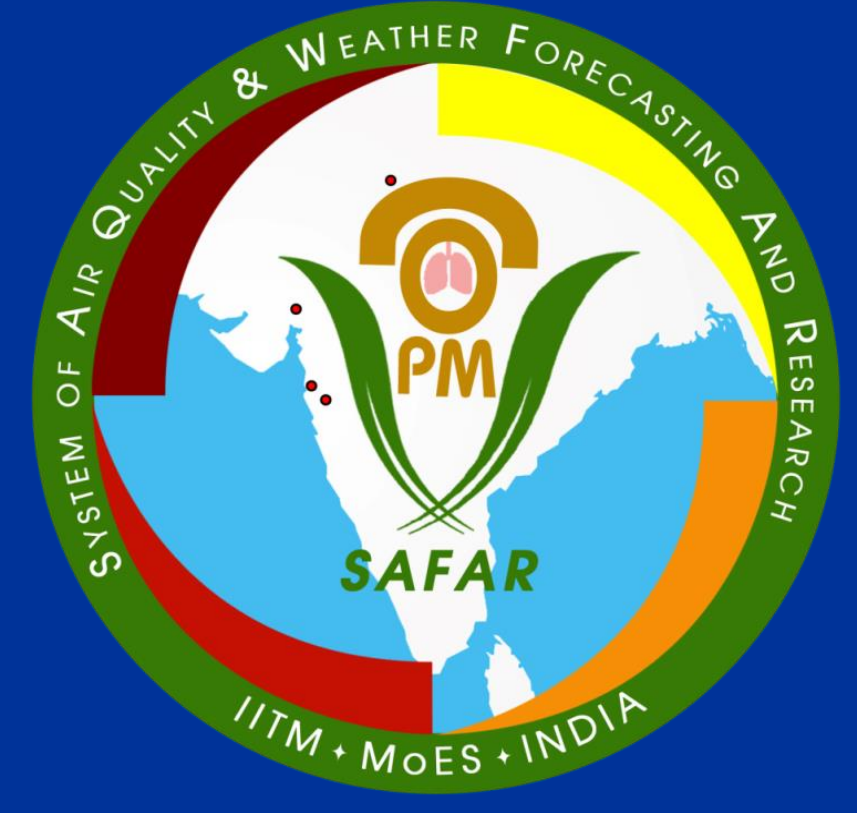


METROPOLITAN AIR QUALITY AND WEATHER SERVICES – SAFAR

Indian Institute Of Tropical Meteorology, Pune, India

PM Speciation, Closure and Source Profile Delhi, winter



INTRODUCTION

Background: The population of Delhi has crossed 2 Cr and with increasing population particulate load especially PM 2.5 also crossed the national air quality standards value of 50µg/m³. Hence, the exposure of such huge population in PM2.5 load has grabbed our attention due to its higher penetrability in the body.

Objectives:

- Estimation of particles with aerodynamic diameter ≤ 2.5 µm (PM_{2.5})
- Categorization of PM 2.5 into different chemical species and mass balance.
- Possible identification of sources based on metals and carbon speciation using receptor model.

METHODOLOGY

Sampling-

- Manual samplers with flow rate 16.7L/min (APM 550) was used for collection of PM 2.5 using Quartz filter paper.
- Sampling period: December, 2017 to February, 2018(02:00-09:00 h-stable & 10:00-16:00 h- unstable)
- Sampling location Ayanagar, Okhla, Noida and Lodhi Road.

Analysis-

- Filter papers are digested for metal (Ca, Cd, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb and Zn) analysis using Atomic Absorption Spectrophotometer.
- Similarly, OC and EC analyzed by OC EC analyzer.
- EPA PMF 5.0 is used for source profiling.

