Supporting information:

ACTIVATED CARBON AND BIOCHAR AMENDMENTS DECREASE POREWATER CONCENTRATIONS OF POLYCYCLIC AROMATIC HYDROCARBONS (PAHs) IN SEWAGE SLUDGES

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Calculation of $K_{AC}/K_{biochar}$ for sewage sludge with AC/biochar

Sorption to AC in an AC-amended sediment was calculated with a nonlinear Freundlich isotherm (1):

$$C_S = f_{TOC} K_{TOC} C_{PW} + f_{AC} K_{AC} C_{PW}^{nF,AC} \quad (1)$$

$$K_{AC} = \frac{C_S - f_{TOC} K_{TOC} C_{PW}}{f_{AC} C_{PW}^{nF,AC}} \quad (2)$$

where C_S is HOC concentration in sediment or soil (ng/kg dry weight), C_{PW} is porewater HOC concentration determined with POM passive samplers (ng/L), f_{TOC} and f_{AC} are the fractions of TOC and AC (either freshly added or field aged), respectively. K_{TOC} and K_{AC} are the sorbent-water distribution coefficients for TOC (L/kg) and AC, respectively [(ng/kg)/(ng/L)^{nF}]. K_{TOC} was calculated as the measured distribution coefficients for unamended sediment normalized to sediment organic carbon content ($K_d=C_S/C_{PW}$ f_{OC}). Porewater concentrations were calculated from measured POM concentration using K_{POM} values in Cornelissen et al. (2) for POM-55 µm and the relationship $K_{POM}=C_{POM}/C_{PW}$. In the present study, the Freundlich exponent of AC sorption ($n_{F,AC}$) was assumed to be 0.8 based on recent modeling results by Werner et al. (3) and studies by McDonough et al. (4). Here a $n_{F,BC}$ value of 0.8 is used under the assumption that the main sorption mechanisms are similar for various PAHs in the same AC material.

Table S1. The log K_{AC} [(ng/kg)/(ng/L)^n] values determined on the basis of equation (2) for AC in AC-amended sewage sludge

PAHs	CP1						BP2					
	AC dose [%]				Average	SD	AC dose [%]				Average	SD
	0.5%	2%	5%	10%			0.5%	2%	5%	10%		
Na	6.75	6.40	6.41	5.91	6.4	0.4	6.96	6.64	6.55	5.99	6.5	0.4
Fl	7.40	7.37	7.10	6.99	7.2	0.2	7.34	7.36	7.24	7.20	7.3	0.1
Phen	8.09	7.81	8.03	7.79	7.9	0.2	7.99	8.01	8.09	7.79	8.0	0.1
Ant	8.06	7.94	7.96	7.42	7.9	0.3	8.06	8.07	7.90	7.32	7.8	0.4
Fln	8.36	7.97	8.21	8.13	8.2	0.2	8.22	8.09	7.99	7.94	8.1	0.1
Pyr	8.31	7.92	8.09	8.03	8.1	0.2	8.18	7.99	7.90	7.80	8.0	0.2
BaA	8.81	8.55	8.63	8.47	8.6	0.2	8.72	8.58	8.48	8.33	8.5	0.2
Ch	8.64	8.35	8.39	8.24	8.4	0.2	8.57	8.39	8.33	8.09	8.4	0.2
BbF	8.87	8.88	8.61	8.45	8.7	0.2	8.80	8.75	8.77	8.54	8.7	0.1
BkF	9.17	9.08	9.35	8.67	9.1	0.3	9.12	9.00	8.95	8.59	8.9	0.2
BaP	9.04	8.86	8.81	8.66	8.8	0.2	8.95	8.95	9.04	8.59	8.9	0.2
Ind	9.34	9.43	9.36	9.02	9.3	0.2	9.27	9.50	9.31	9.12	9.3	0.2
BghiP	9.42	9.60	9.16	9.17	9.3	0.2	9.44	9.42	9.25	9.19	9.3	0.1

Na – naphthalene, Fl – fluorene, Phen – phenanthrene, Ant – anthracene, Fln – fluoranthene, Pyr – pyrene, BaA – benzo[a]anthracene, Ch – chryzene, BbF – benzo[b]fluoranthene, BkF – benzo[k]fluoranthene, BaP – benzo[a]pyrene, Ind – indeno[1,2,3-cd]pyrene, BP – benzo[ghi]perylene.

Table S2. The log $K_{biochar}$ (ng/kg)/(ng/L)^n]values determined on the basis of equation (2) for biochar in biochar-amended sewage sludge

PAHs	MG						PMW					
	Biochar dose [%]				Average	SD	Biochar dose [%]				Average	SD
	0.5%	2%	5%	10%			0.5%	2%	5%	10%		
Na	6.68	6.11	5.76	5.47	6.0	0.5	6.72	6.23	5.89	5.63	6.1	0.5
Fl	6.94	6.39	6.04	5.76	6.3	0.5	6.91	6.40	6.09	5.98	6.3	0.4
Phen	7.53	6.99	6.64	6.39	6.9	0.5	7.55	7.05	6.75	6.63	7.0	0.4
Ant	7.57	6.97	6.61	6.36	6.9	0.5	7.53	6.99	6.59	6.63	6.9	0.4
Fln	7.95	7.36	7.04	6.72	7.3	0.5	7.96	7.44	7.18	6.97	7.4	0.4
Pyr	7.96	7.38	7.04	6.75	7.3	0.5	7.96	7.42	7.06	6.91	7.3	0.5
BaA	8.44	7.84	7.53	7.23	7.8	0.5	8.45	7.95	7.63	7.57	7.9	0.4
Ch	8.32	7.73	7.40	7.09	7.6	0.5	8.33	7.81	7.46	7.36	7.7	0.4
BbF	8.85	8.13	7.42	7.34	7.9	0.7	8.57	7.96	7.63	7.89	8.0	0.4
BkF	8.91	8.30	8.34	7.67	8.3	0.5	8.89	8.54	8.21	8.02	8.4	0.4
BaP	8.79	8.26	7.95	7.68	8.2	0.5	8.85	8.41	8.13	7.89	8.3	0.4
Ind	9.00	8.40	8.12	7.83	8.3	0.5	9.05	8.66	8.49	8.35	8.6	0.3
BghiP	9.18	8.53	8.32	7.98	8.5	0.5	9.18	8.84	8.93	8.71	8.9	0.2

Na – naphthalene, Fl – fluorene, Phen – phenanthrene, Ant – anthracene, Fln – fluoranthene, Pyr – pyrene, BaA – benzo[a]anthracene, Ch – chryzene, BbF – benzo[b]fluoranthene, BkF – benzo[k]fluoranthene, BaP – benzo[a]pyrene, Ind – indeno[1,2,3-cd]pyrene, BP – benzo[ghi]perylen

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