Application of DPPH Assay for Assessment of Particulate Matter Reducing Properties

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Supplementary Materials

Table S1: Chemical composition of the total fraction (water-soluble and insoluble) of brake dust (BD), coke (C), Saharan dust (SD) and calcitic soil dust (CSD). Mean ± standard deviation of three replicates is reported.

			BD	**C**	**SD**	**CSD**
Technique	**UoM**		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
ICP-MS/XRF	g/Kg	**Al**	15 ± 0.42	13 ± 2	69 ± 2	11 ± 0.21
ICP-MS	mg/Kg	**As**	19 ± 1	1.1 ± 0.062	1.4 ± 0.12	96 ± 11
ICP-MS	mg/Kg	**B**	32 ± 0.073	3.5 ± 0.94	13 ± 0.82	1.6 ± 0.4
ICP-MS	mg/Kg	**Cd**	1.1 ± 0.051	0.07 ± 0.04	0.91 ± 0.071	0.11 ± 0.003
ICP-MS	mg/Kg	**Ce**	26 ± 0.12	0.32 ± 0.11	1.2 ± 0.11	10 ± 1.3
ICP-MS	mg/Kg	**Co**	15 ± 0.54	1.1 ± 0.044	0.73 ± 0.037	1.8 ± 0.11
ICP-MS	mg/Kg	**Cr**	3107 ± 74	10 ± 0.2	52 ± 1	40 ± 2
ICP-MS	mg/Kg	**Cs**	3.2 ± 0.036	0.052 ± 0.011	0.025 ± 0.003	2.8 ± 0.32
ICP-MS	mg/Kg	**Cu**	5051 ± 9	56 ± 12	13 ± 4	14 ± 1
ICP-MS	g/Kg	**Fe**	204 ± 5	17 ± 4	41 ± 0.31	4 ± 0.11
ICP-MS	mg/Kg	**La**	13 ± 0.22	0.31 ± 0.23	27 ± 0.11	5.2 ± 1.1
ICP-MS	mg/Kg	**Mn**	1212 ± 4	46 ± 1	29 ±0.51	121 ± 5
ICP-MS	mg/Kg	**Mo**	175 ± 1	77 ± 0.18	0.16 ± 0.021	0.72 ± 0.095
ICP-MS	mg/Kg	**Ni**	112 ± 3	357 ± 1	7 ± 1	11 ± 1.1
ICP-MS	mg/Kg	**Pb**	683 ± 4	18 ± 0.14	2.5 ± 0.22	12 ± 2.5
ICP-MS	mg/Kg	**Rb**	23 ± 1	1.1 ± 0.11	7 ± 0.6	11 ± 2.4
ICP-MS	mg/Kg	**Sb**	306 ± 1	4 ± 0.011	2.4 ± 0.011	0.41 ± 0.12
ICP-MS	mg/Kg	**Se**	9.3 ± 0.43	9 ± 0.21	1.5 ± 0.13	11 ± 2.1
ICP-MS	mg/Kg	**Sn**	1420 ± 3	15 ± 0.32	0.022 ± 0.011	2.8 ± 0.51
ICP-MS	mg/Kg	**Sr**	257 ± 9	10 ± 7	352 ± 10	525 ± 46
ICP-MS	mg/Kg	**Ti**	527 ± 9	907 ± 21	4542 ± 111	255 ± 6.2
ICP-MS	mg/Kg	**Tl**	0.34 ± 0.12	0.032 ± 0.011	0.034 ± 0.012	0.15 ± 0.039
ICP-MS	mg/Kg	**V**	9 ± 0.47	556 ± 1	6.1 ± 0.41	11 ± 1.1
ICP-MS	mg/Kg	**Zn**	5317 ± 20	260 ± 17	50 ± 20	110 ± 24
ICP-MS	mg/Kg	**Zr**	90 ± 1	12 ± 0.14	9.4± 0.21	14 ± 1.5
ECOC	g/Kg	**EC**	17 ± 1	310 ± 15	< 0.001	< 0.001
TOC	g/Kg	**WSOC**	5.7 ± 0.12	9.5 ± 0.21	0.53 ± 0.02	0.3 ± 0.1
ECOC/TOC	g/Kg	**WIOC**	30 ± 3	146 ± 5	0.10 ± 0.02	41 ± 3

Table S1: Chemical composition of the total fraction of brake dust (BD), coke (C), Saharan dust (SD) and calcitic soil dust (CSD). Mean ± standard deviation of three replicates is reported.

