

Review

Polycyclic Aromatic Hydrocarbons (PAHs) in Freshwater Systems: A Comprehensive Review of Sources, Distribution, and Impacts

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Supplementary Materials

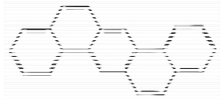
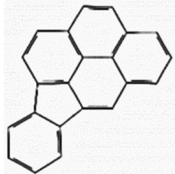
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Table S1. Physical properties and chemical structure of the 16 USEPA priority PAHs.

No.	Name	CS ^(a)	Rings	Class. ^(b)	MW ^(c)	BP ^(d)	MP ^(e)	S ^(f)	Log K _{ow} ^(g)	VP ^(h)
1	Naphthalene		2	LMW	128.17	209	80	31.0	3.37	8.89E ⁻²
2	Acenaphthylene		3	LMW	152.19	290	124	16.1	4.00	2.90E ⁻⁰²
3	Acenaphthene		3	LMW	154.21	252	108	3.8	3.92	3.75E ⁻³
4	Fluorene		3	LMW	166.22	276	119	1.9	4.18	3.24E ⁻³
5	Phenanthrene		3	LMW	178.23	326	136	1.1	4.57	6.80E ⁻⁴
6	Anthracene		3	LMW	178.23	326	136	0.045	4.54	2.55E ⁻⁵
7	Fluoranthene		4	HMW	202.25	369	166	0.26	5.22	8.13E ⁻⁶
8	Pyrene		4	HMW	202.25	369	166	0.132	5.18	4.25E ⁻⁶
9	Benzo[a]anthracene		4	HMW	228.30	400	177	0.011	5.91	1.54E ⁻⁷
10	Chrysene		4	HMW	228.30	400	177	0.0015	5.91	7.80E ⁻⁹
11	Benzo[b]fluoranthene		5	HMW	252.30	461	209	0.0015	5.80	8.06E ⁻⁸
12	Benzo[k]fluoranthene		5	HMW	252.30	430	194	0.0008	6.00	9.59E ⁻¹¹
13	Benzo[a]pyrene		5	HMW	252.30	461	209	0.0038	5.91	4.89E ⁻⁹

14	Indeno[1,2,3-cd]pyrene		6	HMW	276.30	498	233	0.062	6.50	1.40E ⁻¹⁰
15	Dibenz[a,h]anthracene		6	HMW	278.30	487	218	0.0005	6.75	2.10E ⁻¹¹
16	Benzo[g,h,i]perylene		6	HMW	276.30	467	218	0.00026	6.50	1.00E ⁻¹⁰

(a) CS: Chemical structure [1]; (b) Classification as LMW-PAHs and HMW-PAHs; (c) MW: Molecular weight in g/mol [1]; (d) BP: Boiling point in °C [2]; (e) MP: Melting point in °C [2]; (f) S: Water solubility at 25°C [3]; (g) Log K_{ow}: Octanol water partitioning [4]; (h) VP: Vapor pressure mmHg at 25°C [3].

Table S2. Origin and sources of PAHs in various types of freshwater systems.

Freshwater system	Site name and Location	Environmental matrix	PAH Origin	PAH source	Reference
lake	Tangxun and Dong Lake, Wuhan, China	water	mixed	Petroleum biomass heavy oils natural gas	[5]
lake	Soltair and Fairbank, Central Ontario, Canada	sediment	pyrogenic	particulate deposition grass wood gasoline coal	[6]
lake	Shangai, China	sediment	pyrogenic	vehicle emission coal biomass natural gas combustion	[7]
lake	Lake Baikal, Siberia	aerosol	pyrogenic	wildfires	[8]
lake	Lake Baikal, Russia	water aerosol	pyrogenic	wildfires	[9]
river	Jiulong River watershed and estuary, southeast China	water	pyrogenic	fossil fuel combustion petroleum combustion biomass combustion	[10]
river	Rur River catchment, North Rhine-West-phalia, Germany	water sediment	petrogenic	wastewater	[11]
river	Liujiang River Basin, China	sediment	pyrogenic	coal wood weed petroleum gasoline kerosene crude oil	[12]
river	Buffalo River Estuary, South Africa	water sediment	pyrogenic	highway runoff biomass combustion domestic wastes stormwater runoff	[13]
river	Nun River, Bayelsa State, Nigeria	water	petrogenic	oil-related activities	[14]
river	Ekulu, Enugu metropolis, Nigeria	water	mixed	agricultural waste burning vehicular emissions power generators	[15]

