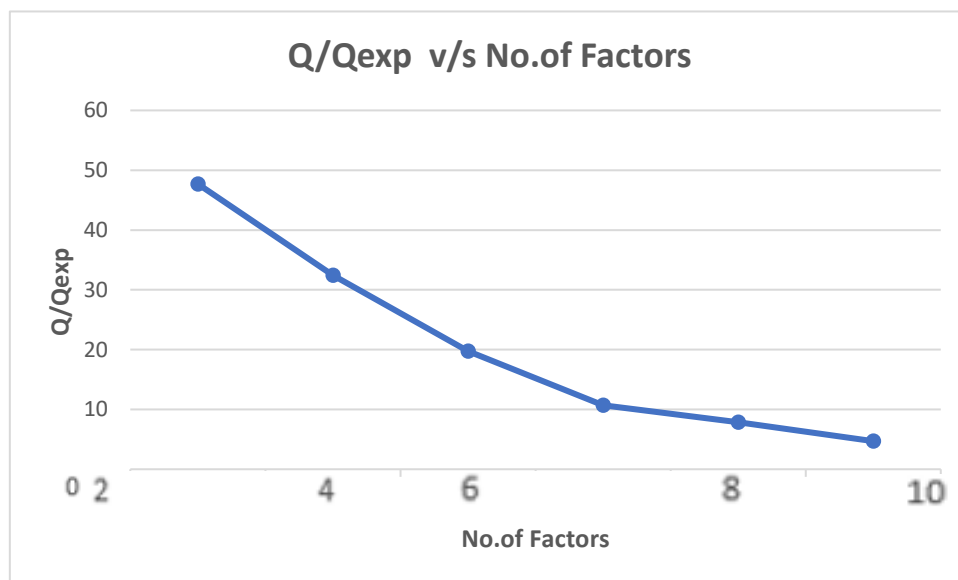**Name:**Ayaan.S.Shaikh

Entry no:2024VST9006

Department of Chemical Engineering

MCL732 ASSIGNMENT REPORT

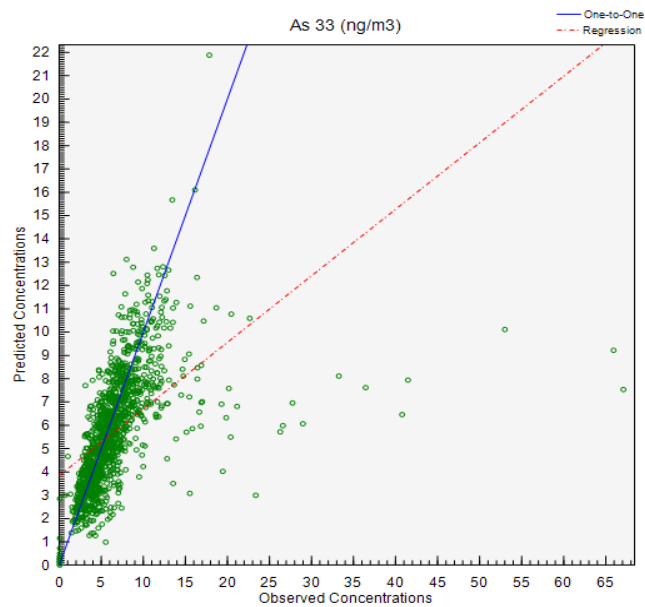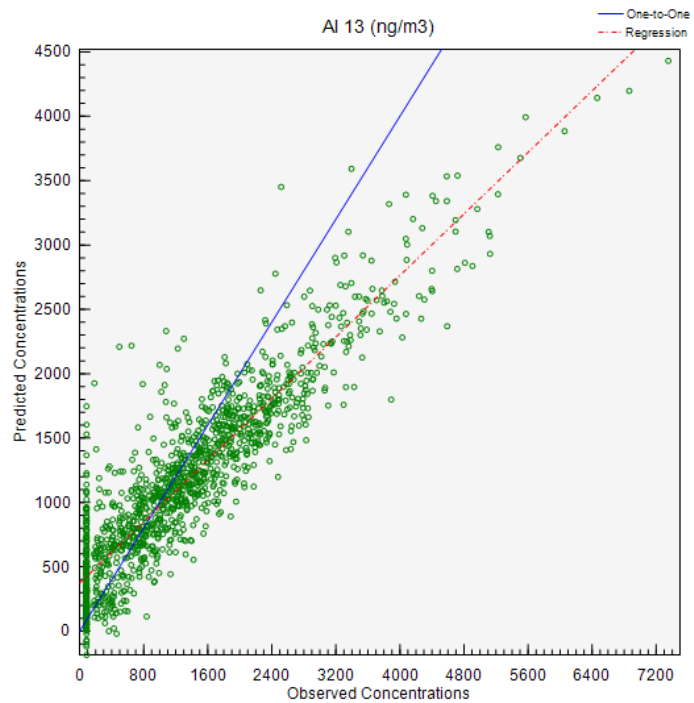**1.Q/Qexp v/s no. of factors:**

