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Supplement of

Organic tracers of fine aerosol particles in central Alaska: summertime composition and sources

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Table S1. Concentrations (ng m⁻³) of organic tracer compounds detected in individual PM_{2.5} aerosol samples collected from central Alaska.^a

Compounds	Formula	Alaska 01	Alaska 02	Alaska 03	Alaska 04	Alaska 05	Alaska 06	Alaska 07	Alaska 08	Alaska 09	Alaska 10	Alaska 11	Alaska 12	Alaska 13
Anhydrosugars														
Levoglucosan	C ₆ H ₁₀ O ₅	106	33	41	463	241	316	75	169	28	50	38	23	36
Mannosan	C ₆ H ₁₀ O ₅	22	6.8	19	180	55	82	15	57	6.5	7.3	6.3	4.1	5.5
Galactosan	C ₆ H ₁₀ O ₅	23	5.2	8.8	106	21	72	16	59	10	3.5	5.1	3.7	3.5
Subtotal		152	45	69	749	317	470	106	285	44	61	49	31	45
Lignin acids														
4-Hydroxybenzoic acid	C ₇ H ₆ O ₃	1.8	0.5	0.9	6.4	2.5	5.3	1.1	1.3	1.0	0.4	0.6	0.4	0.5
Vanillic acid	C ₈ H ₈ O ₄	1.1	0.1	0.8	1.4	2.6	8.6	1.5	5.1	1.2	0.2	0.2	0.1	0.3
Syringic acid	C ₉ H ₁₀ O ₅	0.2	0.04	0.1	0.4	0.4	1.1	0.2	0.4	0.02	0.1	0.02	0.02	0.1
Subtotal		3.1	0.7	1.8	8.3	5.5	15	2.8	6.7	2.2	0.7	0.8	0.5	0.9
Resin acid														
Dehydroabietic acid	C ₂₀ H ₂₈ O ₂	7.6	0.9	1.0	10	7.9	19	7.0	7.3	2.7	5.1	4.3	2.1	5.1
<i>n</i>-Alkanes														
Heneicosane (C ₂₁)	C ₂₁ H ₄₄	1.9	0.6	1.1	14	2.7	8.1	1.6	3.5	1.3	0.4	0.3	0.2	0.1
Docosane (C ₂₂)	C ₂₂ H ₄₆	0.2	0.1	0.2	2.0	0.6	1.9	0.4	1.0	0.6	0.2	0.1	ND ^b	ND ^b
Tricosane (C ₂₃)	C ₂₃ H ₄₈	2.2	0.8	1.4	9.2	2.1	6.0	2.1	5.6	4.0	1.8	1.1	0.4	0.1
Tetracosane (C ₂₄)	C ₂₄ H ₅₀	0.7	0.3	0.3	2.9	0.6	2.5	1.1	1.5	0.9	0.4	0.4	ND ^b	ND ^b
Pentacosane (C ₂₅)	C ₂₅ H ₅₂	3.7	2.0	1.5	8.0	4.8	6.1	3.9	6.8	2.5	2.0	1.2	0.2	0.1
Hexacosane (C ₂₆)	C ₂₆ H ₅₄	0.5	0.3	0.2	2.8	1.7	2.2	0.4	1.9	1.3	0.6	0.3	0.1	0.1
Heptacosane (C ₂₇)	C ₂₇ H ₅₆	7.4	1.9	1.0	23	7.7	20	6.7	8.7	5.7	3.2	2.3	0.2	0.2
Octacosane (C ₂₈)	C ₂₈ H ₅₈	0.3	0.1	0.1	1.3	0.8	1.3	0.8	1.2	0.4	0.2	0.1	ND ^b	ND ^b
Nonacosane (C ₂₉)	C ₂₉ H ₆₀	1.2	0.7	0.3	5.0	2.4	4.5	1.0	4.0	3.7	1.0	0.5	ND ^b	ND ^b
Triacosane (C ₃₀)	C ₃₀ H ₆₂	0.2	0.1	0.1	0.9	0.5	0.7	0.4	0.7	0.7	0.2	0.1	ND ^b	ND ^b
Hentriacontane (C ₃₁)	C ₃₁ H ₆₄	1.5	0.6	0.2	5.9	2.5	4.9	2.5	3.8	3.1	0.7	ND ^b	ND ^b	ND ^b
Dotriacontane (C ₃₂)	C ₃₂ H ₆₆	0.2	0.1	ND ^b	0.4	ND ^b	0.3	0.2	0.4	0.2	0.1	ND ^b	ND ^b	ND ^b
Tritriacontane (C ₃₃)	C ₃₃ H ₆₈	0.5	0.2	ND ^b	1.9	0.3	1.2	0.9	2.0	1.4	0.5	ND ^b	ND ^b	ND ^b
Subtotal		21	7.6	6.4	77	27	60	22	41	26	11	6.5	1.0	0.5

