

## **Comparative study on chemistry of dew water collected from New Delhi and adjoining townships in north India**

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In north India, dew formation is a frequent phenomenon during intense winters and has implications on crop productivity. Dew water is used to understand the pollution sources, and multi phase chemical reactions. Dew water samples were collected during winter of 2015-16 and 2016-17 over New Delhi and Sonipat and Rohtak in the National Capital Region of New Delhi after the Sun set and before the Sun rise. All samples were alkaline in nature (average pH= 6.7) as opposed to the natural rain water pH of 5.6. There has been increase in the ionic equivalents of all ions with few exceptions of  $\text{Ca}^{2+}$  and  $\text{SO}_4^{2-}$  in successive years from 2014 to 2016 indicating the rise in level of anthropogenic pollutant sources such as vehicular emission, biomass burning, industrial activities. Higher values of  $\text{SO}_4^{2-} / \text{NO}_3^-$  ratio in dew water suggested that stationary sources of  $\text{SO}_4^{2-}$  dominates over  $\text{NO}_3^-$  and the role of  $\text{SO}_4^{2-}$  in determining the acidity of the dew water samples was more compared to nitrate ions. Acidity was neutralized by the cations in the order of  $\text{NH}_4^+ > \text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  except that the order for New Delhi samples was  $\text{Ca}^{2+} > \text{NH}_4^+$  and  $\text{Mg}^{2+}$  in 2015-16 due to increased construction activities and re-suspension of crustal mass. All studied ions except  $\text{Cl}^-$  and  $\text{Mg}^{2+}$  have non marine origin.  $\text{Cl}^-$  has very outsized sea salt fraction at both the NCR sites but it partly showed anthropogenic influence over New Delhi. The less than one ratio of formate and acetate were indicative of anthropogenic activity like fossil fuel and biomass burning around the sampling sites. Biomass burning, vehicular emissions and plant emissions as well as oxidation pathways of volatile organic compounds in ambient atmosphere are possible sources of organic acids. Total Carbon in dew water composed of 57 % organic carbon (OC) and 43% Inorganic Carbon (IC). Average TOC (8.15 ppm) was found to be higher than the average carbon equivalents of organic acids (2.75 ppm). This could be due to unaccounted organic compounds present which were not analysed in this study. Zinc, lead and iron concentrations in dew water samples of New Delhi showed increasing trend in the year 2016-17 compared to previous year but Cu and V showed lower concentrations. In general, the metal concentrations in all samples were higher compared to similar previous studies. Higher amounts of soluble metals in dew water could harm the soil and water quality and corrode the surfaces. All sampling sites had similar meteorological conditions but different levels of pollution resulted in variable chemical nature of dew water. Dew water could be used as potable water at Sonipat but at other place would require treatment before being used for drinking and other domestic purposes.