Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Supplemental Information

Mobility of metallic (nano)particles in leachates from landfills containing waste incineration residues

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Table S1: Precipitation recorded at the Flawil weather station by Meteoswiss in the week before each sampling campaign.

Date	Precipitation (mm)
2015.10.07	1.0
2015.10.08	0.0
2015.10.09	0.0
2015.10.10	0.0
2015.10.11	0.0
2015.10.12	0.0
2015.10.13 (first collection)	10.5
2016.01.02	11.1
2016.01.03	0.3
2016.01.04	16.5
2016.01.05	1.0
2016.01.06	0.5
2016.01.07	11
2016.01.08 (second collection)	14.8
2016.03.25	3.7
2016.03.26	0.4
2016.03.27	0.6
2016.03.28	0.0
2016.03.29	2.1
2016.03.30	0
2016.03.31 (third collection)	0

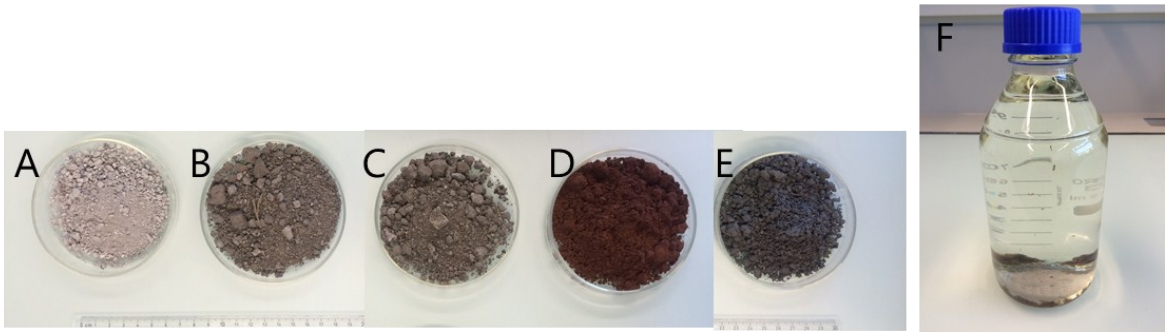

Figure S1: Samples collected from the landfill: bottom ash a) fresh, b) 2 months old, C) 6 months to 1 year old; D) Sludge incineration, E) fly ash and F) natural leachate.

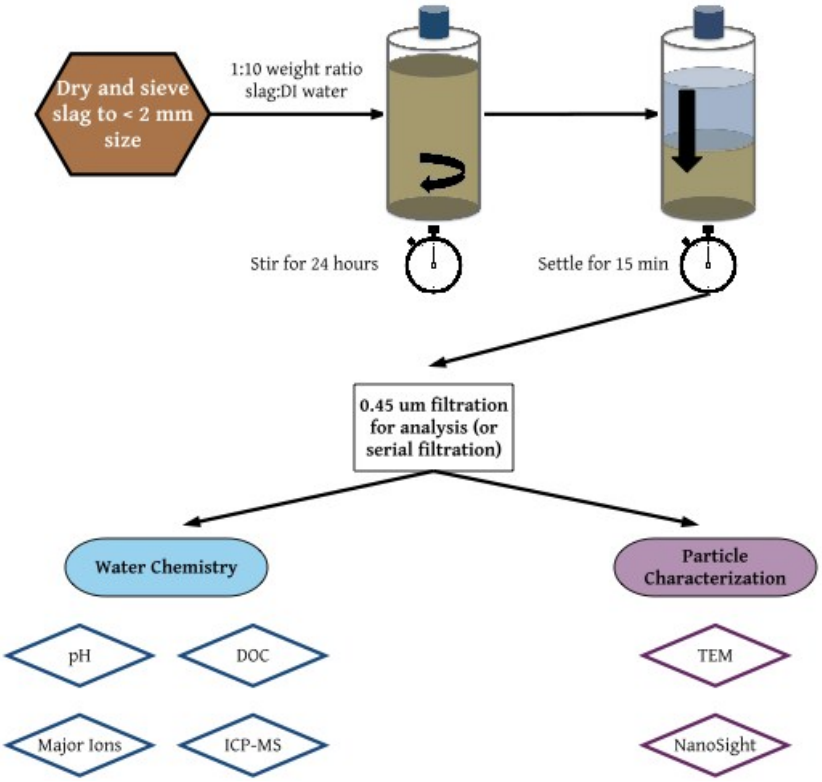

Figure S2: Leaching process of various slags recovered from the landfill and further processing of leachate for chemical and physical characterization.

