Gas and particle phases of NO_3^-, SO_4^{2-} and NH_4^+ in the atmosphere of São Paulo State: a preliminary result.

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Introduction

The objective of this study is to characterize the gas and particulate phase of NO_3^-, SO_4^{2-} and NH_4^+ in the São Paulo State in 6 sites: Cunha (CN); Cachoeira Paulista (CP); São José dos Campos (SJC); São Carlos (SC); Assis (AS); Teodoro Sampaio (TS). The sampling system is based on diffusion tubes (denuders) for gas phase and glass fiber substrate for particle phase[1]. The sampling period was from May/2013 to December/2014 totalizing 16 full samples in each site.

Results and Discussion

The statistics for the aerosol atmospheric concentrations for the gas and particle phases are presents in table 1.

Table 1. Statistics for the species concentration in the gas and particle phases (GM: Geometric mean, STD: Standard deviation) in nmol.m^{-3}.

		GM	*STD*	*GM*	*STD*
		Gas phase		*Particle phase*	
		nmol.m^{-3}			
CN	NH_4^+	19,8	70,5	4,80	14,3
	NO_3^-	0,80	1,86	1,82	3,44
	SO_4^{2-}	0,18	0,64	0,49	1,05
CP	NH_4^+	32,4	23,4	18,4	48,3
	NO_3^-	2,62	3,66	2,88	3,34
	SO_4^{2-}	1,82	3,76	0,69	1,39
SJC	NH_4^+	**97**	162	42,3	80,1
	NO_3^-	**12,3**	21,0	**10,5**	16,9
	SO_4^{2-}	**37,3**	93,3	**6,51**	17,2
SC	NH_4^+	42,1	73,8	18,9	105
	NO_3^-	4,54	9,96	4,34	11,3
	SO_4^{2-}	1,73	7,29	0,33	5,55
AS	NH_4^+	36,9	30,4	9,74	25,6
	NO_3^-	1,95	2,94	2,89	3,24
	SO_4^{2-}	0,49	1,49	0,49	1,14
TS	NH_4^+	42,4	20,3	8,16	50,2
	NO_3^-	2,47	3,09	2,80	2,23
	SO_4^{2-}	0,26	0,72	0,26	0,5

The statistics differences were estimated through Tukey (HSD) method that indicated difference between SJC and all the other sites, individually (bold figures in table1) for both phases except for NH_4^+ for the particulate phase. This species presents no statistical significance difference among the studied sites. The linear correlation test (Pearson coefficient) between the gas and particle phase show that NO_3^- has the higher coefficient value ($P \leq 0.05$) indicating that this species comes from the conversion gas-particle probably derived from biomass burning and fossil fuel combustion. According to Freitas and Solci (2008)[2] the fossil fuel combustion in urban environment is the main cause of particulate NO_3^- emission which is observed by the high Pearson coefficient in SJC (coef.0.637 P=0,0350). The coefficient for CN (coef. 0,835 P=0,0014) and TS (coef.0,819 P=0,0020) are high, probably due to NO emission from the soils as well as the biomass burning during the dry season which can be attributed to its rural condition. Concerning the SO_4^{2-} the only site with positive correlation was SC (coef. 0,646 P=0,0412); this species in the particle matter is normally associated to anthropic sources; as there is a bus stop just in the side of the sampling system it is possible that the detected SO_4^{2-} comes from the bus exhaust. It was not detected any correlation between the gas and particle phases for NH_4^+ among the studied sites.

Conclusions

The present results indicates that SJC has a higher concentration of NO_3^-, SO_4^{2-} for both phases being the only site with urban atmosphere characteristics. The other sites are characteristically rural although small urban centers, as for the NH_4^+ is observed only for the gas phase.

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