Table S1. Continued.

Compounds	Formula	Alaska 01	Alaska 02	Alaska 03	Alaska 04	Alaska 05	Alaska 06	Alaska 07	Alaska 08	Alaska 09	Alaska 10	Alaska 11	Alaska 12	Alaska 13
<i>n</i> -Alkanols														
Octanol (C ₈)	C ₈ H ₁₈ O	0.4	0.2	0.5	1.9	0.9	0.3	0.2	1.1	0.3	0.3	0.3	0.3	0.1
Decanol (C ₁₀)	C ₁₀ H ₂₂ O	1.9	0.7	1.8	6.2	1.9	1.0	0.4	3.3	0.6	0.4	0.3	0.3	0.4
Dodecanol (C ₁₂)	C ₁₂ H ₂₆ O	0.9	0.4	0.5	3.0	1.1	0.5	0.4	1.8	0.8	0.5	1.3	0.8	1.0
Tetradecanol (C ₁₄)	C ₁₄ H ₃₀ O	1.1	0.5	1.0	6.8	3.0	2.2	0.6	3.9	2.1	1.1	0.7	0.9	0.6
Pentadecanol (C ₁₅)	C ₁₅ H ₃₂ O	0.3	0.5	0.4	0.9	1.0	0.4	0.1	0.7	0.6	0.5	0.2	0.2	0.2
Hexadecanol (C ₁₆)	C ₁₆ H ₃₄ O	1.0	0.4	0.5	3.0	0.8	1.3	0.6	1.8	0.7	0.6	1.3	0.2	0.6
Heptadecanol (C ₁₇)	C ₁₇ H ₃₆ O	0.5	1.3	0.4	0.4	0.6	0.5	0.1	0.3	0.2	0.3	0.4	0.2	0.2
Octadecanol (C ₁₈)	C ₁₈ H ₃₈ O	1.3	0.7	0.6	3.4	1.8	2.6	0.7	2.0	1.2	0.6	1.6	0.3	0.6
Nonadecanol (C ₁₉)	C ₁₉ H ₄₀ O	0.7	0.3	0.4	2.5	1.9	2.4	0.6	1.4	1.2	0.3	0.3	0.2	0.2
Eicosanol (C ₂₀)	C ₂₀ H ₄₂ O	5.3	1.9	1.8	16	11	14	3.3	8.8	7.3	1.7	0.9	0.1	0.6
Heneicosanol (C ₂₁)	C ₂₁ H ₄₄ O	0.9	0.5	0.3	2.9	1.3	3.0	0.7	1.7	1.6	0.5	0.3	0.1	0.2
Docosanol (C ₂₂)	C ₂₂ H ₄₆ O	6.9	3.1	2.4	21	15	27	5.4	13	14	6.2	2.9	0.5	2.3
Tricosanol (C ₂₃)	C ₂₃ H ₄₈ O	0.5	0.3	0.3	2.9	2.7	2.8	0.7	1.8	1.8	0.8	0.2	0.2	0.2
Tetracosanol (C ₂₄)	C ₂₄ H ₅₀ O	4.2	2.0	1.2	14	9.9	14	2.4	8.9	7.7	3.8	1.1	0.3	1.6
Pentacosanol (C ₂₅)	C ₂₅ H ₅₂ O	0.7	0.4	0.3	3.7	2.2	2.0	0.2	2.1	2.0	0.5	0.2	0.1	0.2
Hexacosanol (C ₂₆)	C ₂₆ H ₅₄ O	4.3	3.1	0.8	14	11	12	2.6	11	8.8	7.1	2.1	0.8	3.3
Heptacosanol (C ₂₇)	C ₂₇ H ₅₆ O	0.7	0.4	ND ^b	2.7	1.9	2.6	0.5	1.4	1.3	0.1	ND ^b	ND ^b	ND ^b
Octacosanol (C ₂₈)	C ₂₈ H ₅₈ O	3.1	1.8	0.5	9.4	9.1	10	1.2	6.3	5.9	3.2	ND ^b	ND ^b	0.9
Nonacosanol (C ₂₉)	C ₂₉ H ₆₀ O	0.5	0.3	ND ^b	1.0	1.0	0.9	ND ^b	0.6	8.2	0.3	ND ^b	ND ^b	ND ^b
Triacosanol (C ₃₀)	C ₃₀ H ₆₂ O	0.9	0.2	ND ^b	3.5	3.2	2.9	ND ^b	2.0	1.6	0.4	ND ^b	ND ^b	ND ^b
Subtotal		36	19	14	119	82	102	21	74	68	29	14	5.3	13

