

Supplementary Information

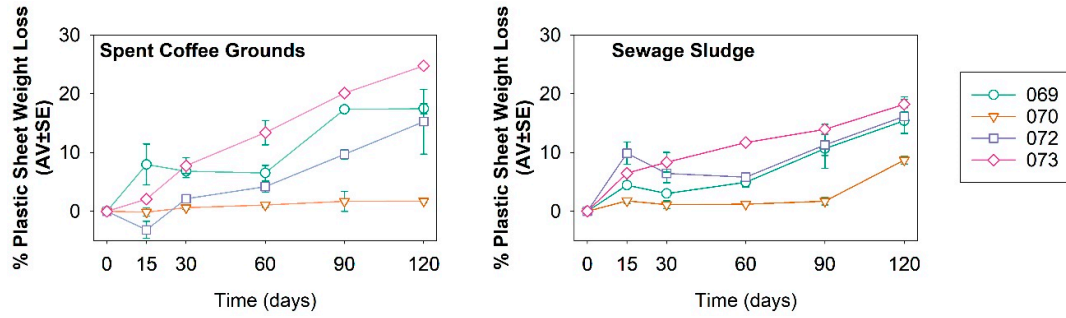


Figure S1: Representation of the degradation of the 4 types of plastic films, represented as % weight loss, in two vermicomposting systems, one containing spent coffee grounds and another containing sewage sludge