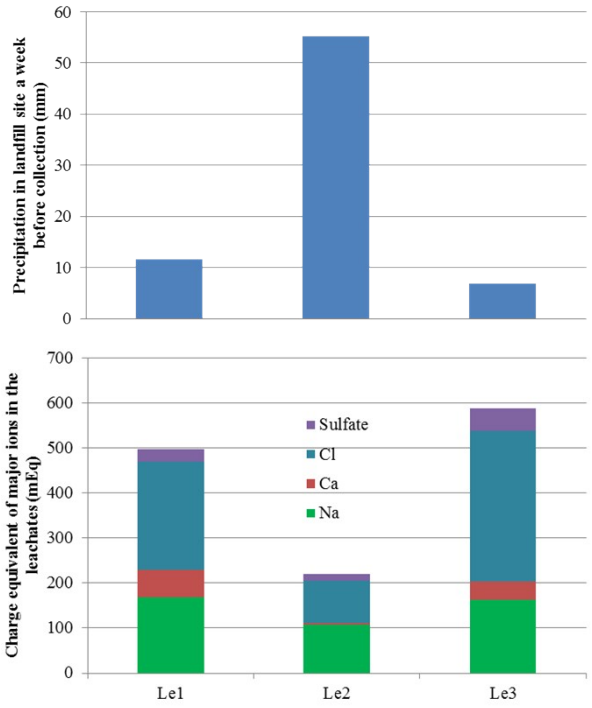

Figure S3: Precipitation a week before sample collection (top graph) and charge equivalent of major ions measured by IC and ICP-OES (bottom graph). The salt concentration in the natural leachate is inversely proportional to the amount of rainfall in the week prior to sampling in each case. Le1, Le2, and Le3 correspond to the 1st, 2nd, and 3rd sampling campaigns.