Table S1. Continued.

Compounds	Formula	Alaska 01	Alaska 02	Alaska 03	Alaska 04	Alaska 05	Alaska 06	Alaska 07	Alaska 08	Alaska 09	Alaska 10	Alaska 11	Alaska 12	Alaska 13
<i>n</i>-Alkanoic acids														
Dodecanoic acid (C ₁₂)	C ₁₂ H ₂₄ O ₂	0.9	0.4	0.5	4.0	1.5	2.0	1.3	1.0	3.1	0.2	1.2	0.4	0.4
Tridecanoic acid (C ₁₃)	C ₁₃ H ₂₆ O ₂	0.5	0.3	0.7	2.9	0.7	1.7	0.5	0.5	0.2	0.2	0.5	0.4	0.2
Tetradecanoic acid (C ₁₄)	C ₁₄ H ₂₈ O ₂	1.8	0.6	0.9	5.3	2.1	4.3	1.4	1.5	1.5	0.8	2.5	0.7	1.0
Pentadecanoic acid (C ₁₅)	C ₁₅ H ₃₀ O ₂	1.4	0.4	0.5	3.1	1.4	3.9	0.9	1.0	0.6	0.5	0.9	0.2	0.4
Hexadecanoic acid (C ₁₆)	C ₁₆ H ₃₂ O ₂	11	3.2	3.7	20	11	29	6.6	9.6	5.3	4.6	7.4	2.5	5.1
Heptadecanoic acid (C ₁₇)	C ₁₇ H ₃₄ O ₂	1.2	0.4	0.5	3.1	2.4	3.8	0.8	1.8	0.5	0.6	0.4	0.2	0.4
Octadecanoic acid (C ₁₈)	C ₁₈ H ₃₆ O ₂	9.6	3.3	6.2	30	25	24	6.5	16	3.0	3.9	2.9	1.0	2.3
Nonadecanoic acid (C ₁₉)	C ₁₉ H ₃₈ O ₂	1.7	0.6	0.8	6.6	5.6	5.7	1.3	3.6	0.5	0.8	0.4	0.2	0.4
Eicosanoic acid (C ₂₀)	C ₂₀ H ₄₀ O ₂	27	9.0	12	99	78	81	17	46	4.6	8.2	2.1	0.7	2.1
Heneicosanoic acid (C ₂₁)	C ₂₁ H ₄₂ O ₂	2.2	1.0	1.0	9.9	8.7	8.6	1.6	5.6	0.6	1.6	0.5	0.2	0.5
Docosanoic acid (C ₂₂)	C ₂₂ H ₄₄ O ₂	18	6.9	7.2	84	97	92	11	38	4.7	9.7	3.0	0.8	3.1
Tricosanoic acid (C ₂₃)	C ₂₃ H ₄₆ O ₂	4.1	2.1	2.2	18	15	13	2.2	9.5	1.6	3.8	0.4	0.2	0.5
Tetracosanoic acid (C ₂₄)	C ₂₄ H ₄₈ O ₂	45	18	11	189	166	199	23	101	20	32	8.4	1.1	10
Pentacosanoic acid (C ₂₅)	C ₂₅ H ₅₀ O ₂	ND ^b	0.6	0.4	8.1	7.0	7.1	0.6	4.1	1.4	1.6	0.3	ND ^b	0.2