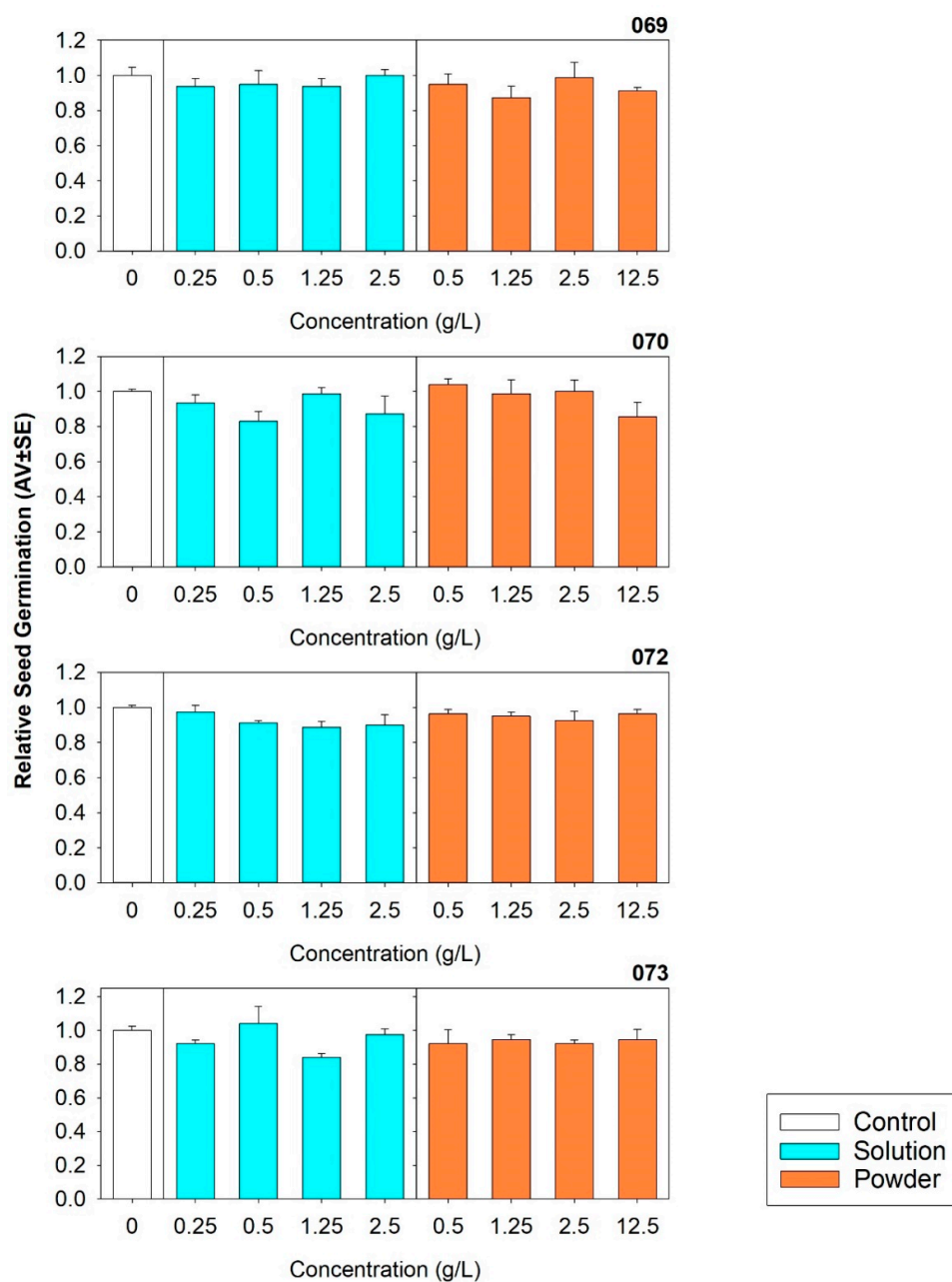


Figure S2: Representation of the Relative Seed Germination (RSG) in *L. sativum* after exposure to powdered microplastics (< 250 µm) and leachates of 4 types of plastic bags for 7 days. Values are expressed as number of germinated seeds relative to control after 7 days (mean ± standard error).

Table S1: Descriptors of the principal component analysis model (component loadings, explained variance and component fitted correlation).

Component loadings and correlation > |0.7| marked in bold.

	PC1	PC2													
Explained Variance (%)	54.46	22.61	Fitted Correlation Matrix												
	Component Loadings		Conc.	Terep.	Talc.	Other Esters	Phtal. Sum	Juv.	Coc.	SCG d30	SCG d60	SCG d120	SS d30	SS d60	SS d120
Concentration	0.662	-0.392	0.591												
Terephthalate Group	0.853	-0.380	0.713	0.871											
Talcum	0.060	-0.806	0.355	0.357	0.653										
Other Esters	0.722	-0.335	0.609	0.743	0.313	0.633									
Phtalate Sum	0.490	-0.770	0.626	0.710	0.650	0.612	0.833								
Juveniles	-0.751	0.488	-0.688	-0.826	-0.438	-0.706	-0.743	0.802							
Cocoons	-0.672	0.343	-0.579	-0.703	-0.316	-0.600	-0.593	0.672	0.569						
SCG day 30	0.736	0.464	0.305	0.451	-0.330	0.376	0.004	-0.326	-0.336	0.757					
SCG day 60	0.759	0.449	0.326	0.477	-0.317	0.398	0.026	-0.351	-0.356	0.767	0.778				
SCG day 120	0.848	0.424	0.395	0.562	-0.292	0.470	0.089	-0.430	-0.424	0.821	0.834	0.899			
SS day 30	0.843	0.357	0.418	0.583	-0.238	0.489	0.138	-0.459	-0.444	0.786	0.800	0.866	0.838		
SS day 60	0.872	0.437	0.406	0.577	-0.300	0.483	0.091	-0.442	-0.436	0.844	0.858	0.924	0.891	0.951	
SS day 120	0.910	0.134	0.550	0.725	-0.054	0.612	0.343	-0.618	-0.566	0.732	0.751	0.828	0.815	0.852	0.846

Table S2: Descriptors of the three-way ANOVA performed on the plastic weight loss in vermicomposting systems. DF – Degrees of Freedom, SS – Sum of Squares, MS – Mean of Squares. p<0.05 values highlighted in bold.

Source of Variation	DF	SS	MS	F-ratio	P
Polymer	3	2469.796	823.265	18.004	<0.001

<u>Polymer</u>	069	070	072	073	<u>Polymer</u>	069	070	072	073
069		0.173	0.016	0.31	069		<0.001	0.025	0.624
070			<0.001	<0.001	070			0.093	<0.001
072				0.606	072				<0.001
073					073				
Comparison within Time 15					Comparison within Time 30				
<u>Polymer</u>	069	070	072	073	<u>Polymer</u>	069	070	072	073
069		0.301	0.792	0.925	069		0.557	0.997	0.74
070			0.845	0.676	070			0.686	0.092
072				0.99	072				0.614
073					073				
Comparison within Time 60					Comparison within Time 90				
<u>Polymer</u>	069	070	072	073	<u>Polymer</u>	069	070	072	073
069		0.447	0.002	0.121	069		<0.001	0.669	0.761
070			<0.001	0.001	070			0.023	<0.001
072				0.519	072				0.149
073					073				
Comparison within Time 120									
<u>Polymer</u>	069	070	072	073					
069		0.005	0.997	0.442					
070			0.01	<0.001					
072				0.32					
073									

Table S3: Descriptors of the two-way ANOVA performed on the plastic weight loss in vermicomposting systems for each plastic type (069, 070, 072, 073). DF – Degrees of Freedom, SS – Sum of Squares, MS – Mean of Squares. p<0.05 values highlighted in bold.