			BD	**C**	**SD**	**CSD**
Technique	**UoM**		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
ICP-MS/XRF	g/Kg	**Al**	15 ± 0.4	13 ± 2	69 ± 2	11 ± 0.21
ICP-MS	mg/Kg	**As**	19.0 ± 1	1.1 ± 0.06	1.4 ± 0.1	96 ± 11
ICP-MS	mg/Kg	**B**	32 ± 0.07	3.5 ± 0.9	13 ± 0.8	1.6 ± 0.4
ICP-MS	mg/Kg	**Cd**	1.1 ± 0.05	0.07 ± 0.04	0.91 ± 0.071	0.11 ± 0.003
ICP-MS	mg/Kg	**Ce**	26 ± 0.1	0.32 ± 0.11	1.2 ± 0.11	10 ± 1.3
ICP-MS	mg/Kg	**Co**	15 ± 0.5	1.1 ± 0.04	0.73 ± 0.03	1.8 ± 0.11
ICP-MS	mg/Kg	**Cr**	3107 ± 74	10 ± 0.2	52 ± 1	40 ± 2
ICP-MS	mg/Kg	**Cs**	3.2 ± 0.03	0.05 ± 0.01	0.025 ± 0.003	2.8 ± 0.32
ICP-MS	mg/Kg	**Cu**	5051 ± 9	56 ± 12	13 ± 4	14 ± 1
ICP-MS	g/Kg	**Fe**	204 ± 5	17 ± 4	41 ± 0.31	4 ± 0.11
ICP-MS	mg/Kg	**La**	13 ± 0.2	0.31 ± 0.2	27 ± 0.11	5.2 ± 1.1
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ECOC	g/Kg	**EC**	17 ± 1	310 ± 15	< 0.001	< 0.001
TOC	g/Kg	**WSOC**	5.7 ± 0.1	9.5 ± 0.2	0.53 ± 0.02	0.3 ± 0.1
ECOC/TOC	g/Kg	**WIOC**	30 ± 3	146 ± 5	0.10 ± 0.02	41 ± 3

Table S2: Correlation matrix among elemental concentrations, PM mass concentration (PM), 2,2-diphenyl-1-picrylhydrazyl assay (RP) and oxidative potential assays (ascorbic acid, AA; dithiothreitol, DTT; 2′,7′-dichlorofluorescin, DCFH) of extracted fraction of $PM_{2.5}$ filters collected in Cassana (FE), Italy.