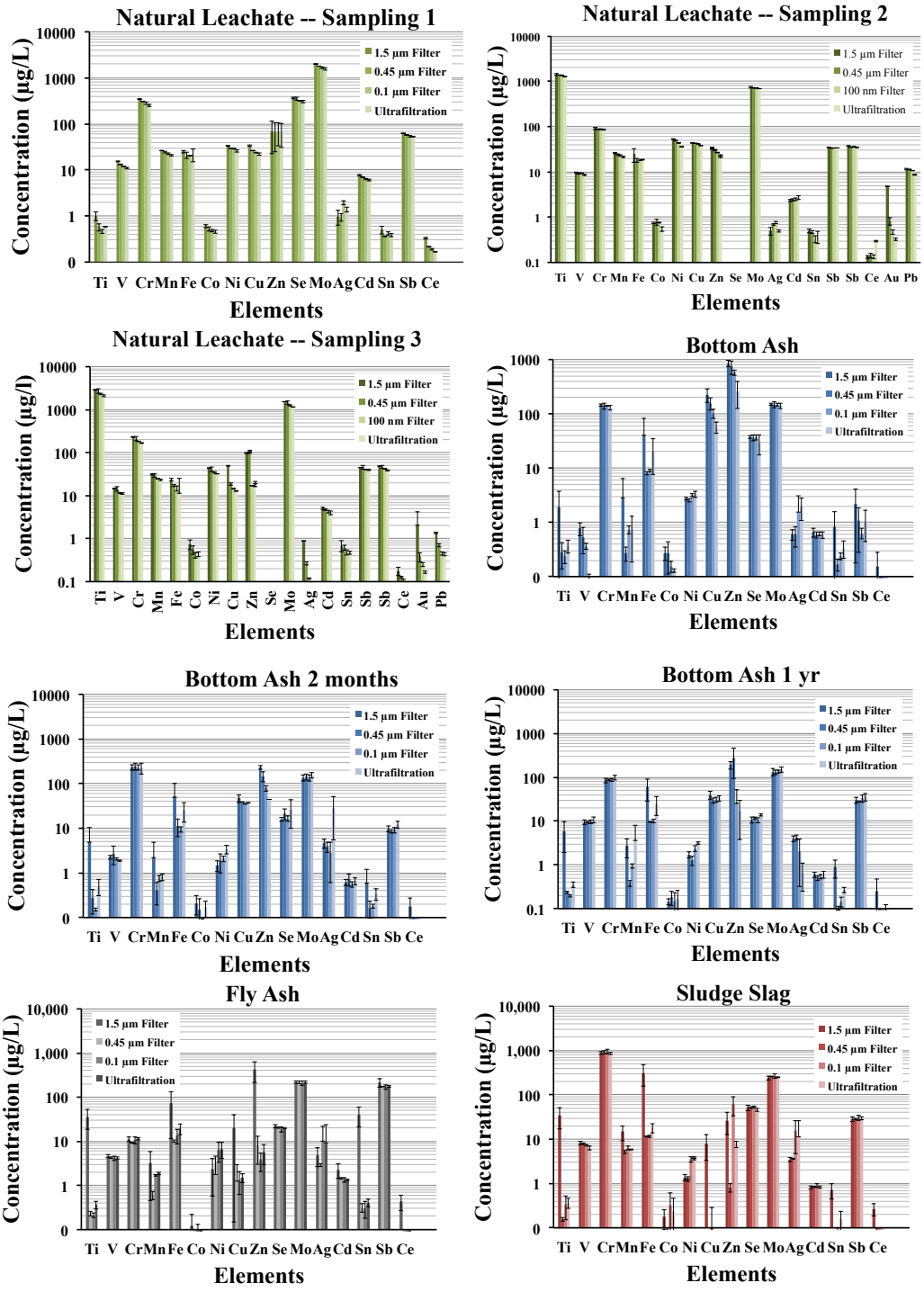

Figure S4: Full ICP-MS elemental analysis of the leachates in serial filtration studies. Average of triplicate leachates shown with standard deviation between replicates. Ultrafiltration depicts the analysis of metal < 10 kDa. Please note the logarithmic scale of the graphs.

	Natural Leachate -- Sampling 1													
	Ti	Zn	Ag	Cu	Fe	Ce	Cd	Cr	Mn	Mo	Ni	Sb	Se	Sn
0.45μm -1.5μm	0.422	1.561	0.039	6.944	4.022	0.111	0.717	42.533	2.211	217.783	3.961	3.994	8.394	0.144
0.1μm - 0.45μm	0.111	0.000	0.000	2.994	0.589	0.028	0.539	25.400	1.728	120.789	0.956	4.483	42.439	0.000
Nano	0.000	2.106	0.556	1.628	0.000	0.022	0.433	28.967	1.567	113.544	2.806	1.672	10.256	0.039
Ultrafilter	0.589	67.111	1.406	21.944	22.044	0.167	5.961	252.200	20.806	1558.100	26.178	52.317	303.917	0.383

	Natural Leachate -- Sampling 2													
	Ti	Zn	Ag	Cu	Fe	Ce	Cd	Cr	Mn	Mo	Ni	Sb	Se	Sn
0.45μm -1.5μm	48.107	3.069	0.000	0.911	6.817	0.000	0.000	2.651	2.015	21.604	3.817	1.411	N/M	0.032
0.1μm - 0.45μm	9.684	3.396	0.000	1.581	0.000	0.008	0.000	1.070	1.251	11.948	6.610	0.000	N/M	0.136
Nano	85.922	4.129	0.254	2.890	0.000	0.000	0.000	1.485	1.571	10.537	6.955	0.093	N/M	0.000
Ultrafilter	1262.032	22.525	0.502	38.214	18.477	0.299	2.713	85.716	21.247	690.952	36.083	33.884	N/M	0.372

	Natural Leachate -- Sampling 3													
	Ti	Zn	Ag	Cu	Fe	Ce	Cd	Cr	Mn	Mo	Ni	Sb	Se	Sn
0.45μm -1.5μm	144.837	0.000	0.619	30.253	6.285	0.053	0.383	19.931	1.280	75.804	2.713	0.000	N/M	0.070
0.1μm - 0.45μm	367.332	86.831	0.148	4.274	2.379	0.023	0.474	25.925	4.706	201.572	6.354	4.959	N/M	0.139
Nano	231.093	0.000	0.074	1.672	0.000	0.010	0.267	15.383	1.719	87.535	2.416	1.122	N/M	0.009
Ultrafilter	2099.540	18.628	0.045	12.769	18.402	0.093	3.988	169.328	23.227	1165.392	32.550	39.510	N/M	0.471