RESULTS

PM2.5 estimation from speciation measurement

$$PM_{2.5} = OM + EC + Ions + \text{Fine soil} + \text{Trace elements}$$

$$OM = 1.6 * OC$$

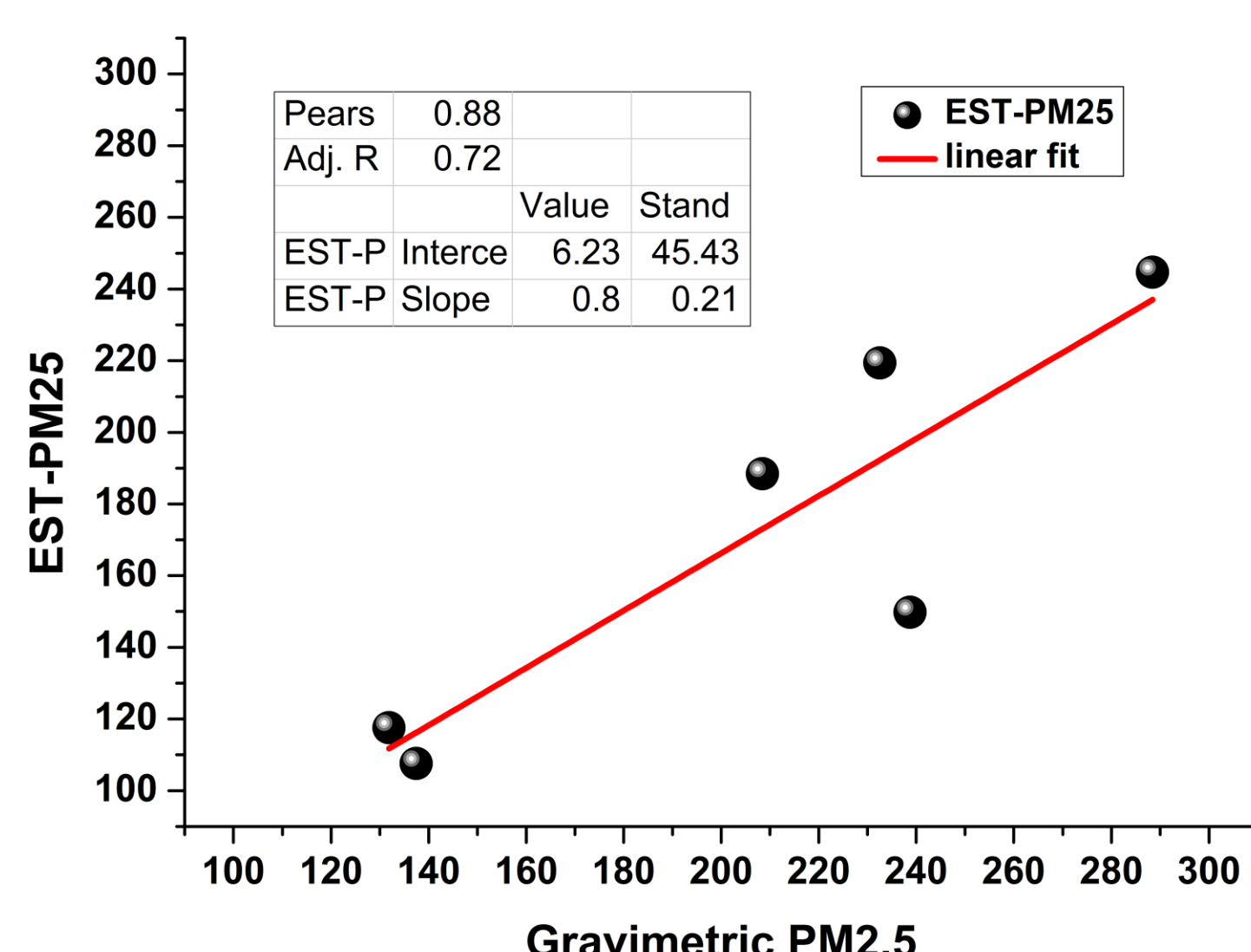
$$\text{Trace elements} = Cr + Cu + Zn + As + Br + Pb$$

$$\text{Fine soil} = 1.89 * Al + 2.14 * Si + 1.21 * K + 1.4 * Ca + 1.67 * Ti + 1.58 * Mn + 1.43 * Fe$$