069					
Source of Variation	DF	SS	MS	F-ratio	P
System	1	120.234	120.234	8.202	0.006

Time	5	1694.076	338.815	23.113	<0.001
System x Time	5	62.72	12.544	0.856	0.518
<i>Residual</i>	<i>46</i>	<i>674.318</i>	<i>14.659</i>		
<i>Total</i>	<i>57</i>	<i>2651.668</i>	<i>46.52</i>		

Comparison within Sewage Sludge							Comparison within Spent Coffee Grounds						
<u>Time</u> (days)	0	15	30	60	90	120	<u>Time</u> (days)	0	15	30	60	90	120
0		0.573	0.872	0.461	0.004	<0.001	0		0.009	0.038	0.053	<0.001	<0.001
15			0.995	1	0.217	0.003	15			0.995	0.986	0.002	0.005
30				0.98	0.072	<0.001	30				1	<0.001	0.001
60					0.297	0.004	60					<0.001	<0.001
90						0.506	90						1
120							120						

Comparison within Time 15		Comparison within Time 30		Comparison within Time 60		Comparison within Time 90		Comparison within Time 120	
<u>System</u>	SS	<u>System</u>	SS	<u>System</u>	SS	<u>System</u>	SS	<u>System</u>	SS
SCG	0.161	SCG	0.132	SCG	0.525	SCG	0.01	SCG	0.452

070

Source of Variation	DF	SS	MS	F-ratio	P
System	1	35.226	35.226	12.679	<0.001
Time	5	142.986	28.597	10.293	<0.001
System x Time	5	77.638	15.528	5.589	<0.001
<i>Residual</i>	<i>46</i>	<i>127.803</i>	<i>2.778</i>		
<i>Total</i>	<i>57</i>	<i>382.258</i>	<i>6.706</i>		

Comparison within Sewage Sludge							Comparison within Spent Coffee Grounds						
<u>Time</u> (days)	0	15	30	60	90	120	<u>Time</u> (days)	0	15	30	60	90	120
0		0.656	0.927	0.907	0.686	<0.001	0		1	0.987	0.869	0.494	0.583
15			0.994	0.996	1	<0.001	15			0.97	0.809	0.417	0.511
30				1	0.996	<0.001	30				0.997	0.87	0.898

60	0.998	<0.001	60	0.987	0.989
90		<0.001	90		1
120			120		

Comparison within Time 15		Comparison within Time 30		Comparison within Time 60		Comparison within Time 90		Comparison within Time 120	
<u>System</u>	SS	<u>System</u>	SS	<u>System</u>	SS	<u>System</u>	SS	<u>System</u>	SS
SCG	0.083	SCG	0.637	SCG	0.907	SCG	0.982	SCG	<0.001

072

Source of Variation	DF	SS	MS	F-ratio	P
System	1	172.98	172.98	11.139	0.002
Time	5	1394.882	278.976	17.965	<0.001
System x Time	5	278.3	55.66	3.584	0.008
<i>Residual</i>	45	698.798	15.529		
<i>Total</i>	56	2682.34	47.899		

Comparison within Sewage Sludge							Comparison within Spent Coffee Grounds						
<u>Time (days)</u>	0	15	30	60	90	120	<u>Time (days)</u>	0	15	30	60	90	120
0		0.011	0.21	0.398	0.003	<0.001	0		0.734	0.934	0.451	0.001	<0.001
15			0.818	0.752	0.996	0.235	15			0.205	0.027	<0.001	<0.001
30				1	0.512	0.013	30				0.944	0.02	<0.001
60					0.46	0.015	60					0.168	0.001
90						0.51	90						0.267
120							120						

Comparison within Time 15		Comparison within Time 30		Comparison within Time 60		Comparison within Time 90		Comparison within Time 120	
<u>System</u>	SS	<u>System</u>	SS	<u>System</u>	SS	<u>System</u>	SS	<u>System</u>	SS
SCG	<0.001	SCG	0.097	SCG	0.564	SCG	0.536	SCG	0.746

073

Source of Variation		DF	SS	MS	F-ratio	P
System		1	34.095	34.095	6.07	0.018
Time		5	2896.348	579.27	103.135	<0.001
System x Time		5	203.046	40.609	7.23	<0.001
<i>Residual</i>		46	258.365	5.617		
<i>Total</i>		57	3617.395	63.463		