	Bottom Ash Fresh													
	Ti	Zn	Ag	Cu	Fe	Ce	Cd	Cr	Mn	Mo	Ni	Sb	Se	Sn
0.45μm -1.5μm	1.620	110.083	-0.002	64.113	32.243	0.147	0.070	6.163	2.560	3.217	0.183	1.073	1.073	0.670
0.1μm - 0.45μm	0.043	162.907	0.000	56.567	0.000	-0.003	0.000	0.000	0.000	0.000	0.000	0.443	0.000	0.000
Nano	0.000	317.137	0.000	43.860	0.000	0.000	0.027	11.203	0.000	6.723	0.000	0.000	7.430	0.000
Ultrafilter	0.370	258.947	1.960	57.223	21.233	0.027	0.587	129.950	0.747	141.933	3.310	1.050	29.303	0.333

	Bottom Ash -- 2 Months													
	Ti	Zn	Ag	Cu	Fe	Ce	Cd	Cr	Mn	Mo	Ni	Sb	Se	Sn
0.45μm -1.5μm	4.623	82.937	0.770	7.658	38.247	0.153	0.000	0.000	1.787	0.000	0.000	1.263	0.000	0.410
0.1μm - 0.45μm	0.123	68.047	1.167	3.402	1.790	0.013	0.173	11.503	0.000	8.247	0.000	0.000	5.087	0.000
Nano	0.000	34.363	0.000	0.000	0.000	0.000	0.000	0.610	0.000	0.000	0.000	0.000	0.000	0.000
Ultrafilter	0.507	44.230	28.047	37.115	25.267	0.043	0.650	227.247	0.807	153.677	3.353	12.067	26.420	0.340

	Bottom Ash -- 1 Year													
	Ti	Zn	Ag	Cu	Fe	Ce	Cd	Cr	Mn	Mo	Ni	Sb	Se	Sn
0.45μm -1.5μm	5.697	0.000	0.000	9.709	50.994	0.234	0.099	0.000	2.321	2.628	0.426	1.898	0.000	0.790
0.1μm - 0.45μm	0.042	255.069	2.135	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	1.381	0.000
Nano	0.000	7.880	1.414	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ultrafilter	0.354	17.117	0.664	33.279	24.583	0.051	0.601	98.883	3.598	149.982	3.162	36.000	13.793	0.270

	Fly Ash													
	Ti	Zn	Ag	Cu	Fe	Ce	Cd	Cr	Mn	Mo	Ni	Sb	Se	Sn
0.45μm -1.5μm	35.530	409.425	1.967	18.993	62.057	0.423	0.827	1.807	2.563	0.000	0.000	41.160	1.390	39.668
0.1μm - 0.45μm	0.017	4.230	0.000	0.000	0.000	0.000	0.107	0.000	0.000	6.380	0.000	5.157	1.813	0.010
Nano	0.000	0.000	0.820	0.000	0.000	0.000	0.000	0.000	0.000	-8.347	0.000	0.000	0.000	0.000
Ultrafilter	0.367	5.697	9.240	1.480	19.430	0.010	1.340	11.433	1.900	218.833	6.697	177.103	19.770	0.407

	Sludge													
	Ti	Zn	Ag	Cu	Fe	Ce	Cd	Cr	Mn	Mo	Ni	Sb	Se	Sn
0.45μm -1.5μm	34.430	25.634	0.000	8.492	303.163	0.264	0.000	0.000	9.554	0.000	0.105	0.000	0.000	0.725
0.1μm - 0.45μm	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nano	0.000	54.657	4.132	0.271	0.000	0.000	0.070	91.008	0.453	21.081	0.000	0.283	8.016	0.000
Ultrafilter	0.368	7.663	11.112	0.000	17.992	0.012	0.833	866.279	5.853	246.682	3.659	29.946	45.837	0.155