Hexacosanoic acid (C ₂₆)	C ₂₆ H ₅₂ O ₂	5.3	2.2	0.9	26	24	23	2.1	13	3.4	5.0	0.7	ND ^b	1.1
Heptacosanoic acid (C ₂₇)	C ₂₇ H ₅₄ O ₂	1.1	0.4	0.1	5.6	4.5	4.7	0.4	2.4	2.1	0.9	ND ^b	ND ^b	0.2
Octacosanoic acid (C ₂₈)	C ₂₈ H ₅₆ O ₂	3.7	1.4	0.2	17	21	14	1.0	7.9	ND ^b	3.2	ND ^b	ND ^b	0.3
Nonacosanoic acid (C ₂₉)	C ₂₉ H ₅₈ O ₂	0.4	0.1	ND ^b	2.2	2.0	1.8	0.2	1.0	ND ^b	0.3	ND ^b	ND ^b	ND ^b
Triacosanoic acid (C ₃₀)	C ₃₀ H ₆₀ O ₂	ND ^b	0.3	0.1	6.5	5.8	4.9	0.3	3.0	ND ^b	0.9	ND ^b	ND ^b	ND ^b
Hentriacosanoic acid (C ₃₁)	C ₃₁ H ₆₂ O ₂	ND ^b	ND ^b	ND ^b	0.8	0.6	0.3	ND ^b	0.3	ND ^b	0.1	ND ^b	ND ^b	ND ^b
Dotriacosanoic acid (C ₃₂)	C ₃₂ H ₆₄ O ₂	ND ^b	ND ^b	ND ^b	1.4	1.5	1.5	ND ^b	0.8	ND ^b	0.4	ND ^b	ND ^b	ND ^b
Myristoleic acid (C _{14:1})	C ₁₄ H ₂₆ O ₂	0.5	0.4	0.5	1.9	0.5	0.7	0.2	0.4	ND ^b	0.4	0.5	0.4	0.3
Palmitoleic acid (C _{16:1})	C ₁₆ H ₃₀ O ₂	0.5	0.2	0.2	1.0	0.2	0.9	0.3	0.2	ND ^b	0.05	0.1	0.05	0.01
Oleic acid (C _{18:1})	C ₁₈ H ₃₄ O ₂	1.0	0.7	1.0	2.7	2.1	0.8	0.4	0.9	0.1	0.3	0.9	0.2	0.2
Linoleic acid (C _{18:2})	C ₁₈ H ₃₂ O ₂	0.3	0.1	0.4	2.4	1.1	0.7	0.6	0.9	0.02	0.3	0.03	0.1	0.1
Gondoic acid (C _{20:1})	C ₂₀ H ₃₈ O ₂	0.4	0.7	0.4	3.7	2.7	3.3	0.6	1.8	ND ^b	0.3	0.6	ND ^b	0.1
Erucic acid (C _{22:1})	C ₂₂ H ₄₂ O ₂	ND ^b	0.1	0.2	2.4	1.3	3.7	0.3	1.2	ND ^b	0.7	ND ^b	ND ^b	0.3
Nervonic acid (C _{24:1})	C ₂₄ H ₄₆ O ₂	1.2	1.4	ND ^b	7.3	3.9	1.5	0.8	2.9	ND ^b	0.6	ND ^b	ND ^b	0.4
Subtotal		140	55	51	562	492	537	83	276	53	82	34	9.2	30

Table S1. Continued.