river	Euphrates River system, Iraq	water sediment	pyrogenic	petroleum combustion vehicular emissions fossil fuel burning illegal waste disposal wastewater discharge	[16]
river	Huaihe River, China	soil	pyrogenic	vehicular emissions biomass combustion coal combustion	[17]
river	River Benue, Nigeria	sediment	mixed	coal combustion crude oil wood burning vehicular emissions	[18]
river	Yangtze River, China	water sediment	pyrogenic	coal burning coke plants biomass vehicular emissions energy consumption	[19]
river	River systems, Taiwan	sediment fish	pyrogenic	petroleum grass and wood burning coal	[20]
river	Ulhas River, India	sediment	pyrogenic	wood burning coke plants coal gasoline and diesel	[21]
river	Pitimbu River, Natal, Brazil	sediment	pyrogenic	biomass coal petroleum refined oil products	[22]
river	Eastern Tibetan Plateau, China	water	pyrogenic	coal charcoal coking discharge	[23]
river	Great Lakes tributaries, USA and Canada	sediment	petrogenic	coal-tar-sealed pavement	[24]
stream	Suzhou Industrial Park, China	sediment	pyrogenic	biomass coal petroleum	[25]
stream	Oliwski and Strzyza, Gdansk, Poland	sediment	pyrogenic	biomass coal petroleum	[26]
stream	North-central Portugal	water	pyrogenic	biomass wildfires	[27]

stream	Monastir Bay, Tunisia	sediment	mixed	road runoff domestic wastewater industrial wastewater workshops waste oil industrial activity	[28]
groundwater	Yellow River Estuary, China	water	pyrogenic	fossil fuels coal natural gas vehicular emissions	[29]
groundwater	Chongqing, Southwest, China	water soil	pyrogenic	grass wood coal	[30]
groundwater	Abou Ali River-North Lebanon	water	pyrogenic	fuel incineration miscellaneous burning	[31]
groundwater	Peri-Urban Forest Area, Braga Region, NW Portugal	water	pyrogenic	grass wood coal	[32]
groundwater	Banja Luka, Republic of Srpska, Bosnia and Herzegovina	soil	mixed	traffic emissions coal combustion biomass combustion	[33]
groundwater	Nanchuan catchment, Chongqing, Southwest, China	soil water	pyrogenic	coal combustion vehicular emissions	[34]
groundwater	Lanzhou, Shijiazhuang, and Golmud and Du'an County, China	water	mixed	oil pipeline leakage coal combustion wood and straw burning	[35]
groundwater	Campania Plain, South Italy	water	pyrogenic	carbon and fuel	[36]
groundwater	Eleme, Nigeria	water soil	mixed	petroleum extraction	[37]
wetland	Shadegan wetland, Iran	sediment water	mixed	bulrush burning biomass combustion heavy gasoline oils lubricating oils used motor oils	[38]
wetland	Anzali Wetland, Caspian Sea, Iran	sediment	petrogenic	fuel oil light refined oil	[39]
wetland	Anzali Wetland, Caspian Sea, Iran	water sediment fish	mixed	crude oil combustion diesel fuel biomass coal and oil leakage	[40]

wetland	Coastal Industrial Zone, Tianjin, China	sediment water reed	mixed	fossil fuels combustion petroleum leakage	[41]
wetland	Ashtamudi Wetland, south-west coast, India	sediment	mixed	biomass burning fuel combustion oil leakage	[42]
wetland	Hoor Al-Azim Wetland, Iran	sediment	mixed	fossil fuel combustion oil leakage petroleum combustion	[43]
wetland	Momoge Wetland, China	soils	mixed	coal combustion petroleum spills	[44]
wetland	Miankaleh International Wetland, Iran	water sediment	mixed	fossil fuel sewage discharge port activity	[45]
wetland	Baghjan, upper Assam, India	water sediment fish	petrogenic	oil spill	[46]
peatland	Songkhla Lake Basin Swamp Forest, Thailand	air	pyrogenic	biomass and peat burning	[47]
bog	Southern Taiga of Western Siberia	water peat	pyrogenic	biomass and peat burning wildfires	[48]
marsh	Pantanal Biome, Brazil	soil	pyrogenic	biomass burning wildfires	[49]
glacier	Tibetan Plateau, China	meltwater	pyrogenic	coal incomplete combustion biomass combustion coking discharge	[23]
glacier	Kongsfjorden, Svalbard, Norway	water	pyrogenic	diesel fuel leakage heat and power generation dust from coal mining long-range transport	[50]
glacier	Kongsfjorden, Arctic	water	pyrogenic	grass wood coal	[51]
glacier	Admiralty Bay, King George Island, Maritime Antarctica	water	petrogenic	fuel consumption local human activity	[52]
glacier	King George Island, Antarctica	soil	petrogenic	electricity generators light-duty gasoline fuel consumption	[53]
glacier	Eastern Tibetean Plateau, China	water	pyrogenic	coal charcoal coking discharge	[23]

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