Comparison within Sewage Sludge							Comparison within Spent Coffee Grounds						
<u>Time</u> <u>(days)</u>	0	15	30	60	90	120	<u>Time</u> <u>(days)</u>	0	15	30	60	90	120
0		0.004	<0.001	<0.001	<0.001	<0.001	0		0.652	<0.001	<0.001	<0.001	<0.001
15			0.881	0.037	<0.001	<0.001	15			0.002	<0.001	<0.001	<0.001
30				0.356	0.019	<0.001	30				0.002	<0.001	<0.001
60					0.761	0.004	60					<0.001	<0.001
90						0.133	90						0.043
120							120						

Comparison within Time 15		Comparison within Time 30		Comparison within Time 60		Comparison within Time 90		Comparison within Time 120	
<u>System</u>	SS	<u>System</u>	SS	<u>System</u>	SS	<u>System</u>	SS	<u>System</u>	SS
SCG	0.006	SCG	0.708	SCG	0.275	SCG	<0.001	SCG	<0.001

Plastic Type	Source of Variation	DF	SS	MS	F	P	Relative Seed Germination								
							Solution				Powder				
069	Between Groups	8	0.0423	0.00529	0.538	0.813	<i>Conc.</i> (g/L)	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5

070	Residual	18	0.177	0.00983	1.416	0.256	Control	0.961	0.989	0.961	1	0.989	0.518	1	0.827
	Total	26	0.219												
	Between Groups	8	0.134	0.0168			<u>Conc.</u> (g/L)	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
072	Residual	18	0.214	0.0119	1.157	0.375	Control	0.973	0.324	1	0.587	0.999	1	1	0.49
	Total	26	0.348												
	Between Groups	8	0.0338	0.00422			<u>Conc.</u> (g/L)	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
073	Residual	18	0.0656	0.00365	1.181	0.362	Control	0.997	0.389	0.172	0.264	0.966	0.871	0.546	0.966
	Total	26	0.0994												
	Between Groups	8	0.0773	0.00966			<u>Conc.</u> (g/L)	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	0.147	0.00818			Control	0.833	0.995	0.21	1	0.833	0.974	0.833	0.974
	Total	26	0.224												

Plastic Type	Source of Variation	DF	SS	MS	F	P	Relative Root Growth								
							Solution					Powder			
069	Between Groups	8	0.0586	0.00733	0.499	0.841	<i>Conc.</i> <i>(g/L)</i>	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	0.264	0.0147			Control	0.996	0.757	0.852	0.912	0.573	1	0.647	0.979
	Total	26	0.323												
070	Between Groups	8	0.0562	0.00702	0.283	0.963	<i>Conc.</i> <i>(g/L)</i>	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	0.446	0.0248			Control	1	0.98	1	1	0.999	1	0.99	1
	Total	26	0.503												
072	Between Groups	8	0.164	0.0205	1.199	0.353	<i>Conc.</i> <i>(g/L)</i>	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	0.307	0.0171			Control	0.987	0.458	0.734	0.104	0.887	1	0.993	0.686
	Total	26	0.471												
073	Between Groups	8	0.381	0.0477	5.587	0.001	<i>Conc.</i> <i>(g/L)</i>	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	0.154	0.00853			Control	0.004	0.042	0.609	0.428	0.638	0.998	0.569	0.648

Total	26	0.535	Relative Shoot Growth												
Plastic Type	Source of Variation	DF	SS	MS	F	P	Solution				Powder				
069	Between Groups	8	0.0577	0.00721	0.696	0.691	<u>Conc.</u> <u>(g/L)</u>	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	0.187	0.0104			Control	0.999	1	0.998	0.991	0.788	0.574	1	0.838
	Total	26	0.244												
070	Between Groups	8	0.144	0.018	2.322	0.066	<u>Conc.</u> <u>(g/L)</u>	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	0.139	0.00774			Control	1	0.985	0.999	0.893	1	1	0.101	0.128
	Total	26	0.283												
072	Between Groups	8	0.0316	0.00395	1.148	0.38	<u>Conc.</u> <u>(g/L)</u>	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	0.0619	0.00344			Control	1	0.3	0.261	0.874	0.999	0.909	0.69	0.991
	Total	26	0.0935												
073	Between Groups	8	0.507	0.0634	17.782	<0.001	<u>Conc.</u> <u>(g/L)</u>	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	0.0641	0.00356			Control	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001
	Total	26	0.571												
Root to Shoot Ratio															
Plastic Type	Source of Variation	DF	SS	MS	F	P	Solution				Powder				
069	Between Groups	8	0.396	0.0495	0.843	0.578	<u>Conc.</u> <u>(g/L)</u>	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	1.056	0.0587			Control	0.747	0.633	0.403	0.48	0.149	0.493	0.326	0.423
	Total	26	1.452												
070	Between Groups	8	0.339	0.0424	0.686	0.699	<u>Conc.</u> <u>(g/L)</u>	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	1.114	0.0619			Control	0.999	0.963	1	0.999	0.994	1	1	0.635
	Total	26	1.453												

