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SEASONAL VARIATION AND INTER-CORRELATION OF SO_4^{2-}, NO_3^- NH_4^+ IN PM_{10} AEROSOLS AND TRACE GASES SO_2 & NH_3 AT HYDERABAD

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Simultaneous measurements of PM_{10} aerosols and trace gases were carried out at the urban site Hyderabad. These samples were analysed for SO_4^{2-}, NO_3^- and NH_4^+ in water soluble extract. Simultaneously, trace gases SO_2 and NH_3 were also collected to understand their seasonal variation along with PM_{10} fractions of SO_4^{2-}, NO_3^- and NH_4^+. A brief description on methodology and results is given below-

Methodology

Samples of PM_{10} aerosols were collected at Hyderabad which lies in south-central India (17.5˚ N, 78.5˚ E) about 536m above sea level. The samples were collected at the terrace of the main building of our institute at a height of around 11m using Respirable Dust sampler (Envirotech APM 460 NL) on Whatman 41 filters on 24 hr basis with an average flow rate of 1.1 m^3/min. These samples were stored in polythene bags and refrigerated. Trace gases (SO_2 and NH_3) were collected using gaseous attachment of Respirable Dust sampler (Envirotech APM 411 TE) using wet chemical method. The absorbing reagent used for SO_2 was a mixture of Na_2CO_3 and $NaHCO_3$ solution while dilute H_2SO_4 was used for NH_3. These gases were also collected on 24 hr basis with an approximate flow of 1 LPM.

To extract water soluble fraction of SO_4^{2-}, NO_3^- and NH_4^+, a 2 x 2 cm^2 size portion was cut from the filter and transferred in to 7 ml of distilled deionized water. It was extracted using ultrasonic bath (Enertech Electronic Pvt.Ltd.) for 75 min. This extraction showed an efficiency of 99% for these components.

The analysis of SO_4^{2-}, NO_3^- and NH_4^+ was carried out using an Ion Chromatography (Metrohm Basic 792). The samples of SO_2 were determined by Ion Chromatography (as SO_4^{2-}) using anion column while the samples of NH_3 were determined (as NH_4^+) using cation column.

Results and Discussions:

Table 1 gives average concentration and standard deviation of SO_4^{2-}, NO_3^- and NH_4^+ during winter and summer seasons of 2007. Samples collected during January and February months are considered as winter samples (n = 17) while during March-May are considered as summer season samples (n = 40).

It is to be noted that concentrations of SO_4^{2-}, NO_3^- and NH_4^+ are higher during winter season as compared to summer season. This may be due to favourable meteorological conditions. During winters, the boundary layers comes down enhancing the density of pollutants in ambient air. Also, the increased humidity in winter season

catalyzes the oxidation of SO_2 and NO_2 which form SO_4^{2-}, NO_3^- aerosols (Kulshrestha et al., 2005). It is observed that in PM_{10}, SO_4^{2-}, NO_3^- aerosols are correlated with NH_4^+ aerosols. As shown in Fig. 1 & 2, during winter, NH_4^+ showed better correlation with SO_4^{2-} (r^2= 0.67) and NO_3^- (0.63) as compared to summer season (Fig. 3 & 4) when r^2 values were 0.19 and 0.19 respectively. These observations indicated that presence of $(NH_4)_2SO_4$ and $(NH_4)NO_3$ aerosols is more prevalent during winter than in summer.

Table 1: Concentrations of SO_4^{2-}, NO_3^- and NH_4^+ (µg/m^3) in PM_{10} aerosols during winter and summer seasons.

	WINTER (N=17)		**SUMMER** (N=40)	
	Average	**SD**	**Average**	**SD**
SO_4^{2-}	24.1	8.7	11.8	8.1
NO_3^-	13.0	3.6	11.9	4.7
NH_4^+	15.1	5.7	7.0	3.0

Table 2 gives the concentrations of SO_2 and NH_3 during winter and summer seasons. It is seen from the table that there is no much seasonal difference for SO_2 but NH_3 showed slightly higher value during summer season. With subject to correlation analysis, data showed no significant correlation between SO_4^{2-} & SO_2 and NH_4^+ & NH_3. Further details on these results will be discussed during the conference.

