, Raso E, Giancotti V, Minero C. 2011.
 N,N-diethyl-m-toluamide transformation in river water. Science of The Total
 Environment 409(19):3894–3901. https://doi.org/10.1016/j.scitotenv.2011.06.006
- [50] Celano R, Piccinelli AL, Campone L, Rastrelli L. 2014. Ultra–preconcentration and determination of selected pharmaceutical and personal care products in different water matrices by solid–phase extraction combined with dispersive liquid–liquid microextraction prior to ultra high pressure liquid chromatography tandem mass spectrometry analysis. *Journal of Chromatography A* 1355:26–35. https://doi.org/10.1016/j.chroma.2014.06.009
- [51] Loos R, Tavazzi S, Paracchini B, Canuti E, Weissteiner C. 2013. Analysis of polar organic contaminants in surface water of the northern Adriatic Sea by solid–phase extraction followed by ultrahigh–pressure liquid chromatography–QTRAP® MS using a hybrid triple–quadrupole linear ion trap instrument. *Analytical and Bioanalytical Chemistry* 405(18):5875–5885. https://doi.org/10.1007/s00216–013–6944–8
- [52] Erdélyi N, Gere D, Engloner A, Vargha M. 2024. Temperature–driven and discharge–driven variability of organic micropollutants in a large urban river and its implications for risk–based monitoring. *Chemosphere* 363:142803. https://doi.org/10.1016/j.chemosphere.2024.142803
- [53] Gandar A, Giraudo M, Perion T, Houël E, Noguer T, et al. 2025. Targeted and untargeted discovery of UV filters and emerging contaminants with

- environmental risk assessment on the Northwestern Mediterranean coast. *Marine Pollution Bulletin* 212:117567. https://doi.org/10.1016/j.marpolbul.2025.117567
- [54] Folorunsho O, Bogush A, Kourtchev I. 2025. Occurrence of emerging and persistent organic pollutants in the rivers Cam, Ouse and Thames, UK. The *Science of The Total Environment* 962:178436. https://doi.org/10.1016/j.scitotenv.2025.178436
- [55] Dawood A, Drage DS, Harrad S, Abdallah MAE. 2024. Concentrations, partitioning and ecological risk of pharmaceuticals and personal care products in UK freshwater sediment. *Environmental Pollution and Management* 1:87–98. https://doi.org/10.1016/j.epm.2024.08.006
- [56] Oppeltová P, Vlček V, Geršl M, Chaloupský P, Ulrich O, et al. 2024. Occurrence and path pollution of emerging organic contaminants in mineral water of hranice hypogenic karst. *Frontiers in Environmental Science* 12. https://doi.org/10.3389/fenvs.2024.1339818
- [57] Choi Y, Kim K, Kim D, Moon H, Jeon J. 2020. Ny-Ålesund-oriented organic pollutants in sewage effluent and receiving seawater in the Arctic region of Kongsfjorden. *Environmental Pollution* 258:113792. https://doi.org/10.1016/j.envpol.2019.113792
- [58] Rehrl AL, Golovko O, Ahrens L, Köhler S. 2020. Spatial and seasonal trends of organic micropollutants in Sweden's most important drinking water reservoir. *Chemosphere* 249:126168. https://doi.org/10.1016/j.chemosphere.2020.126168
- [59] Brumovský M, Bečanová J, Kohoutek J., Borghini M, Nizzetto L. 2017. Contaminants of emerging concern in the open sea waters of the Western Mediterranean. *Environmental Pollution* 229:976–983. https://doi.org/10.1016/j.envpol.2017.07.082
- [60] Chebii F, K'oreje K, Okoth M, Lutta S, Masime P, et al. 2024. Occurrence and

- environmental risks of contaminants of emerging concern across the River Athi Basin, Kenya, in dry and wet seasons. *Science of The Total Environment* 914:169696. https://doi.org/10.1016/j.scitotenv.2023.169696
- [61] Chandrajith R, Zwiener C, Daniel C, Amann K., Nanayakkara N, et al. 2025. Screening of Micro-organic Compounds in Groundwater from Areas with Chronic Kidney Disease of Unclear Aetiology (CKDu) in the Dry Zone of Sri Lanka. *Exposure and Health* 17:167–176. https://doi.org/10.1007/s12403-024-00651-7
- [62] Sridhar D, Parimalarenganayaki S. 2025. Evaluation of sources, spatial and temporal distribution, ecological and health risk associated with CAF (Caffeine) and DEET (N, N-diethyl-meta-toluamide) contamination in the urban groundwater parts of Vellore city, Tamilnadu, India. *Environmental Geochemistry* and Health 47(2):44. https://doi.org/10.1007/s10653-024-02351-2
- [63] Stuart ME, Lapworth DJ, Thomas J, Edwards L. 2014. Fingerprinting groundwater pollution in catchments with contrasting contaminant sources using microorganic compounds. *Science of The Total Environment* 468–469: 564–577. https://doi.org/10.1016/j.scitotenv.2013.08.042
- [64] Sorensen JP, Lapworth DJ, Nkhuwa DC, Stuart ME, Gooddy DC, et al. 2015.
 Emerging contaminants in urban groundwater sources in Africa. Water Research
 72:51–63. https://doi.org/10.1016/j.watres.2014.08.002