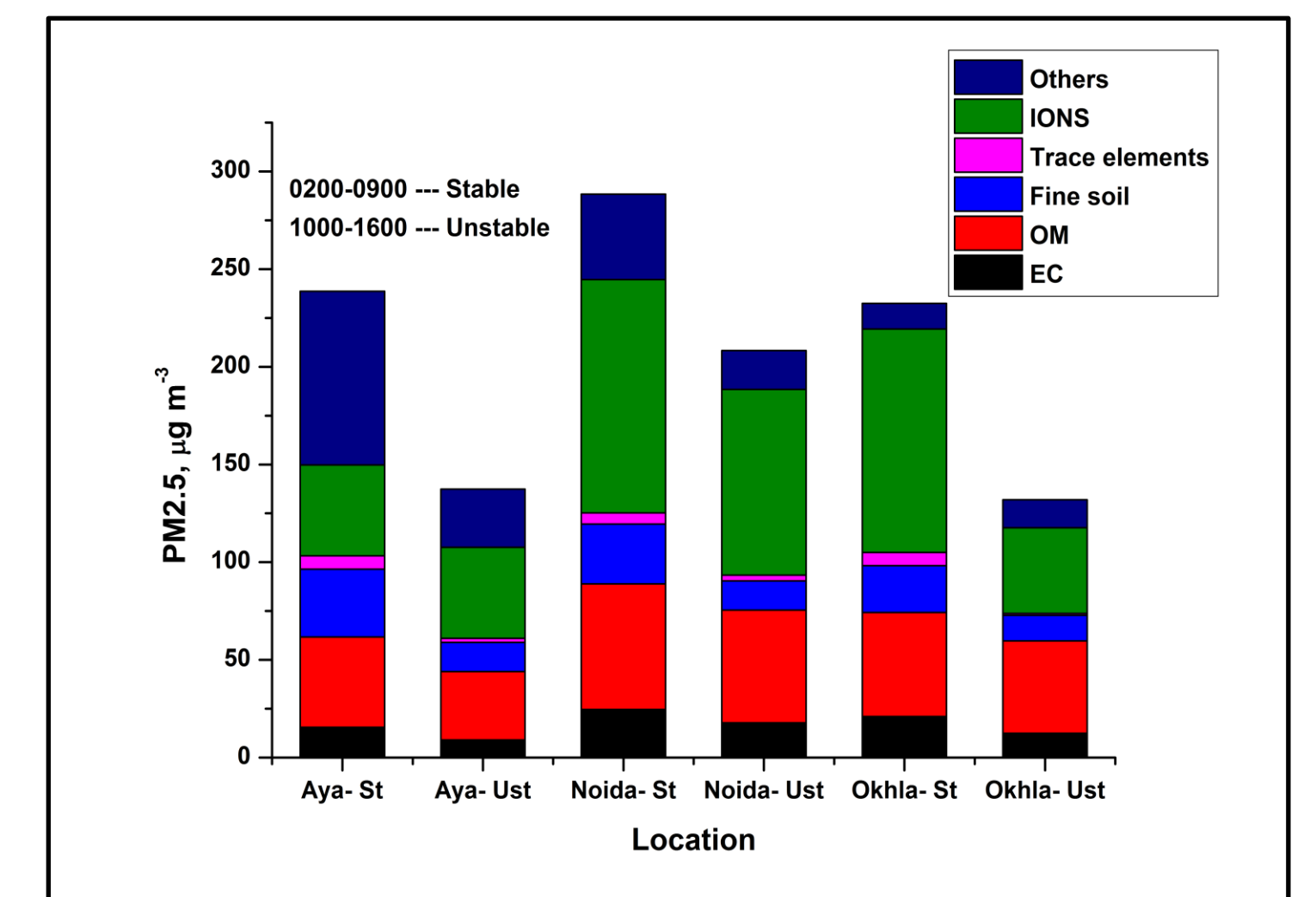
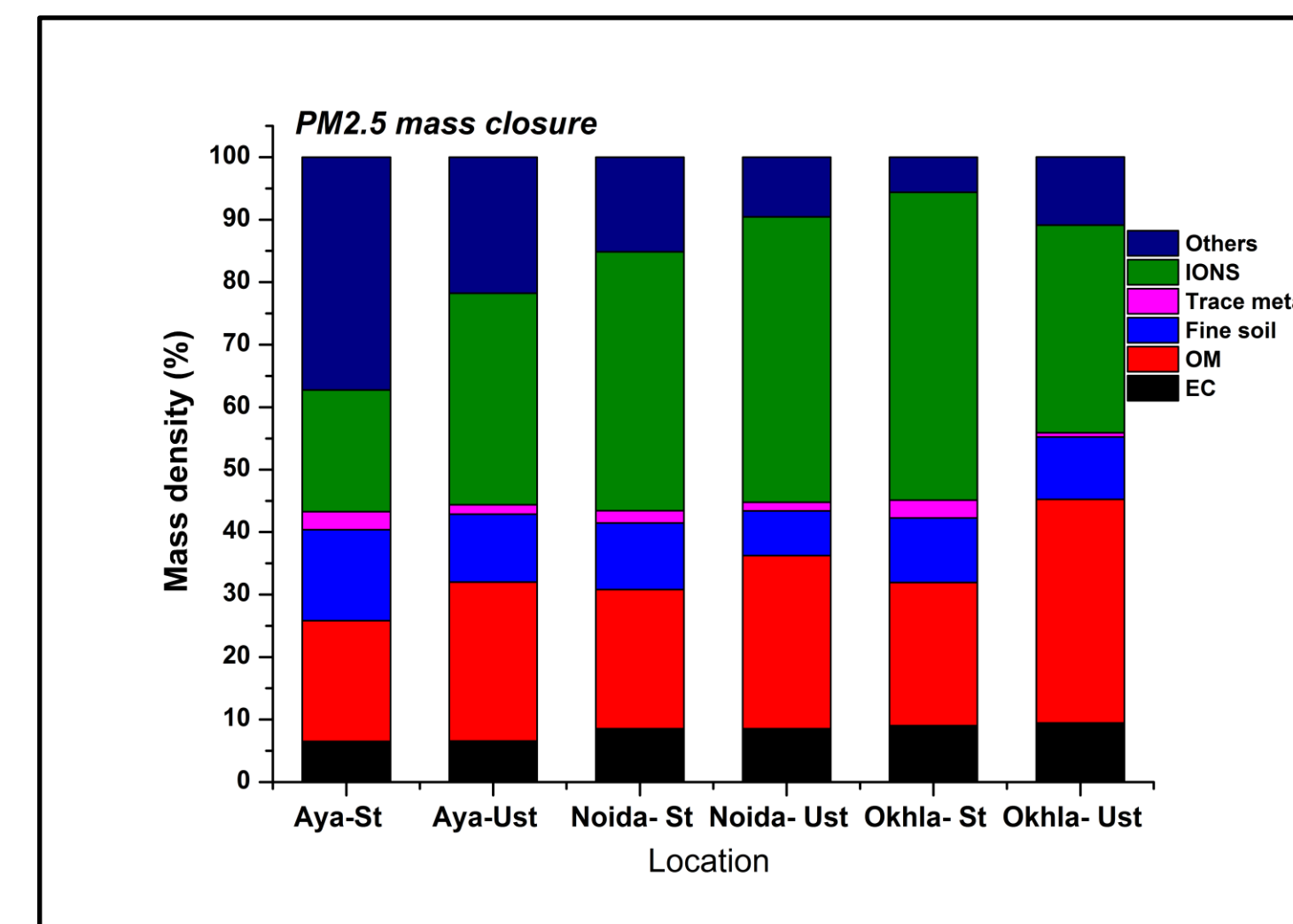
$$Ions = \text{sulphate} + \text{nitrate} + \text{ammonium} + \text{chloride}$$

