

Supplementary Material

1 Supplementary Tables

Table 1. Physicochemical properties of leachate from Bielawa landfill: raw and after treatment with *Phragmites australis* (P)/*Ceratophyllum demersum* (C). The t-test for dependent samples was used; the bold-coded differences are significant with $p < 0.05$.

Pollution indicators	Unit	Leachate										
		Raw	After treatment with <i>Phragmites australis</i> (P)/ <i>Ceratophyllum demersum</i> (C)									
			100% P	100% C	50% P	50% C	25% P	25% C	12.5% P	12.5% C	6.25% P	6.25% C
pH	-	8.42	9.05	9.4	8.79	9.34	7.52	9.24	7.5	8.98	7.65	8.11
EC	$\mu\text{S}/\text{cm}$	2318	2340	2419	1425	1423	1042	980	752	576.8	692.4	490.2
BOD	$\text{mg O}_2/\text{dm}^3$	28.4	8.2	42	8.2	19.6	7.9	9.8	7.5	4.3	6.8	2.6
COD	$\text{mg O}_2/\text{dm}^3$	321.8	154	198.8	68.9	145.2	47.6	37.5	45.8	27.7	3.9	7.5
TKN	$\text{mg N}/\text{dm}^3$	51.12	6.15	11.89	6.1	7.13	3.61	5.05	1.53	4.71	1.76	4.27
ON	$\text{mg N}_{\text{org}}/\text{dm}^3$	22.7	5.99	11.89	3.09	7.13	2.06	5.05	1.53	4.71	1.76	4.27
AN	$\text{mg N}_{\text{NH}_4}/\text{dm}^3$	28.42	0.16	0.005	3.01	0.005	1.55	0.005	0.005	0.005	0.005	0.005
TP	$\text{mg P}/\text{dm}^3$	3.11	8.23	1.86	6.39	0.85	7.49	0.5	6.62	0.34	4.52	0.24
TS	mg/dm^3	2045	2028	2196	1173	1210	822	430	531	430	535	379
TDS	mg/dm^3	1920	1864	2178	1145	1220	785	636	577	491	495	395
TSS	mg/dm^3	125	23	639	29	164	26	153	18	154	17	120
Sulphates	$\text{mg SO}_4/\text{dm}^3$	1481	268.2	207.3	79	292.9	87.2	233.7	263.2	103.6	260	162.9
Chlorides	$\text{mg Cl}/\text{dm}^3$	303	670	468	560	267	530	163	320	123	420	111
Sodium	$\text{mg Na}/\text{dm}^3$	151.8	162.9	307.5	136.9	186	83.4	96.3	72	62.1	63.5	55.4
Potassium	$\text{mg K}/\text{dm}^3$	256.2	207.4	368.5	98.6	191.5	79.3	39.8	36.5	23.5	24.6	22.1
Calcium	$\text{mg Ca}/\text{dm}^3$	150.3	188.5	60.9	144.2	52.2	110.5	22.9	105.1	30.7	118.6	24.4
Magnesium	$\text{mg Mg}/\text{dm}^3$	79.3	72.3	66.95	43.4	49.78	31	27.03	19.2	19.67	16.8	15.84
Iron	$\text{mg Fe}/\text{dm}^3$	0.5	0.1876	0.2247	0.00025	0.2114	0.2043	0.2848	0.1147	0.1616	0.4356	0.2432
Manganese	$\text{mg Mn}/\text{dm}^3$	0.35	0.064	0.0798	0.0905	0.0455	0.082	0.052	0.0334	0.0258	0.0406	0.028
Copper	$\text{mg Cu}/\text{dm}^3$	0.0457	0.00025	0.0113	0.0055	0.0122	0.00025	0.00025	0.00025	0.0005	0.3106	0.00025
Zinc	$\text{mg Zn}/\text{dm}^3$	0.1977	0.2021	0.2296	0.1821	0.1866	0.117	0.2249	0.1824	0.188	1.5581	0.2609
Chromium	$\text{mg Cr}/\text{dm}^3$	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Lead	$\text{mg Pb}/\text{dm}^3$	0.0163	0.032	0.0385	0.0092	0.0204	0.0066	0.0387	0.0215	0.0283	0.0235	0.0258
Nickel	$\text{mg Ni}/\text{dm}^3$	0.00025	0.0565	0.09	0.0563	0.0245	0.0431	0.0253	0.0547	0.0156	0.049	0.0243
Cadmium	$\text{mg Cd}/\text{dm}^3$	0.0033	0.0073	0.0092	0.0077	0.0075	0.0079	0.107	0.0071	0.0083	0.0083	0.0079

Table 2. Physicochemical properties of leachate from Wrocław landfill: raw and after treatment with *Phragmites australis* (P)/*Ceratophyllum demersum* (C). The t-test for dependent samples was used; the bold-coded differences are significant with $p < 0.05$.