	Al	As	Bi	Cd	Ce	Co	Cr	Cs	Cu	Fe	La	Li	Mg	Mn	Mo	Na	Ni	Pb	Rb	Sb	Sn	Sr	Ti	V	Zn	Zr	PM	RP	AA	DTT	DCFH
Al	-																														
As	0.59	-																													
Bi	0.59	0.77	-																												
Cd	0.25	0.29	0.37	-																											
Ce	0.56	0.49	0.47	0.64	-																										
Co	0.67	0.62	0.49	0.33	0.64	-																									
Cr	0.50	0.77	0.81	0.55	0.51	0.45	-																								
Cs	0.64	0.52	0.41	0.47	0.56	0.41	0.46	-																							
Cu	0.62	0.78	0.84	0.67	0.59	0.57	0.91	0.54	-																						
Fe	0.70	0.61	0.72	0.33	0.70	0.78	0.63	0.49	0.68	-																					
La	0.10	-0.04	-0.013	0.63	0.67	0.21	0.13	0.19	0.25	0.25	-																				
Li	0.62	0.65	0.74	0.69	0.64	0.51	0.87	0.66	0.93	0.65	0.28	-																			
Mg	0.77	0.45	0.52	0.32	0.73	0.79	0.48	0.46	0.56	0.89	0.39	0.58	-																		
Mn	0.63	0.75	0.79	0.67	0.56	0.52	0.91	0.61	0.94	0.61	0.15	0.96	0.55	-																	
Mo	0.46	0.64	0.78	0.58	0.66	0.52	0.85	0.41	0.85	0.71	0.35	0.86	0.64	0.84	-																
Na	0.44	0.16	0.16	0.34	0.64	0.64	0.21	0.18	0.32	0.59	0.63	0.34	0.83	0.28	0.44	-															
Ni	0.007	0.20	0.048	-0.066	0.038	0.51	0.076	-0.13	-0.002	0.26	0.10	-0.15	0.27	-0.070	0.058	0.33	-														
Pb	0.58	0.59	0.63	0.51	0.53	0.56	0.62	0.65	0.67	0.68	0.05	0.65	0.48	0.64	0.43	0.17	0.052	-													
Rb	0.64	0.36	0.35	0.40	0.36	0.47	0.48	0.58	0.53	0.49	0.09	0.61	0.52	0.61	0.38	0.26	-0.006	0.43	-												
Sb	0.49	0.72	0.72	0.67	0.44	0.51	0.86	0.55	0.91	0.56	0.10	0.83	0.38	0.87	0.64	0.13	0.04	0.78	0.55	-											
Sn	0.61	0.76	0.75	0.61	0.41	0.56	0.84	0.65	0.89	0.61	0.04	0.82	0.45	0.87	0.63	0.15	0.12	0.81	0.57	0.97	-										
Sr	0.77	0.54	0.60	0.26	0.74	0.81	0.52	0.50	0.58	0.96	0.28	0.59	0.96	0.54	0.66	0.71	0.26	0.59	0.47	0.41	0.49	-									
Ti	0.54	0.52	0.58	0.41	0.56	0.79	0.48	0.42	0.58	0.82	0.14	0.48	0.69	0.47	0.44	0.44	0.34	0.78	0.41	0.65	0.66	0.75	-								
V	0.004	-0.11	-0.37	-0.21	-0.17	0.31	-0.31	-0.16	-0.31	-0.19	0.01	-0.34	-0.022	-0.29	-0.35	0.16	0.65	-0.19	-0.017	-0.19	-0.14	-0.078	-0.044	-							
Zn	0.72	0.52	0.65	0.34	0.69	0.73	0.59	0.55	0.64	0.97	0.26	0.68	0.91	0.61	0.69	0.61	0.19	0.68	0.52	0.51	0.58	0.96	0.76	-0.21	-						
Zr	0.45	0.59	0.73	0.64	0.51	0.53	0.66	0.42	0.79	0.55	0.09	0.69	0.37	0.71	0.56	0.13	-0.002	0.72	0.36	0.85	0.81	0.44	0.72	-0.24	0.49	-					
PM	0.59	0.77	0.79	0.42	0.59	0.49	0.79	0.64	0.76	0.61	-0.05	0.78	0.43	0.81	0.71	0.043	-0.15	0.68	0.44	0.73	0.73	0.54	0.52	-0.35	0.56	0.71	-				
RP	0.31	0.43	0.63	0.59	0.46	0.26	0.65	0.35	0.62	0.38	0.06	0.59	0.21	0.62	0.56	-0.058	-0.16	0.56	0.25	0.68	0.64	0.28	0.50	-0.38	0.33	0.82	0.77	-			
AA	0.22	0.31	0.40	0.31	0.25	0.16	0.43	0.061	0.59	0.36	0.32	0.56	0.33	0.48	0.61	0.35	-0.16	0.15	0.078	0.33	0.32	0.31	0.067	-0.32	0.38	0.22	0.19	0.052	-		
DTT	0.69	0.66	0.60	0.31	0.43	0.66	0.65	0.57	0.65	0.71	-0.01	0.59	0.67	0.67	0.56	0.31	0.23	0.64	0.67	0.67	0.73	0.71	0.73	-0.008	0.71	0.53	0.63	0.47	0.14	-	
DCFH	0.18	0.31	0.43	0.18	0.14	0.23	0.23	0.21	0.26	0.39	-0.20	0.11	0.11	0.15	0.003	-0.16	0.14	0.66	0.19	0.45	0.46	0.23	0.65	-0.24	0.31	0.62	0.33	0.51	-0.23	0.34	-

