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Supplementary material

Composition of water-soluble organic carbon in non-urban atmospheric aerosol collected at the Storm Peak Laboratory

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Results and discussion

Inorganic ionic composition

The concentration ranges of inorganic ions (Na^+, K^+, Ca^{2+}, Mg^{2+}, NH_4^+, SO_4^{2-}, Cl^- and NO_3^-) for the six composites of atmospheric aerosol samples collected at Storm Peak Laboratory (SPL) are presented in Fig. S1. For all composites, sulfate ions were the most abundant inorganic species. Inorganic sulfates originate in part from sulfur oxides emitted by the three coal power plants (distances of ~50, 80 and 250 km) upwind to the west of the sampling site.[1] It is known that there are some particle phase nitrate sampling artefacts caused by evaporative loss of the semi-volatile ammonium nitrate or gas-phase formation and then adsorption of nitric acid.[2] In the present study particle phase nitrate sampling artefacts were not estimated, thus the values of nitrate concentration in atmospheric aerosol samples collected at SPL may have higher degree of uncertainty.

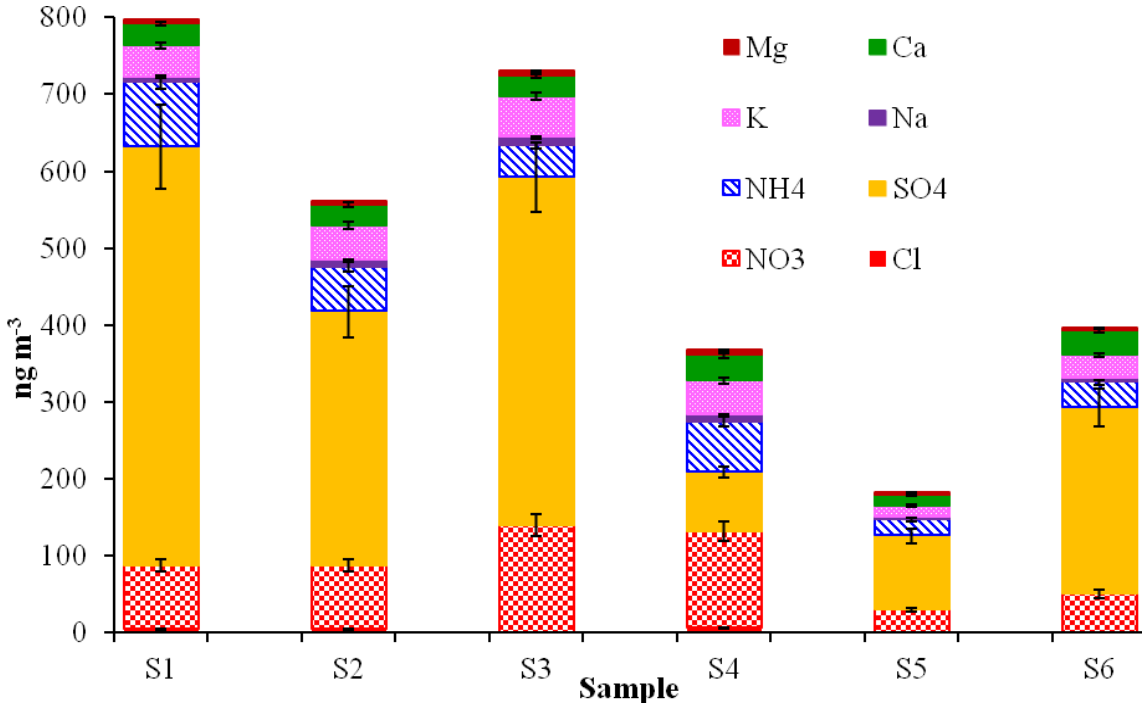

Fig. S1. Concentrations of inorganic ions measured in the six composite samples of atmospheric $PM_{2.5}$.