Pollution indicators	Unit	Leachate										
		Raw	After treatment with <i>Phragmites australis</i> (P)/ <i>Ceratophyllum demersum</i> (C)									
			100% P	100% C	50% P	50% C	25% P	25% C	12.5% P	12.5% C	6.25% P	6.25% C
pH	-	8.16	8.58	7.79	7.53	8.17	7.39	7.37	7.37	7.64	7.6	8.39
EC	μS/cm	1800	811.7	1907.1	1999.1	1179.3	1274	747.2	943.5	591.3	677.6	449.6
BOD	mg O ₂ /dm ³	1.8	8	10.4	7.5	6.2	7.2	3.3	6	1.1	4.8	0.7
COD	mg O ₂ /dm ³	127.6	42.6	300	37.2	105	38.7	31.3	30.8	23.3	41.1	25.2
TKN	mg N/dm ³	1.09	1.76	2.31	2.07	2.37	1.27	2.13	1.25	1.67	1.28	0.43
ON	mg N _{org} /dm ³	1.07	1.76	2.31	2.07	2.37	1.27	2.13	1.25	1.67	1.28	0.43
AN	mg N _{NH4} /dm ³	0.02	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
TP	mg P/dm ³	0.22	0.36	0.24	0.92	0.44	0.43	0.24	0.7	0.18	0.3	0.16
TS	mg/dm ³	2190	2364	2246	1250	1194	879	733	599	571	689	387
TDS	mg/dm ³	1680	2251	2229	1265	1258	848	759	536	521	693	413
TSS	mg/dm ³	510	47	151	11	137	27	126	48	125	51	117
Sulphates	mg SO ₄ /dm ³	1035	1303.3	1214.5	589.1	901.8	365.3	441	350.5	352.2	241.9	250.1
Chlorides	mg Cl/dm ³	74	88	84	83	85	94	66	94	76	90	96
Sodium	mg Na/dm ³	91.2	122.6	117.8	92.7	82.3	67.1	57.8	99.5	51.6	48.2	41.6
Potassium	mg K/dm ³	61.2	49.6	73.5	18.2	36.5	13.1	11.8	2.0	6.2	247.2	3.2
Calcium	mg Ca/dm ³	309.4	349.6	284.9	248.1	216.6	207.2	97.9	152.5	55.5	137.8	39.8
Magnesium	mg Mg/dm ³	52.5	43.6	32.2	37.9	21.82	29.1	21.02	22.8	18.79	15.2	14.58
Iron	mg Fe/dm ³	0.15	0.0721	0.00025	0.2164	0.0117	0.1541	0.1907	0.1737	0.2735	0.138	0.0714
Manganese	mg Mn/dm ³	0.02	0.0464	0.0287	0.0458	0.0384	0.0537	0.0245	0.0249	0.0311	0.0414	0.024
Copper	mg Cu/dm ³	0.0486	0.00025	0.0011	0.00025	0.00025	0.00025	0.0013	0.00025	0.00025	0.00025	0.007
Zinc	mg Zn/dm ³	0.2241	0.1257	0.2293	0.1244	0.2546	0.1506	0.2986	0.2351	0.3003	0.1728	0.3504
Chromium	mg Cr/dm ³	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Lead	mg Pb/dm ³	0.0054	0.0353	0.0322	0.0419	0.0429	0.0242	0.0554	0.0295	0.0549	0.0175	0.0568
Nickel	mg Ni/dm ³	0.00025	0.0289	0.0391	0.045	0.02	0.0531	0.289	0.0481	0.0451	0.0516	0.0317
Cadmium	mg Cd/dm ³	0.0047	0.0083	0.0082	0.0093	0.0088	0.0095	0.0117	0.008	0.0114	0.01	0.0114

Table 3. Physicochemical properties of leachate from Legnica landfill: raw and after treatment with *Phragmites australis* (P)/*Ceratophyllum demersum* (C). The t-test for dependent samples was used; the bold-coded differences are significant with $p < 0.05$.