Table S3: Correlation matrix among elemental concentrations, PM mass concentration (PM), 2,2-diphenyl-1-picrylhydrazyl assay (RP) and oxidative potential assays (ascorbic acid, AA; dithiothreitol, DTT; 2′,7′-dichlorofluorescin, DCFH) of residual fraction of $PM_{2.5}$ filters collected in Cassana (FE), Italy.

	Al	**Bi**	**Cd**	**Ce**	**Cr**	**Cs**	**Cu**	**Fe**	**La**	**Li**	**Mg**	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Sn**	**Sr**	**Ti**	**Tl**	**V**	**Zn**	**Zr**	**PM**	**RP**	**AA**	**DTT**	**DCFH**
Al	-																											
Bi	-0.11	-																										
Cd	0.56	-0.11	-																									
Ce	0.065	0.17	-0.12	-																								
Cr	0.57	0.081	0.61	-0.07	-																							
Cs	0.012	0.17	0.18	-0.14	0.17	-																						
Cu	-0.013	0.89	-0.091	0.00	0.16	0.14	-																					
Fe	0.25	0.68	0.23	-0.10	0.53	0.21	0.77	-																				
La	-0.21	-0.013	-0.19	0.87	-0.24	-0.079	-0.18	-0.22	-																			
Li	0.037	0.39	0.28	-0.21	0.19	0.75	0.44	0.56	-0.19	-																		
Mg	0.69	-0.008	0.69	-0.13	0.71	0.31	0.059	0.45	-0.35	0.29	-																	
Mn	0.0004	0.76	0.18	-0.15	0.22	0.42	0.74	0.74	-0.24	0.62	0.15	-																
Mo	-0.19	0.57	-0.069	0.12	0.013	0.21	0.55	0.37	0.088	0.34	-0.002	0.44	-															
Ni	0.14	-0.04	0.29	-0.37	0.56	0.13	0.21	0.54	-0.24	0.27	0.44	0.11	0.27	-														
Pb	-0.075	0.38	0.058	-0.11	-0.32	0.22	0.21	0.14	-0.04	0.45	-0.22	0.53	0.16	-0.32	-													
Sb	0.19	0.36	0.47	-0.28	0.19	-0.013	0.42	0.55	-0.33	0.43	0.33	0.57	0.48	0.33	0.34	-												
Sn	-0.017	0.85	-0.18	0.06	-0.015	0.18	0.81	0.63	-0.14	0.41	0.039	0.72	0.56	0.032	0.45	0.38	-											
Sr	0.32	-0.13	0.53	0.06	0.66	0.31	-0.16	0.11	-0.02	0.16	0.61	-0.017	-0.008	0.32	-0.23	0.052	-0.34	-										
Ti	0.19	0.42	-0.12	-0.04	0.069	0.078	0.57	0.66	-0.17	0.51	0.22	0.34	0.24	0.35	0.15	0.32	0.63	-0.29	-									
Tl	0.22	0.12	0.61	-0.10	0.32	0.62	0.17	0.21	-0.07	0.61	0.35	0.37	-0.061	0.072	0.26	0.18	-0.075	0.47	-0.14	-								
V	0.13	-0.35	0.61	-0.30	0.59	0.077	-0.27	0.11	-0.21	0.22	0.34	-0.085	-0.18	0.53	-0.23	0.21	-0.45	0.55	-0.16	0.31	-							
Zn	0.44	-0.13	0.48	-0.02	0.46	0.41	-0.17	0.041	-0.21	0.14	0.73	0.093	-0.025	0.062	-0.11	0.11	-0.15	0.79	-0.25	0.37	0.22	-						
Zr	-0.056	0.49	-0.17	0.13	-0.018	-0.24	0.31	0.28	-0.05	-0.025	0.036	0.13	0.28	-0.11	0.14	0.17	0.59	-0.34	0.32	-0.35	-0.34	-0.25	-					
PM	0.024	0.63	-0.25	0.00	-0.25	0.026	0.54	0.19	-0.29	0.17	-0.074	0.43	0.18	-0.53	0.53	0.18	0.64	-0.25	0.24	0.020	-0.58	0.029	0.43	-				
RP	0.30	0.47	0.13	-0.04	0.030	-0.11	0.41	0.31	-0.39	0.15	0.32	0.38	0.23	-0.24	0.45	0.39	0.59	0.015	0.36	-0.027	-0.33	0.31	0.46	0.77	-			
AA	-0.21	0.55	-0.42	0.40	-0.27	-0.29	0.47	0.28	0.42	-0.25	-0.34	0.22	0.25	-0.071	0.093	-0.092	0.51	-0.49	0.26	-0.33	-0.64	-0.52	0.39	0.19	0.052	-		
DTT	-0.13	0.38	-0.003	-0.13	-0.25	-0.18	0.41	0.061	-0.28	0.011	-0.18	0.29	0.041	-0.37	0.31	0.17	0.31	-0.29	0.033	0.13	-0.18	-0.23	0.21	0.63	0.46	0.14	-	
DCFH	0.19	0.12	0.24	0.07	0.012	0.13	0.092	0.12	-0.072	0.27	0.16	0.38	0.14	-0.27	0.46	0.29	0.061	0.26	0.035	0.21	-0.011	0.38	-0.27	0.33	0.51	-0.23	0.34	-

