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^-. NO_3^-. SO_4^{2-}.) and cation species (Na^+. NH_4^+. K^+. Mg^{2+}. Ca^{2+}), 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.

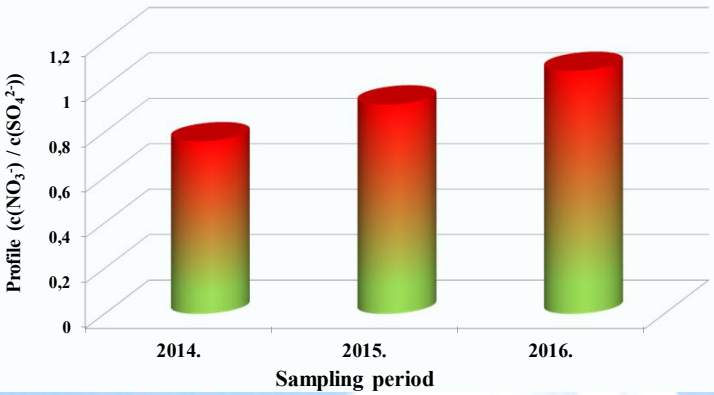
QC/QA ; Accreditation Certificate 1288 / CAA, HRN EN ISO/IEC 17025:2007 (ISO/IEC 17025:2005+Cor.1:2006; EN ISO/IEC 17025:2005+AC:2006)

RESULTS

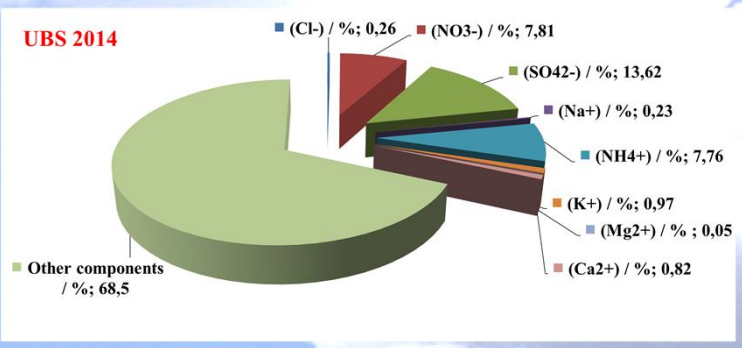
Mass concentration of pollutants (μg m^{-3}).

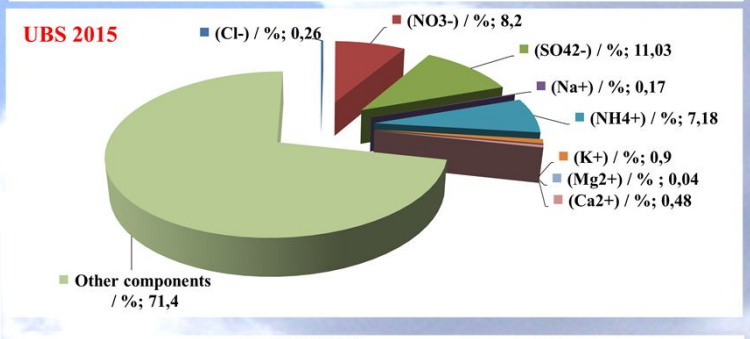
Sampling period		$PM_{2.5}$	Cl^-	NO_3^-	SO_4^{2-}	Na^+	NH_4^+	K^+	Mg^{2+}	Ca^{2+}
2014. N = 364	$\bar{\gamma}$	19.6	0.05	1.53	2.67	0.045	1.52	0.19	0.01	0.16
	γ_{50}	14.4	0.01	0.53	1.80	0.03	1.01	0.11	0.01	0.09
	γ_{max}	102.9	1.51	10.01	21.14	0.59	10.56	4.91	0.26	1.47
2015. N = 364	$\bar{\gamma}$	21.4	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

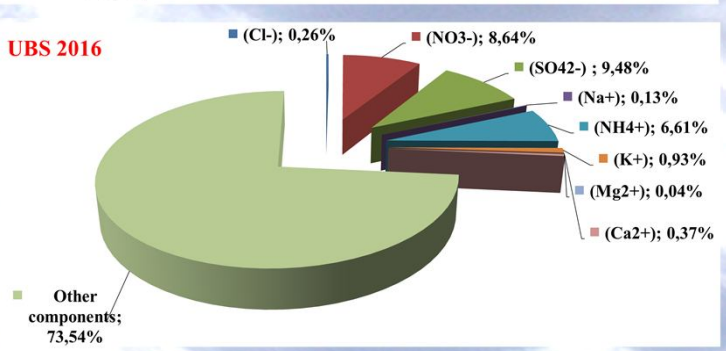
N – number of samples $\bar{\gamma}$ – mean value γ_{50} - median γ_{max} – maximum value



The annual average mass ratio of $(NO_3^-)/(SO_4^{2-})$.







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

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 $SO_4^{2-} > NO_3^- > NH_4^+ > K^+ > Ca^{2+} > Cl^- > Na^+ > Mg^{2+}$, respectively, contributed from 26.5% to 31.5% to the overall $PM_{2.5}$ mass, respectively.

Annual average mass ratios of $(NO_3^-)/(SO_4^{2-})$ 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.