Compounds	Formula	Alaska 01	Alaska 02	Alaska 03	Alaska 04	Alaska 05	Alaska 06	Alaska 07	Alaska 08	Alaska 09	Alaska 10	Alaska 11	Alaska 12	Alaska 13
Primary sugars														
Glucose	C ₆ H ₁₂ O ₆	5.9	7.2	9.7	9.1	7.6	19	0.9	2.2	0.1	7.2	7.3	6.9	5.0
Fructose	C ₆ H ₁₂ O ₆	1.0	1.2	2.1	1.2	0.7	5.7	0.3	0.8	0.02	1.0	0.8	1.1	0.8
Sucrose	C ₁₂ H ₂₂ O ₁₁	1.1	1.0	1.1	1.6	1.8	13	0.3	0.6	0.1	0.3	0.2	0.2	0.1
Trehalose	C ₁₂ H ₂₂ O ₁₁	2.2	1.7	2.6	2.5	2.1	3.6	0.2	0.3	0.01	2.8	5.7	4.6	4.9
Xylose	C ₅ H ₁₀ O ₅	0.9	0.3	0.3	5.1	0.7	2.3	0.5	2.3	0.2	0.4	0.4	0.2	0.2
Subtotal		11	11	16	20	13	44	2.2	6.2	0.3	12	14	13	11
Sugar alcohols														
Arabitol	C ₅ H ₁₂ O ₅	9.2	4.7	8.1	10	4.7	7.2	0.6	4.5	0.5	4.5	11	11	11
Mannitol	C ₆ H ₁₄ O ₆	9.9	3.9	8.9	11	5.5	6.3	0.5	3.0	0.4	4.5	9.4	9.0	8.0
Inositol	C ₆ H ₁₂ O ₆	0.2	0.2	0.2	0.7	0.2	1.3	0.1	0.5	0.05	0.1	0.1	0.1	0.1
Erythritol	C ₄ H ₁₀ O ₄	0.6	0.3	0.5	2.3	1.4	3.5	0.5	2.3	0.1	0.4	0.5	0.3	0.4
Subtotal		20	9.0	18	24	12	18	1.7	10	1.0	9.6	21	20	19
Phthalate esters														
Diethyl phthalate	C ₁₂ H ₁₄ O ₄	0.2	0.03	0.1	0.5	0.4	0.2	0.3	3.8	2.7	0.9	1.2	0.04	0.1
Dibutyl phthalate	C ₁₆ H ₂₂ O ₄	0.1	0.1	0.1	0.6	0.5	0.3	0.2	1.0	0.6	0.5	0.4	0.3	0.2
Diisobutyl phthalate	C ₁₆ H ₂₂ O ₄	0.04	0.1	0.1	0.2	0.1	0.1	0.1	1.0	0.2	0.1	0.1	0.1	0.1
Diethylhexyl phthalate	C ₂₄ H ₃₈ O ₄	0.1	0.2	0.3	0.6	0.6	0.2	0.3	0.8	0.6	0.3	0.2	0.2	0.3
Subtotal		0.4	0.4	0.6	1.9	1.6	0.8	0.9	6.6	4.1	1.9	1.9	0.6	0.7
Aromatic acid														
Benzoic acid	C ₇ H ₆ O ₂	0.2	0.1	0.2	0.9	0.4	0.6	0.3	0.5	0.3	0.1	0.2	0.1	0.2
Polyacids														
Glyceric acid	C ₃ H ₆ O ₄	0.9	0.7	1.0	1.7	3.2	2.9	0.7	6.2	0.9	0.9	0.7	0.5	0.4
Tartaric acid	C ₄ H ₆ O ₆	0.7	0.4	0.7	0.9	2.2	1.2	0.3	2.1	0.8	1.0	0.7	1.1	0.3
Citric acid	C ₆ H ₈ O ₇	0.6	0.5	0.9	0.6	1.5	0.9	0.2	1.3	0.2	0.9	0.8	1.0	0.5
Subtotal		2.2	1.5	2.6	3.2	6.9	5.0	1.2	9.6	1.9	2.7	2.1	2.6	1.2

Table S1. Continued.