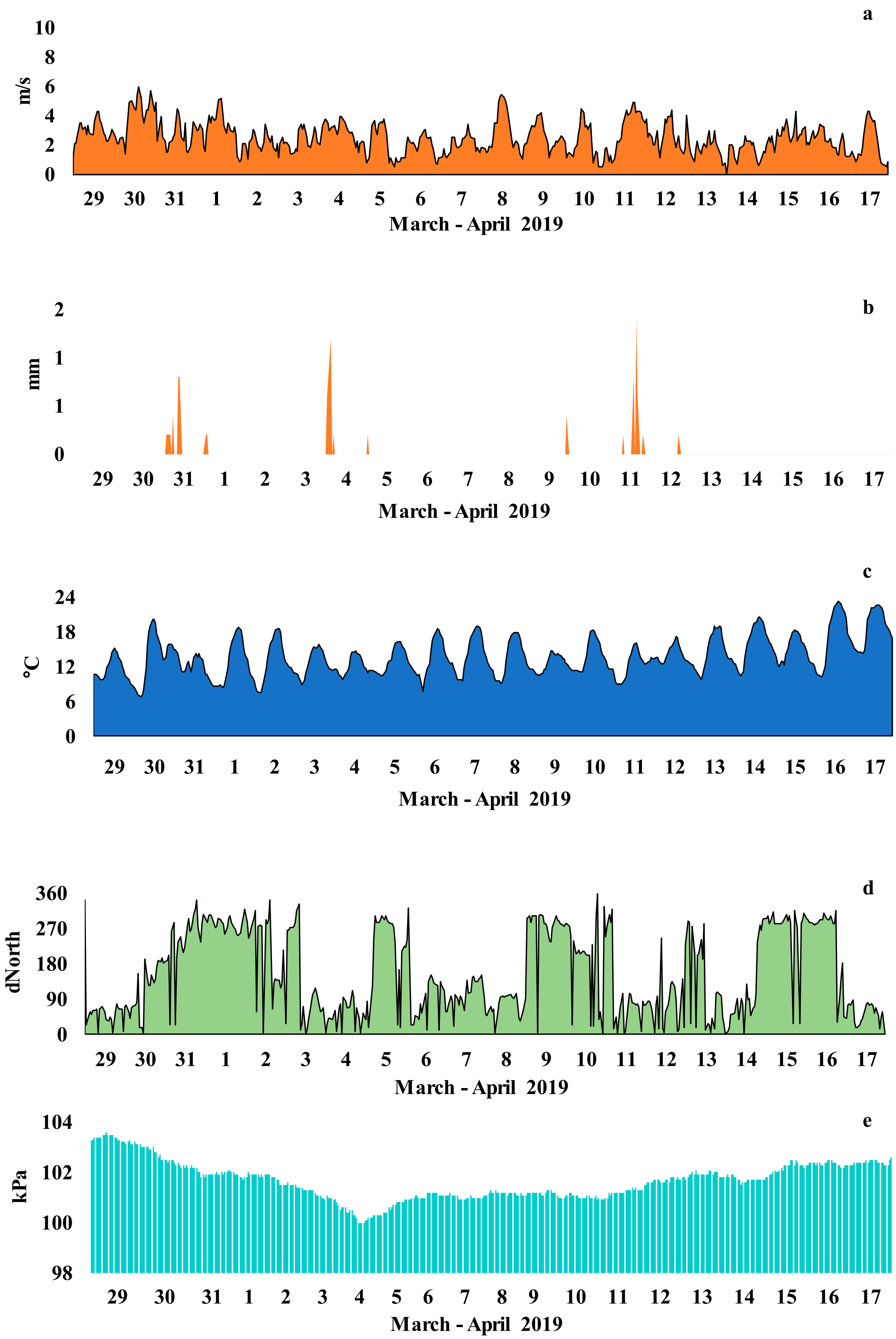

Figure S1: Meteorological data collected from 29th to 17th March-April 2019at Cassana (FE), Italy: wind speed (a), rainfall (b), temperature (c), wind direction (d) and pressure (e).