Table 2: Concentrations of SO_2 and NH_3 (µg/m^3) in gaseous samples during winter and summer seasons.

	WINTER (N=38)		**SUMMER** (N=68)	
	Average	**SD**	**Average**	**SD**
SO_2	12.9	5.7	12.3	7.8
NH_3	13.7	6.2	15.2	8.8

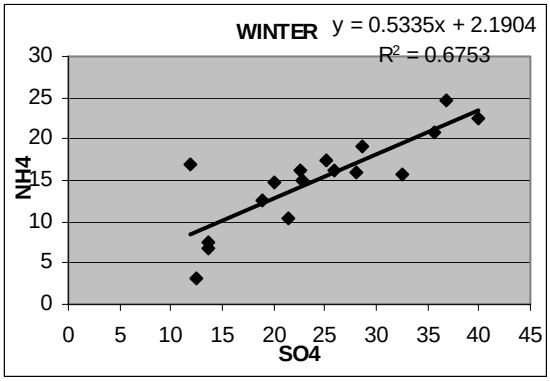

Fig. 1 PM_{10} SO_4^{2-} vs NH_4^+ during winter season

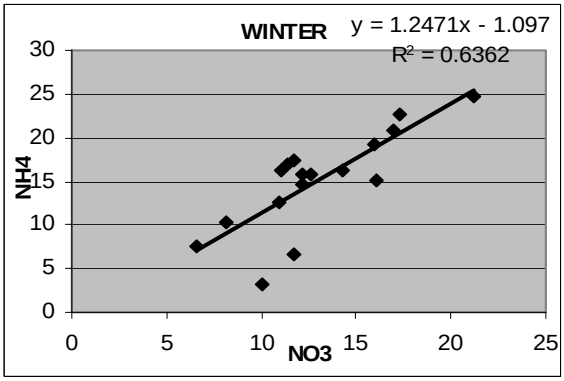

Fig. 2 PM_{10} NO_3^- vs NH_4^+ during winter season

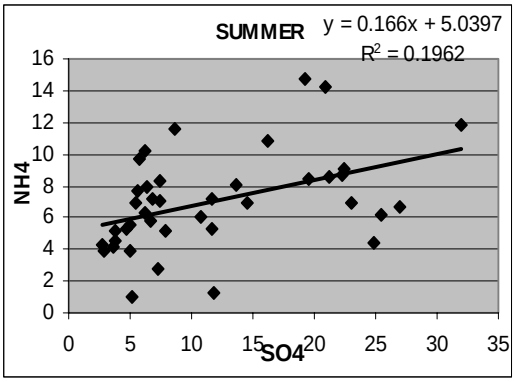

Fig. 3 PM_{10} SO_4^{2-} vs NH_4^+ during summer season

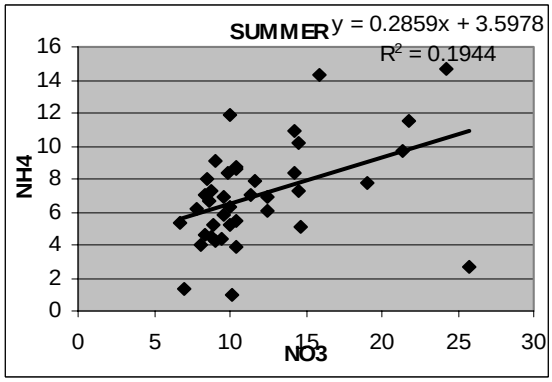

Fig. 4 PM_{10} NO_3^- vs NH_4^+ during summer season

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References:

1. Kulshrestha U C, Hazarika P and Nageshwara rao T 2005 Dominance of anthropogenic sources of PM10 aerosols at allahabad during ISRO-GBP LC II. Special issue Proceedings of the 4th Asian Aerosol Conference, IASTA Bulletin.