Pollution indicators	Unit	Leachate										
		Raw	After treatment with <i>Phragmites australis</i> (P)/ <i>Ceratophyllum demersum</i> (C)									
			100% P	100% C	50% P	50% C	25% P	25% C	12.5% P	12.5% C	6.25% P	6.25% C
pH	-	8.84	9.09	9.53	8.97	9.31	8.84	8.76	8.55	8.81	7.42	8.53
EC	μS/cm	7791	8109	8503	4954	5135	2765	2726	1538	1834	1132	1156.6
BOD	mg O ₂ /dm ³	76	8.2	2.6	7.9	1.5	7.9	0.3	7.9	0.2	7.9	0.2
COD	mg O ₂ /dm ³	2007	1577	1520.8	755.6	629.2	586.1	173	205.5	108	128.8	70.3
TKN	mg N/dm ³	269.85	30.38	58.2	15.72	36.05	8.84	25.25	4.7	13.08	5.7	5.5
ON	mg N _{org} /dm ³	81.69	6.79	58.2	14.29	35.33	8.66	25.25	2.44	12.24	5.54	5.5
AN	mg N _{NH4} /dm ³	188.16	23.59	0.005	1.43	0.72	0.18	0.005	2.26	0.84	0.16	0.005
TP	mg P/dm ³	3.936	10.53	6.86	5.97	3.41	23.62	2.32	7.85	1.22	12.39	0.55
TS	mg/dm ³	7395	7669	8545	4421	4701	2380	2323	1293	1520	886	929
TDS	mg/dm ³	7065	7613	7697	4314	4573	2314	2298	1227	1517	885	898
TSS	mg/dm ³	330	168	320	76	381	34	54	7	166	20	94
Sulphates	mg SO ₄ /dm ³	261.6	477.2	419.6	251.8	385.1	217.2	365.3	283	394.9	131.6	312.7
Chlorides	mg Cl/dm ³	2160	2330	2920	1930	1950	880	1010	540	840	500	650
Sodium	mg Na/dm ³	177.8	809.5	876.5	713	842	813.5	891.5	347	822	123.1	141.3
Potassium	mg K/dm ³	507.6	997.0	1024.9625	633.5	702.692	322.5	352.895	153.0	212.1685	69.8	95.6
Calcium	mg Ca/dm ³	68.1	113.05	91.1	144.9	61.3	89.2	86.7	143.6	63.8	97.8	48.5
Magnesium	mg Mg/dm ³	87.9	90.6	92.05	64	71.93	42.12	48.798	26.9	33.37	20.2	24.1
Iron	mg Fe/dm ³	2.16	2.1195	1.1168	1.443	0.5911	0.2636	0.2834	0.8727	0.1305	0.902	0.2648
Manganese	mg Mn/dm ³	0.47	0.5299	0.5171	0.2014	0.4064	0.0561	0.0967	0.0494	0.0411	0.0652	0.0396
Copper	mg Cu/dm ³	0.1448	0.0867	0.0525	0.0501	0.0221	0.0329	0.0043	0.9849	0.0099	0.0157	0.015
Zinc	mg Zn/dm ³	0.4987	0.3169	0.7841	0.3856	0.4401	0.3863	0.3927	1.9946	0.5328	0.2912	0.3813
Chromium	mg Cr/dm ³	0.1927	0.01825	0.2078	0.088	0.1126	0.0271	0.0287	0.00025	0.0148	0.00025	0.0018
Lead	mg Pb/dm ³	0.0866	0.0462	0.0752	0.0184	0.0626	0.0171	0.0439	0.0138	0.0439	0.0235	0.0366
Nickel	mg Ni/dm ³	0.1716	0.0515	0.1979	0.0304	0.1365	0.0442	0.0709	0.0514	0.0121	0.0182	0.0416
Cadmium	mg Cd/dm ³	0.0033	0.0068	0.0077	0.0074	0.0061	0.0067	0.0094	0.0079	0.0082	0.0087	0.0085

Table 4. Physicochemical properties of leachate from Jawor landfill: raw and after treatment with *Phragmites australis* (P)/*Ceratophyllum demersum* (C). The t-test for dependent samples was used; the bold-coded differences are significant with $p < 0.05$.