072	Between Groups	8	0.223	0.0279	0.64	0.735	<u>Conc.</u> (g/L)	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	0.785	0.0436			Control	0.995	0.997	0.998	0.586	0.991	0.998	1	0.948
	Total	26	1.008												
073	Between Groups	8	0.881	0.11	0.864	0.563	<u>Conc.</u> (g/L)	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	2.293	0.127			Control	1	0.999	0.986	0.921	0.726	0.309	1	0.624
	Total	26	3.174												
Germination Index															
Plastic Type	Source of Variation	DF	SS	MS	F	P	Solution							Powder	
069	Between Groups	8	0.0693	0.00866	0.331	0.943	<u>Conc.</u> (g/L)	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	0.471	0.0262			Control	0.96	0.782	0.782	0.984	0.666	0.797	0.896	0.815
	Total	26	0.54												
070	Between Groups	8	0.275	0.0344	0.851	0.572	<u>Conc.</u> (g/L)	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	0.728	0.0404			Control	0.99	0.585	1	0.971	0.996	1	0.998	0.951
	Total	26	1.003												
072	Between Groups	8	0.0751	0.00939	0.444	0.878	<u>Conc.</u> (g/L)	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	0.38	0.0211			Control	1	0.99	1	0.785	0.995	1	1	0.934
	Total	26	0.455												
073	Between Groups	8	0.452	0.0565	3.774	0.009	<u>Conc.</u> (g/L)	0.25	0.5	1.25	2.5	0.5	1.25	2.5	12.5
	Residual	18	0.27	0.015			Control	0.01	0.25	0.105	0.906	0.364	0.897	0.33	0.508
	Total	26	0.722												

Table S5: Descriptors of the one-way ANOVAs performed on the *Eisenia andrei* survival and reproduction test parameters (Number of surviving adults, number of juveniles and number of cocoons) after exposure to plastic bag as powder and as leachate, for each plastic type (069, 070, 072, 073). DF – Degrees of Freedom, SS – Sum of Squares, MS – Mean of Squares. p<0.05 values highlighted in bold.

Plastic Type	Source of Variation	Number of surviving adults					Concentration (g/kg)
		DF	SS	MS	F	P	
069	Between Groups	2	1.762	0.881	0.622	0.582	2
	Residual	4	5.667	1.417			10
	Total	6	7.429				0.984
070	Between Groups	2	2	1	0.6	0.579	2
	Residual	6	10	1.667			10
	Total	8	12				0.568
072	Between Groups	2	2.19	1.095	0.657	0.567	2
	Residual	4	6.667	1.667			10
	Total	6	8.857				0.947
073	Between Groups	2	2	1	0.75	0.512	2
	Residual	6	8	1.333			10

							n 5	
							t 0	
							r 4	
							o	
							l	
Total		8	10					
Number of juveniles								
Plastic Type 069	Source of Variation	DF	SS	MS	F	P	Concentration (g/kg)	
	Between Groups	2	941.333	470.667	7.511	0.044	2	10
	Residual	4	250.667	62.667			0	0.034
Total		6	1192					
070	Between Groups	2	860.222	430.111	25.807	0.001	2	10
	Residual	6	100	16.667			0	0.001
	Total	8	960.222					
072	Between Groups	2	1014.548	507.274	8.144	0.039	2	10
	Residual	4	249.167	62.292			0	0.067
	Total	6	1192					

							o l			
073	Total	6	1263.714				C o n t r o l	2	10	
	Between Groups	2	1069.556	534.778	51.202	<0.001				
	Residual	6	62.667	10.444					<0.001	
Total		8	1132.222							
Number of cocoons										
Plastic Type 069	Source of Variation	DF	SS	MS	F	P	Concentration (g/kg)			
	Between Groups	2	139.214	69.607	5.303	0.075	C o n t r o l	2	10	
	Residual	4	52.5	13.125					0.048	
	Total	6	191.714							
070	Between Groups	2	62	31	1.576	0.282	C o n t r o l	2	10	
	Residual	6	118	19.667					0.346	
	Total	8	180							

072	Between Groups	2	139.857	69.929	3.73	0.122	2	10
	Residual	4	75	18.75			Con- t- r- o- l	0.126
	Total	6	214.857					
073	Between Groups	2	156.222	78.111	5.669	0.041	2	10
	Residual	6	82.667	13.778			Con- t- r- o- l	0.033
	Total	8	238.889					