Qiyuan Wang et al, Atmos. Chem. Phys., 19, 1881–1899, 2019

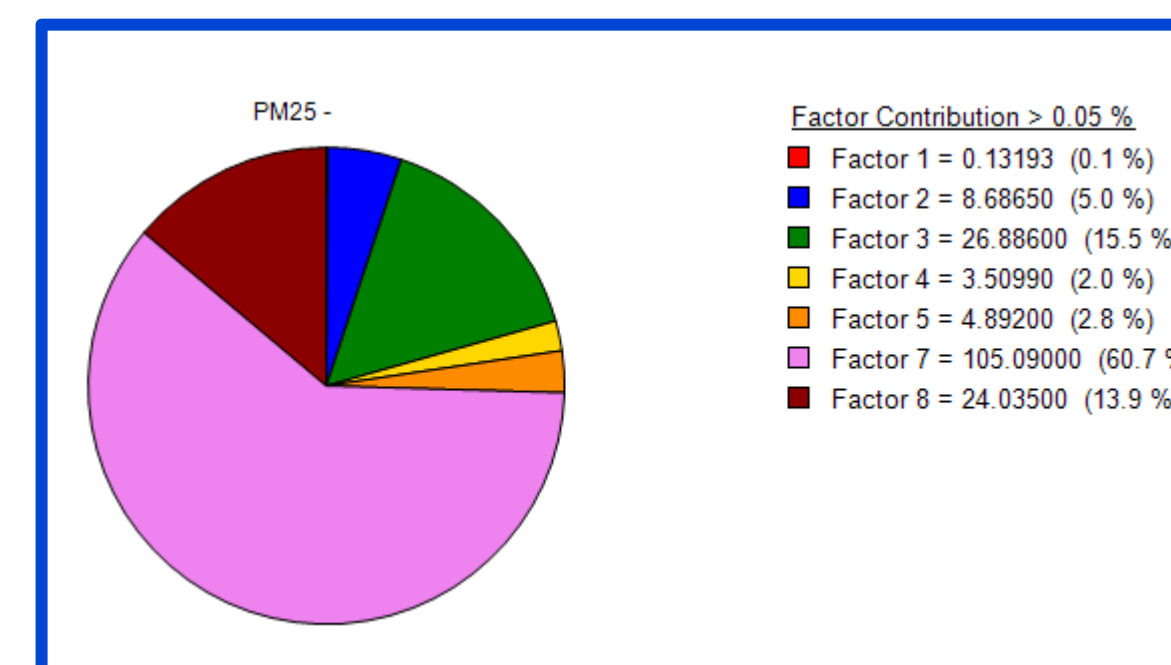