Pollution indicators	Unit	Leachate										
		Raw	After treatment with <i>Phragmites australis</i> (P)/ <i>Ceratophyllum demersum</i> (C)									
			100% P	100% C	50% P	50% C	25% P	25% C	12.5% P	12.5% C	6.25% P	6.25% C
pH	-	8.11	8.8	9.4	8.91	9.25	7.36	9.12	8.28	9.08	8.37	9.05
EC	$\mu\text{S}/\text{cm}$	3919	3559	3577	2351	2272	1298.2	1489.7	1365.5	1007.6	1242.2	713.6
BOD	$\text{mg O}_2/\text{dm}^3$	288	7.9	34	7.9	9.2	7.7	152.4	7.9	8.2	7.5	3.2
COD	$\text{mg O}_2/\text{dm}^3$	1765.9	887.1	441.9	792.6	84.4	660.2	88.2	147.1	40.4	53.7	20.2
TKN	$\text{mg N}/\text{dm}^3$	310.16	110.69	75.08	46.79	42.03	19.62	22.31	10.28	6.76	5.59	3.65
ON	$\text{mg N}_{\text{org}}/\text{dm}^3$	63.54	73.94	75.08	19.52	41.81	13.54	22.37	3.05	6.76	5.59	3.65
AN	$\text{mg N}_{\text{NH}_4}/\text{dm}^3$	246.62	36.75	0.005	27.45	0.22	6.09	0.04	7.23	0.005	0.005	0.005
TP	$\text{mg P}/\text{dm}^3$	12.04	0.84	13.43	0.94	0.58	0.34	2.38	2.55	1.24	0.4	0.34
TS	mg/dm^3	3890	3067	3449	1979	2054	1101	1278	998	805	636	643
TDS	mg/dm^3	2915	2693	3274	1956	1982	1073	1252	812	758	592	576
TSS	mg/dm^3	975	63	206	41	175	19	109	88	112	55	120
Sulphates	$\text{mg SO}_4/\text{dm}^3$	130.8	261.6	232	192.5	516.7	166.2	258.4	343	204.1	385	182.7
Chlorides	$\text{mg Cl}/\text{dm}^3$	660	810	870	780	560	470	480	400	350	310	420
Sodium	$\text{mg Na}/\text{dm}^3$	162.9	809.5	440.5	240.55	238	121.5	140.5	127.5	84.5	75.2	63.8
Potassium	$\text{mg K}/\text{dm}^3$	410	598.5	725.5	344.5	412	162.5	233.5	88.5	112.5	34.8	63.3
Calcium	$\text{mg Ca}/\text{dm}^3$	171.5	202.3	58.1	156.6	104.9	90.713	75.9	174.7	77.9	153.6	52.5
Magnesium	$\text{mg Mg}/\text{dm}^3$	91.2	81.7	80.72	56.1	63.05	33.6	46.27	27.2	27.63	17.5	20.2
Iron	$\text{mg Fe}/\text{dm}^3$	3.81	0.6804	0.8089	0.8416	0.4996	0.3381	0.0555	0.1039	0.2139	0.2477	0.2327
Manganese	$\text{mg Mn}/\text{dm}^3$	1.61	0.5509	0.3041	0.3529	0.1814	0.1191	0.0549	0.0692	0.0666	0.056	0.0466
Copper	$\text{mg Cu}/\text{dm}^3$	0.059	0.00025	0.0023	0.2755	0.00025	0.00025	0.00025	0.0176	0.0072	0.0014	0.00025
Zinc	$\text{mg Zn}/\text{dm}^3$	0.3049	0.1618	0.2939	1.4563	0.7194	0.2466	0.2005	0.4679	0.3438	0.209	0.2372
Chromium	$\text{mg Cr}/\text{dm}^3$	0.00025	0.0092	0.0066	0.00025	0.0026	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Lead	$\text{mg Pb}/\text{dm}^3$	0.004	0.0266	0.0493	0.0318	0.0373	0.0256	0.0306	0.0285	0.0302	0.0271	0.0461
Nickel	$\text{mg Ni}/\text{dm}^3$	0.0209	0.0618	0.0014	0.0702	0.0355	0.0343	0.0331	0.0384	0.0564	0.0346	0.0081
Cadmium	$\text{mg Cd}/\text{dm}^3$	0.0039	0.0081	0.0091	0.0079	0.0089	0.0076	0.0086	0.01	0.0072	0.0092	0.0081