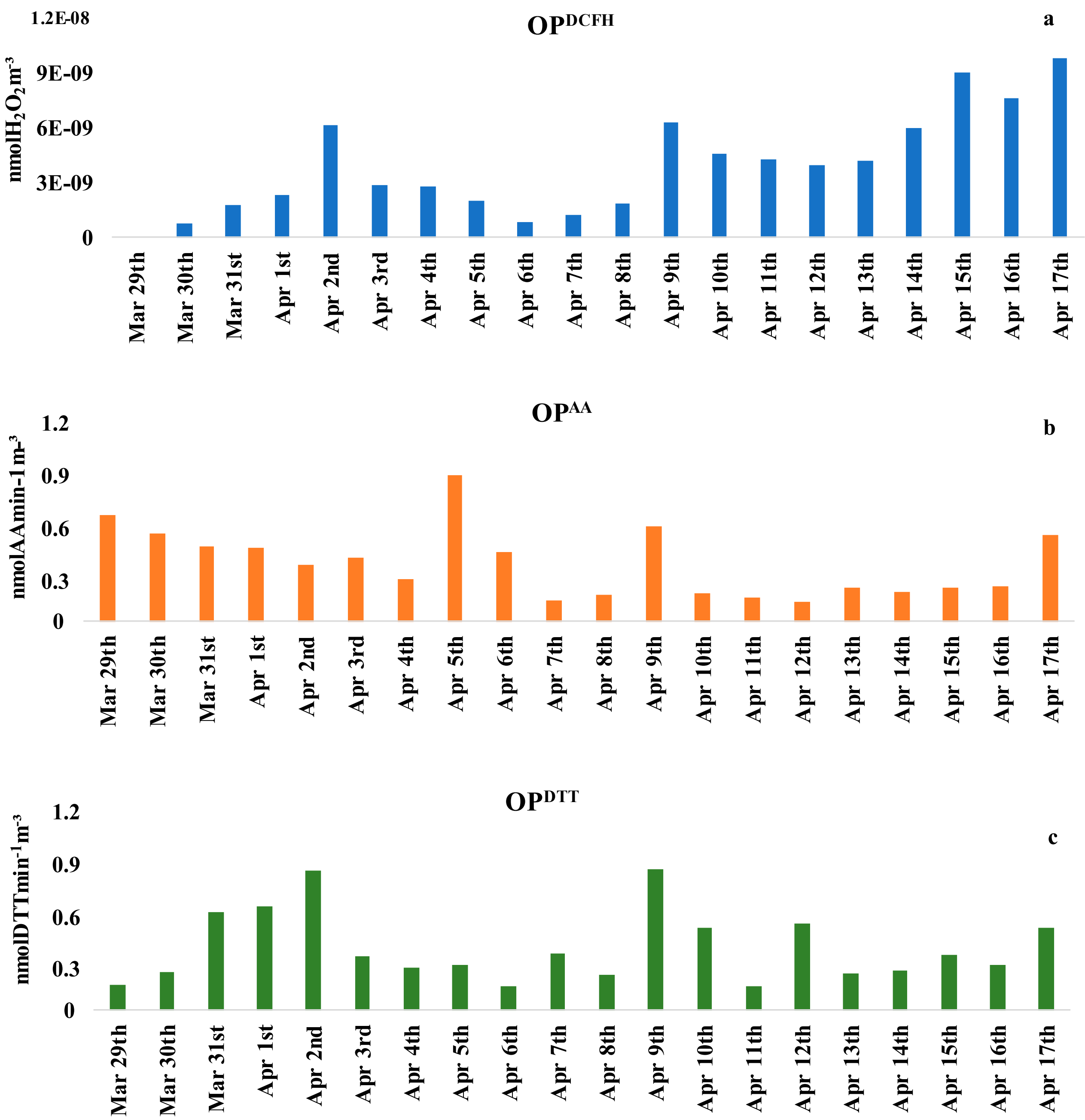

Figure S2: Oxidative potential obtained through 2′,7′-dichlorofluorescin (OP^{DCFH}), ascorbic acid (OP^{AA}) and dithiothreitol (OP^{DTT}) assays on $PM_{2.5}$ filters collected at Cassana (FE), Italy, from 29^{th} to 17^{th} March-April 2019. Values