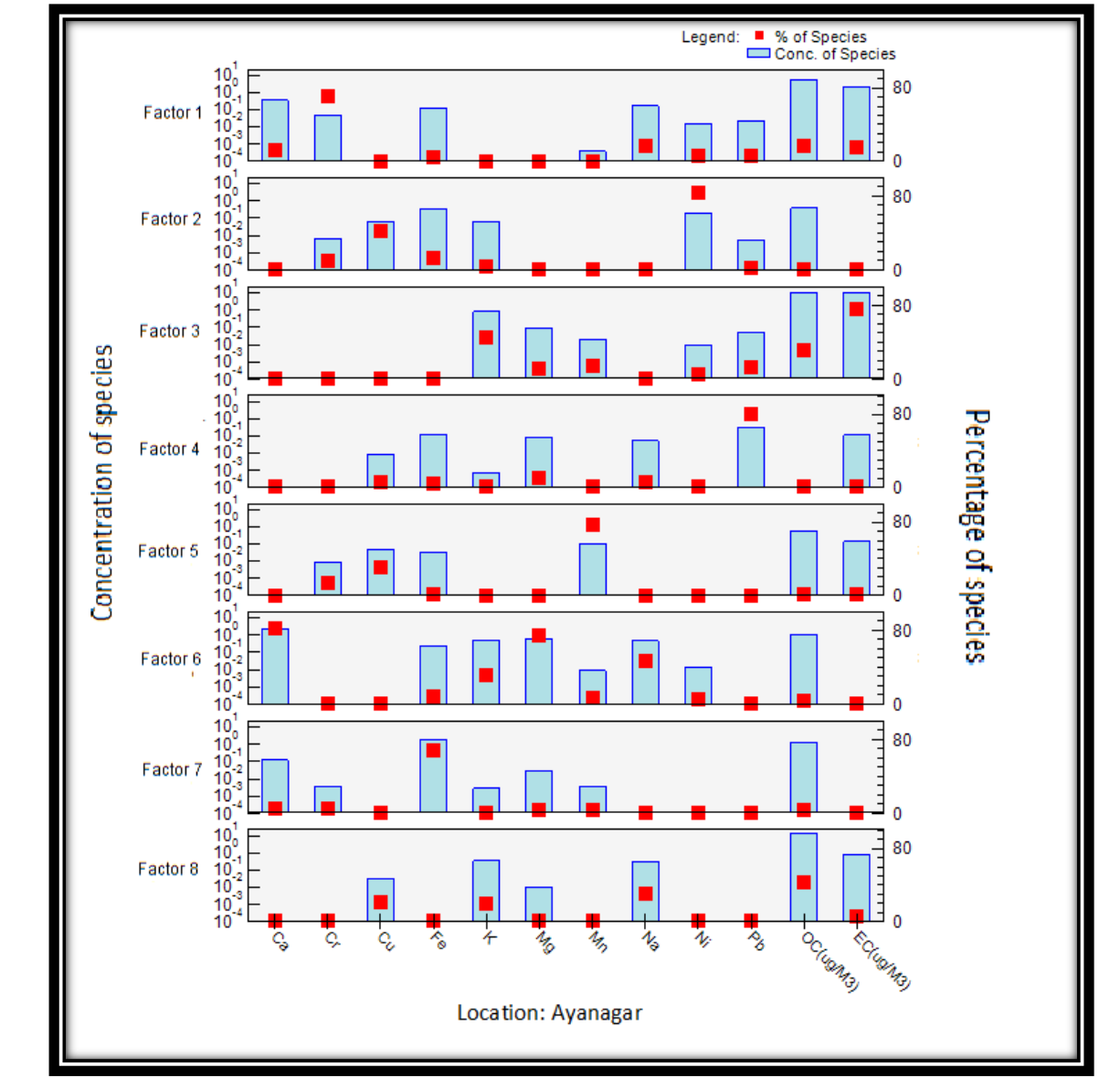
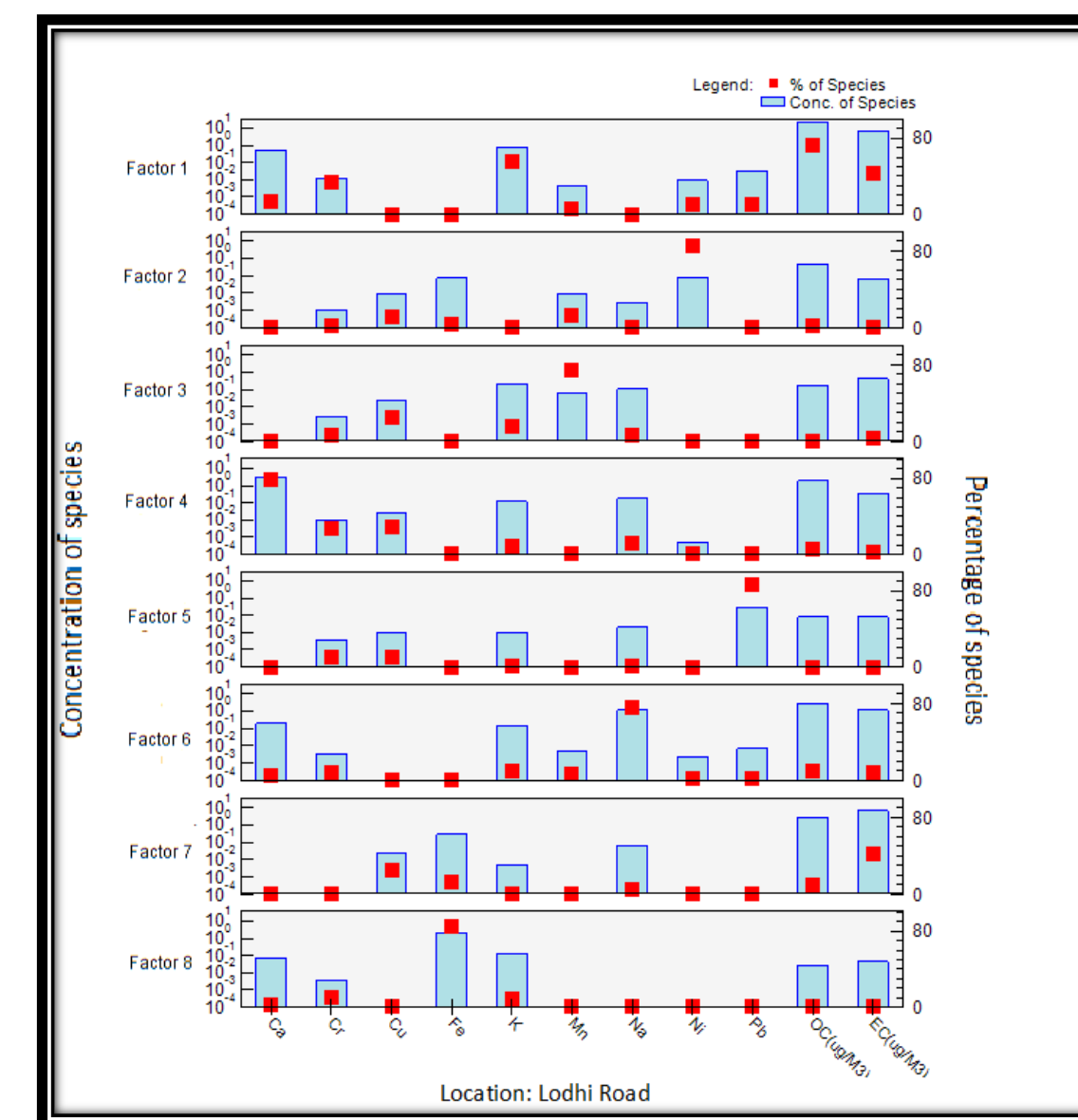
Speciation