Table S1. Concentrations (ng m^{-3}) of inorganic ions measured in the six composite samples of atmospheric $PM_{2.5}$ collected at the SPL

Sample	Cl	NO_3	SO_4	NH_4	Na	K	Ca	Mg
S1	4.4	83	544	85	6.5	42	28	5.0
S2	4.3	83	330	58	2.0	46	27	4.6
S3	2.6	137	452	41	11	54	27	6.0
S4	5.6	126	77	66	8.9	44	33	7.0
S5	2.4	27	97	21	3.5	14	14	3.0
S6	0.4	50	242	33	6.4	29	33	2.2

Table S2. Concentrations of the low molecular weight organic acids measured using IC with conductivity detector in the six composite samples of atmospheric $PM_{2.5}$ collected at SPL

Sample	Lactic acid	Acetic acid	Formic acid	Methane sulfonic acid	Malonic acid	Oxalic acid
S1	11	13	7.9	4.5	20	34
S2	13	11	7.7	3.8	22	25
S3	11	15	11	4.5	27	38
S4	13	19	13	6.7	25	27
S5	4.2	4.4	4.8	2.4	13	28
S6	5.4	2.8	4.6	2.5	25	42

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Table S3. Concentrations (ng m^{-3}) of organic acids and lignin derivatives measured using GC/MS in the six composite samples of atmospheric $PM_{2.5}$ collected at the SPL

Organic acids and lignin derivatives	S1	S2	S3	S4	S5	S6
Maleic acid	1.1	1.0	1.1	1.3	1.3	1.8
me-Succinic acid	1.0	0.8	0.9	0.9	0.2	0.4
Succinic acid	12	13	16	15	4.7	8.6
Glutaric acid	3.7	3.7	4.4	4.4	1.9	3.0
Salicylic acid	0.2	0.1	0.1	0.1	0.0	0.0
2-Methylglutaric	0.7	0.5	0.7	0.9	0.2	0.3
3-Methylglutaric acid	0.3	0.4	0.4	0.3	0.0	0.0
3-Methyladipic acid	0.9	0.9	0.6	0.6	0.3	0.6
Isophthalic acid	2.9	1.6	3.5	1.6	1.2	0.0
Phthalic acid	2.9	2.4	2.6	2.2	0.8	2.1
Vanillic acid	0.1	0.0	0.1	0.1	0.0	0.0
Suberic acid	0.9	1.0	0.9	1.1	0.4	0.8
cis-Pinonic acid	2.5	2.3	1.1	1.7	0.3	0.6
Azelaic acid	1.5	1.1	1.1	1.5	0.9	1.4
Sebacic acid	0.8	0.7	0.4	0.7	0.2	0.4
Undecanedioic acid	0.2	0.2	0.0	0.4	0.1	0.0
Dodecanedioic acid	0.1	0.1	0.2	0.2	0.0	0.0
Isostearic acid	0.1	0.0	0.3	0.3	0.1	0.0
Hexanedioic acid	2.6	2.9	3.6	4.2	1.6	2.6
Benzoic acid[A]	0.0	0.0	0.0	0.0	0.0	0.0
m-Toluic acid	0.0	0.1	0.1	0.1	0.1	0.0
Myristic acid	0.3	0.3	0.4	0.3	0.0	0.0
Palmitic acid	0.2	0.2	0.1	0.2	0.1	0.0

[A]Extraction artefact.

Table S4. Concentrations (ng m^{-3}) of sugar alcohols measured in the six composite samples of atmospheric $PM_{2.5}$ collected at the SPL

Sugar alcohols	Pinitol	Glycerol	Erythritol	Arabitol	Inositol	Mannitol	Sorbitol
S1	9.9	1.5	0.4	4.1	1.6	2.5	0.0
S2	6.0	1.1	1.0	3.3	1.0	5.1	0.0
S3	4.5	1.4	1.3	3.6	0.5	2.7	0.0
S4	3.7	1.6	1.2	2.9	0.6	2.7	1.1
S5	0.7	0.9	0.9	3.7	0.2	2.6	1.3
S6	0.0	1.0	0.9	4.5	0.0	0.0	0.0

Table S5. Concentrations (ng m^{-3}) of sugars and sugar-derivatives measured in the six composite samples of atmospheric $PM_{2.5}$ collected at SPL

Sugars and sugar derivatives	Composite samples					
	S1	S2	S3	S4	S5	S6
(α+ß) arabinose	13	5.5	3.0	3.6	0.5	0.5
(α+ß) xylose	0.6	0.0	0.2	0.4	0.1	0.0
d(+) galactose	2.6	1.7	0.6	0.8	0.0	0.0
ß-fructose	15	7.5	3.9	4.1	0.0	0.0
(α+ß) glucose	67	37	18	18	4.8	2.2
(α+ß) mannose	2.3	0.8	0.0	0.6	0.1	0.0
a lactose	0.0	11	4.7	4.9	0.5	0.0
sucrose	59	36	14	15	3.4	2.8
trehalose	1.5	2.4	3.8	3.1	2.6	2.3
mannosan	1.4	1.1	0.7	1.1	0.3	0.7
levoglucosan	4.0	2.6	4.2	7.2	1.1	1.4

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