Table S2: Particulate composition of natural and laboratory prepared leachates, average of triplicate samples, concentration μg/L. Categories where ICP-MS analysis was either below the instrumental detection limit or slight variability in serial filtration provided negative values are written as zero

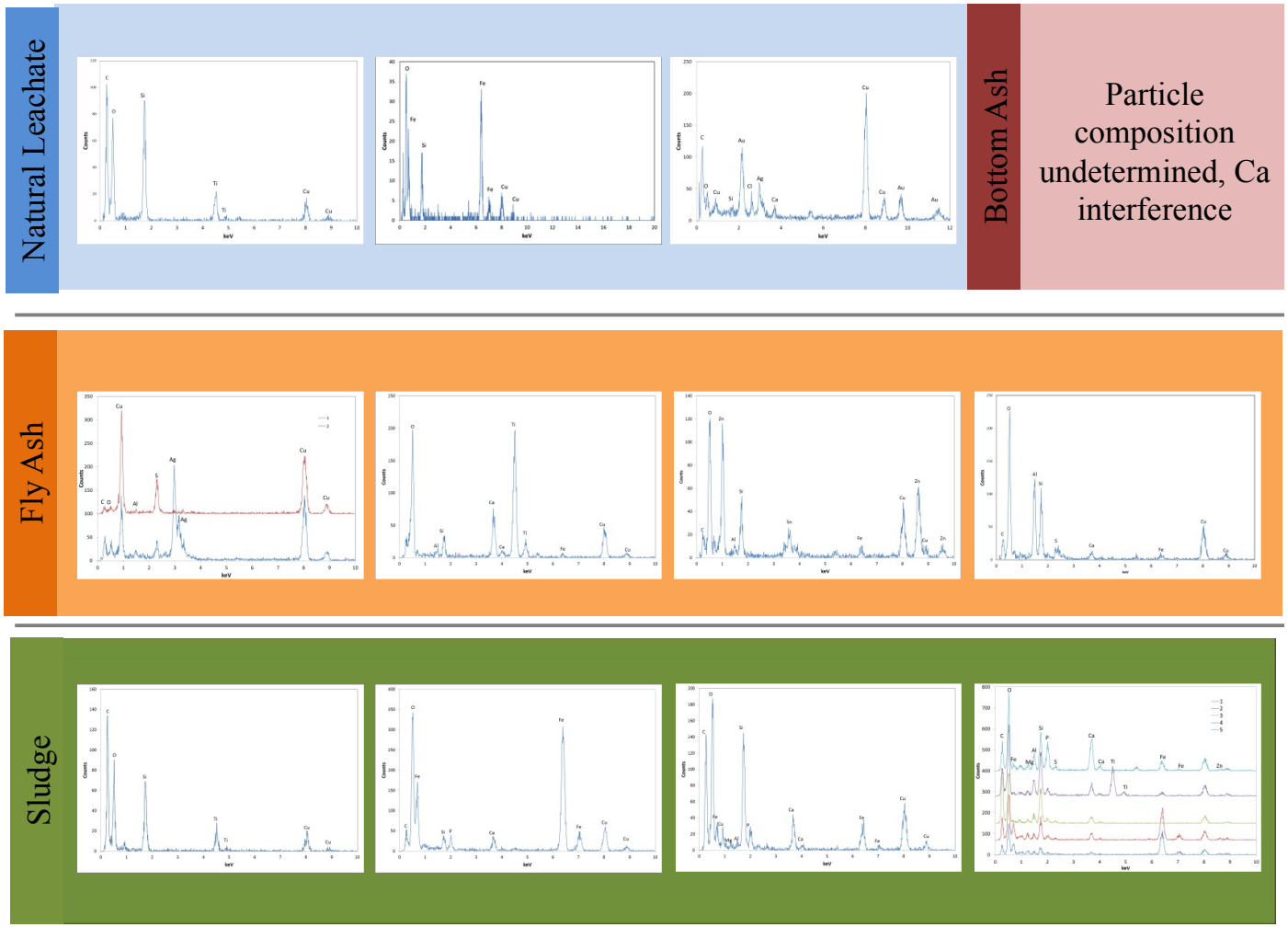

Figure S5: EDX analysis corresponding to TEM images presented in Figure 5 of the main manuscript