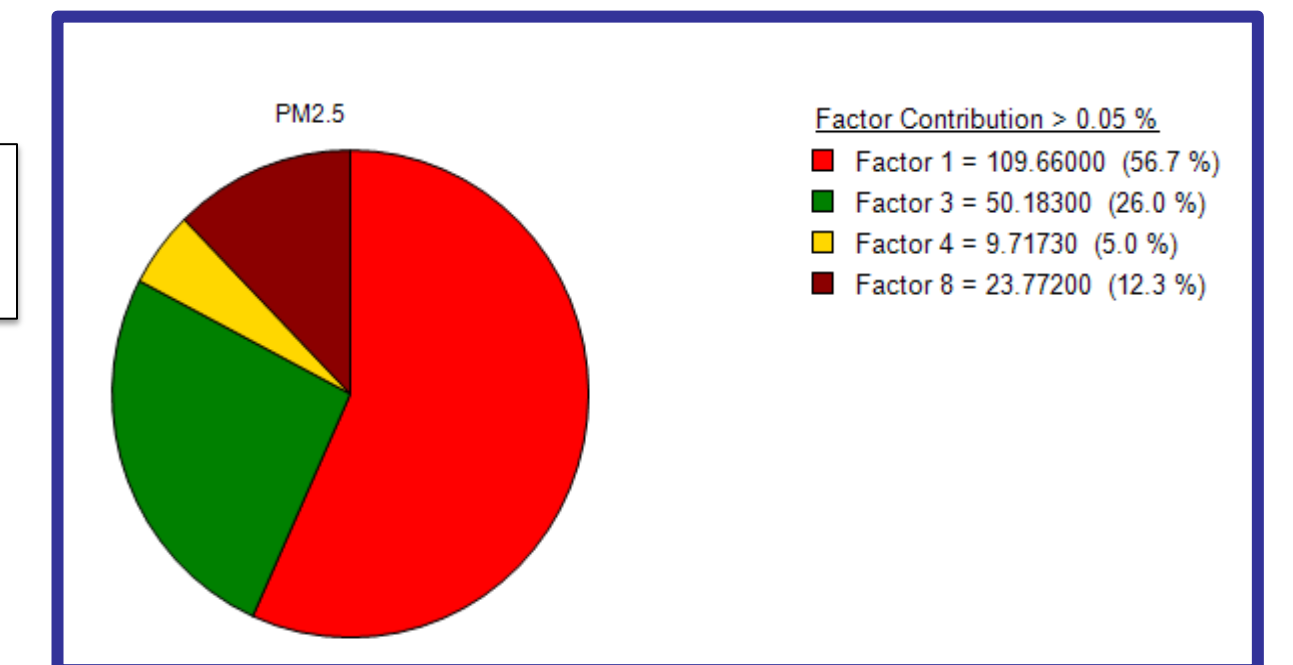
Mass Closure



Source profile



Factor contribution in PM 2.5



Location : Lodhi Road

Location : Ayanagar

Factor	Factor Profiles	
	Lodhi Road	Ayanagar
Factor 1	Biomass burning ⁸	Dust, Industrial combustion and paint industry ¹
Factor 2	Alloy and electroplating industries ⁴	Alloy and electroplating industries
Factor 3	Unknown/ Fugitive/steel industry ²	Vehicular emission ²
Factor 4	Road and construction dust ⁶	Acidic batteries & E-waste incineration ⁴
Factor 5	Acidic batteries & E-waste incineration ⁵	Fugitive Industry emission
Factor 6	Refused Incineration ⁷	Road and construction dust
Factor 7	Vehicular emission ¹	Others/unknown
Factor 8	Ferrous industry ³	Biomass burning ³

CONCLUSIONS

- ❖ The Pearson's correlation between estimated from speciation and gravimetric PM 2.5 is 0.88 which reflects the efficiency of the speciation.
- ❖ In case of Mass density percentage Ayanagar-stable has the highest unidentified components.
- ❖ Noida-stable reported the highest concentration of PM 2.5 with higher EC and organic which reflects higher vehicular and industrial
- ❖ Major contribution factor for PM 2.5 in Lodhi Road is Vehicular emission followed by vehicular emission. The same for Ayanagar is combination of road dust and biomass burning.

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