Compounds	Formula	Alaska 01	Alaska 02	Alaska 03	Alaska 04	Alaska 05	Alaska 06	Alaska 07	Alaska 08	Alaska 09	Alaska 10	Alaska 11	Alaska 12	Alaska 13
Isoprene oxidation products														
2-Methylglyceric acid	C ₄ H ₈ O ₄	2.1	1.1	2.2	3.6	4.5	1.4	0.5	8.8	0.7	1.1	1.5	0.8	0.6
<i>cis</i> -2-methyl-1,3,4-trihydroxy-1-butene	C ₅ H ₁₀ O ₃	6.6	4.2	8.5	9.6	13	0.4	0.2	18	0.2	2.8	2.1	3.6	2.3
<i>trans</i> -2-methyl-1,3,4-trihydroxy-1-butene	C ₅ H ₁₀ O ₃	13	8.3	19	23	33	0.9	0.5	42	0.2	6.9	4.4	7.6	1.6
3-Methyl-2,3,4-trihydroxy-1-butene	C ₅ H ₁₀ O ₃	2.4	1.4	3.3	3.9	6.0	0.2	0.1	7.3	0.1	1.1	0.7	1.3	0.3
C ₅ -Alkene triols ^c		22	14	30	37	53	1.4	0.8	67	0.5	11	7.2	12	4.2
2-Methylthreitol	C ₅ H ₁₂ O ₄	10	5.4	8.5	8.7	13	1.0	1.0	22	0.4	1.9	2.5	1.7	0.8
2-Methylerythritol	C ₅ H ₁₂ O ₄	23	13	21	22	28	1.7	1.4	44	0.5	6.3	5.7	5.4	1.6
2-Methyltetrols ^d		33	19	29	31	41	2.6	2.4	66	0.8	8.1	8.2	7.1	2.4
Subtotal		57	34	62	71	98	5.5	3.7	142	2.0	20	17	20	7.3
Monoterpene oxidation products														
3-Hydroxyglutaric acid	C ₅ H ₈ O ₅	0.9	0.7	1.2	4.8	2.9	1.1	0.3	4.3	0.3	1.6	1.3	1.7	1.0
Pinic acid	C ₉ H ₁₄ O ₄	3.7	2.6	4.4	4.6	4.3	1.5	1.0	13	0.2	1.3	2.8	2.7	2.7
Pinonic acid	C ₁₀ H ₁₆ O ₃	4.9	0.6	2.1	1.0	0.1	1.4	1.5	15	0.3	0.2	1.9	0.5	0.4
3-MBTCA ^e	C ₈ H ₁₂ O ₆	1.2	0.9	1.6	3.8	2.9	0.6	0.2	3.5	0.3	2.1	2.0	2.2	2.0
Subtotal		11	4.9	9.4	14	10	4.6	2.9	36	1.0	5.2	8.1	7.0	6.1
Sesquiterpene oxidation products														
β-Caryophyllinic acid	C ₁₄ H ₂₂ O ₄	0.4	0.3	0.3	3.4	1.5	2.4	0.3	1.7	0.1	0.6	0.3	0.3	0.3

^aThe sample collection periods are June 5-12 (Alaska 01), June 12-25 (Alaska 02), June 25-July 04 (Alaska 03), July 04-06 (Alaska 04), July 06-14 (Alaska 05), July 14-23 (Alaska 06), July 23-30 (Alaska 07), July 30-August 04 (Alaska 08), August 04-08 (Alaska 09), August 08-25 (Alaska 10), August 25-31 (Alaska 11), August 31-September 10 (Alaska 12) and September 10-21 (Alaska 13) in 2009.

^bNot detected

^c*cis*-2-methyl-1,3,4-trihydroxy-1-butene + *trans*-2-methyl-1,3,4-trihydroxy-1-butene + 3-methyl-2,3,4-trihydroxy-1-butene

^d2-Methylthreitol + 2-methylerythritol

^e3-Methyl-1,2,3-butanetricarboxylic acid