below limits of detection (LODs) are not reported.

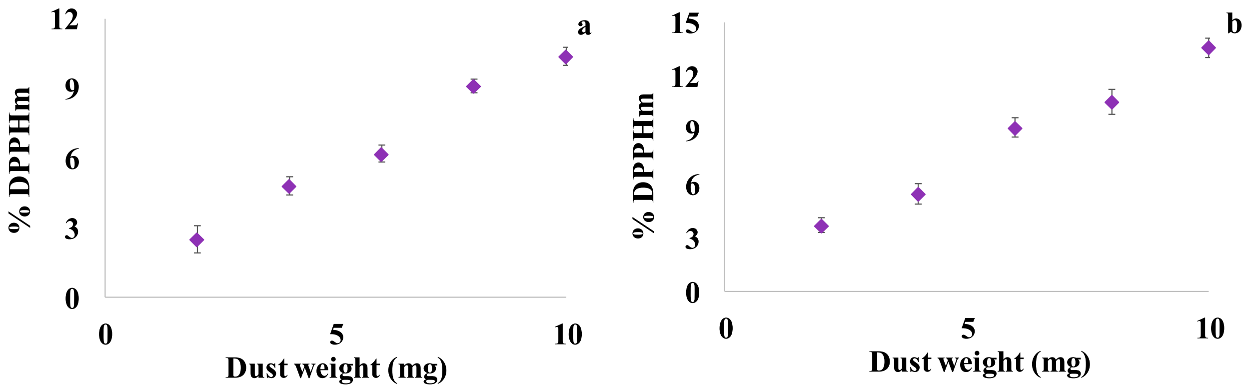

Figure S3: Reducing potential **(**%DPPHm) linearity of response of (a) UD (urban particulate matter certified material, NIST168a) and (b) D (diesel particulate matter certified material, NIST1650b).