

MASS CONCENTRATIONS OF WATER-SOLUBLE IONS IN PM_{2.5} PARTICLE FRACTION MEASURED AT URBAN BACKGROUND SITE IN CROATIA

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OBJECTIVE

Daily PM_{2.5} samples were taken over a three years 2014 – 2016 at urban background site (UBS) in northern part of Zagreb, Croatia. Samples were analysed for water-soluble anion species (Cl⁻, NO₃⁻, SO₄²⁻) and cation species (Na⁺, NH₄⁺, K⁺, Mg²⁺, Ca²⁺), to investigate the relationship between pollutant mass concentrations, contribution of measured species to PM_{2.5} mass and the prediction of the pollutant sources.

METHODOLOGY

Mass concentrations of PM_{2.5} particle fraction were determined by gravimetry according to the standard HRN EN 14907:2006 (EN 14907:2005) and HRN EN 12341:2014 (EN 12341:2014).

Water-soluble ionic species were analysed using Thermo Scientific – ICS 5000 Capillary ion chromatography sistem equipped with suppressed conductivity detection according to the standard CEN/TR 2011.

QC/QA; Accreditation Certificate 1288 / CAA, HRN EN ISO/IEC 17025:2007 (ISO/IEC 17025:2005+Cor.1:2006; EN ISO/IEC 17025:2005+AC:2006)

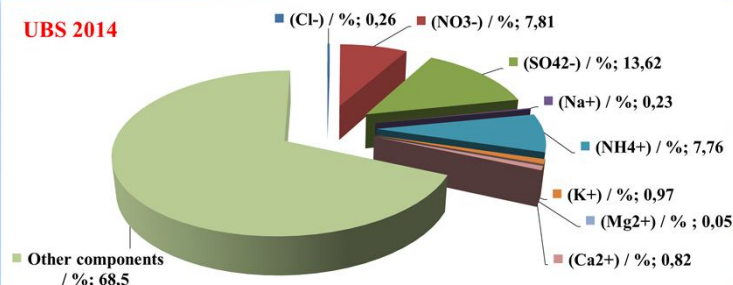
RESULTS

Mass concentration of pollutants (μg m⁻³).

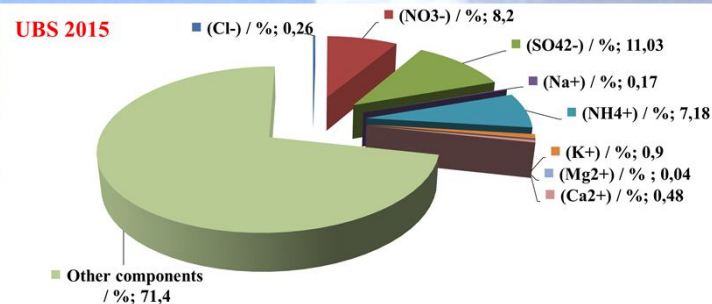
Sampling period		PM _{2.5}	Cl ⁻	NO ₃ ⁻	SO ₄ ²⁻	Na ⁺	NH ₄ ⁺	K ⁺	Mg ²⁺	Ca ²⁺
2014. N = 364	$\bar{\gamma}$	19.6	0.05	1.53	2.67	0.045	1.52	0.19	0.01	0.16
	γ_{50}	14.4	0.01	0.53	1.80	0.03	1.01	0.11	0.01	0.09
	γ_{max}	102.9	1.51	10.01	21.14	0.59	10.56	4.91	0.26	1.47
2015. N = 364	$\bar{\gamma}$	21.4	0.06	1.75	2.36	0.04	1.54	0.21	0.01	0.10
	γ_{50}	15.7	0.01	0.56	1.73	0.028	1.25	0.12	0.006	0.051
	γ_{max}	140.6	2.30	21.21	11.22	0.27	9.11	6.77	0.53	1.73
2016. N = 366	$\bar{\gamma}$	22.7	0.06	1.96	2.15	0.03	1.50	0.21	0.01	0.09
	γ_{50}	12.9	0.01	0.42	1.54	0.02	0.98	0.11	0.00	0.06
	γ_{max}	313.8	0.90	29.62	13.20	0.24	12.00	1.96	0.20	1.33

N – number of samples $\bar{\gamma}$ – mean value γ_{50} – median γ_{max} – maximum value

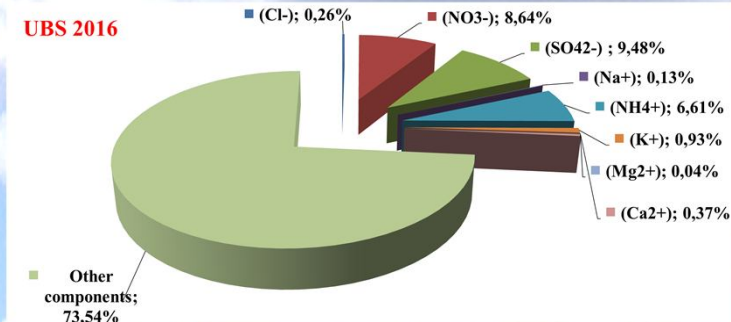
UBS 2014



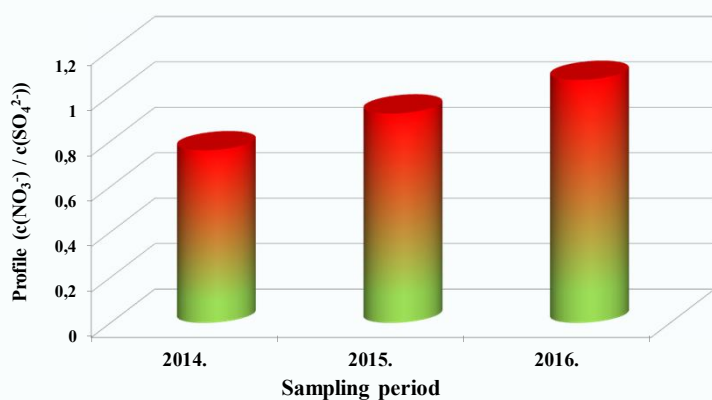
UBS 2015



UBS 2016



Ion mass contributions (%) to the overall PM_{2.5} mass (2014-2016).



The annual average mass ratio of (NO₃⁻)/(SO₄²⁻).

CONCLUSION

PM_{2.5} mass concentration was significantly influenced by the season, reaching their high values in the winter. Annual average PM_{2.5} mass concentration measured at urban background site (UBS) ranged from 19.6 μg m⁻³ to 22.7 μg m⁻³, respectively.

The annual average ion mass concentrations at UBS followed the order SO₄²⁻ > NO₃⁻ > NH₄⁺ > K⁺ > Ca²⁺ > Cl⁻ > Na⁺ > Mg²⁺, respectively, contributed from 26.5% to 31.5% to the overall PM_{2.5} mass, respectively.

Annual average mass ratios of (NO₃⁻)/(SO₄²⁻) obtained in PM_{2.5} ranged from 0.76 to 1.05, respectively, indicating that mobile source emission was an important contributor to particle mass at UBS.

The results of the principal component analysis (PCA) of pollutant mass concentrations pointing to a local traffic emission, biomass burning, re-suspended soil dust and to secondary aerosols as important sources.