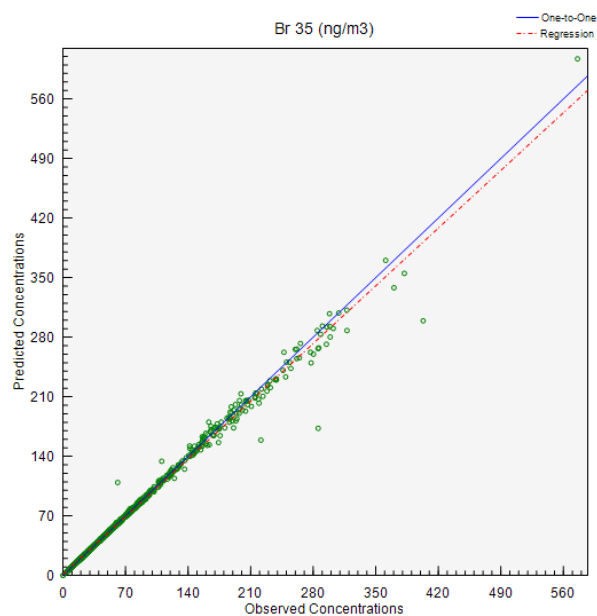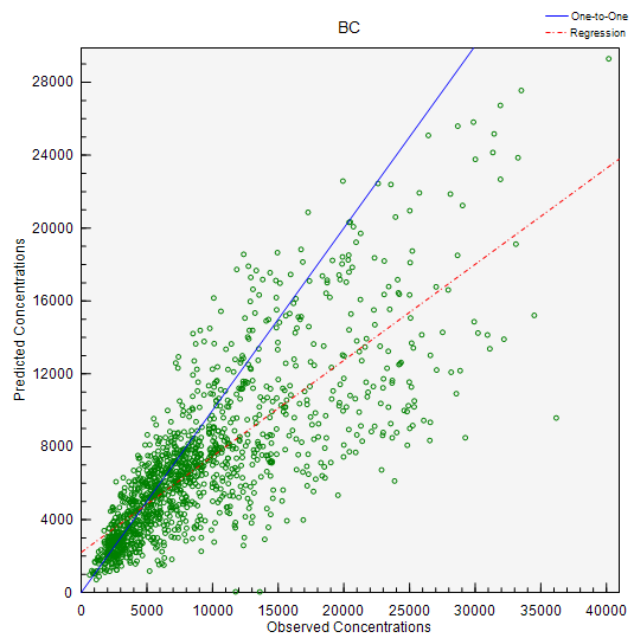**a)Plot for Q/Qexp v/s no.of Factors:**

b)Result table for no.of factors and Q/Qexp:

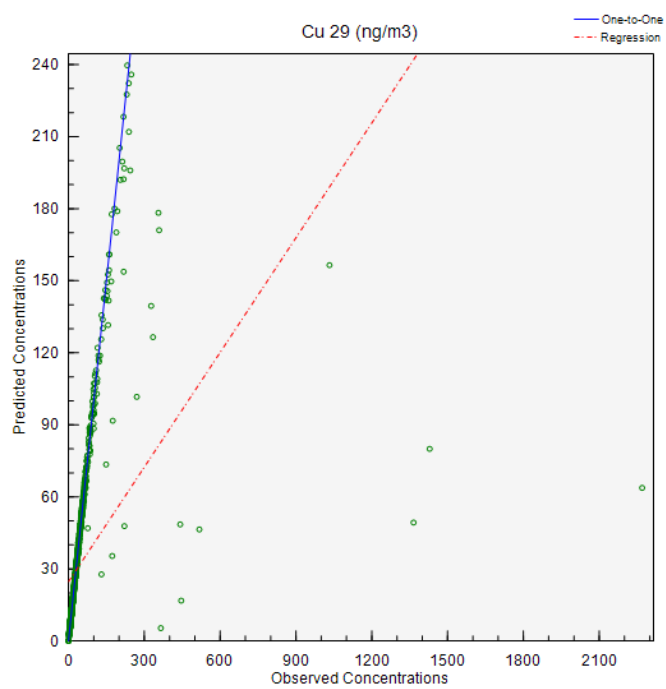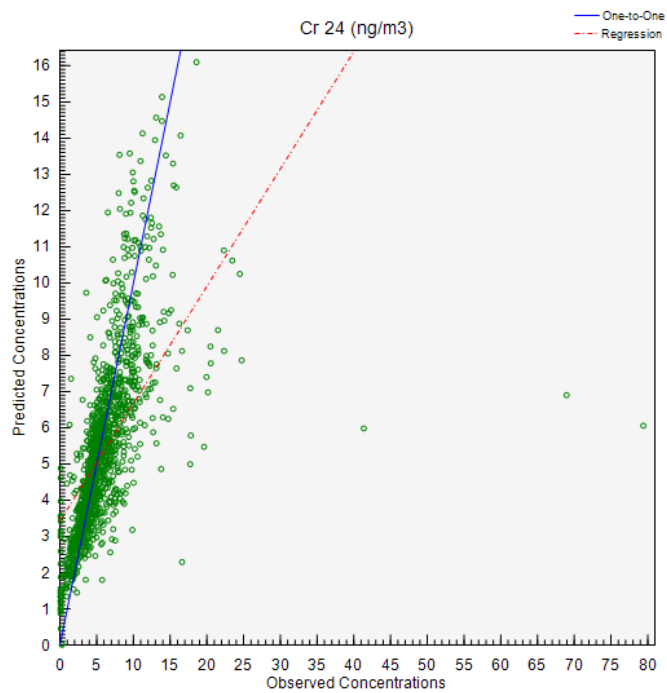| No. of factors	Q/Qexp
3	47.70023556
4	32.43263378
6	19.73024082
7	10.7118896
8	7.866075325
9	4.695434284

Inference:Since the plot stabilizes for 8 no. of factors,hence optimum no.of factors=8
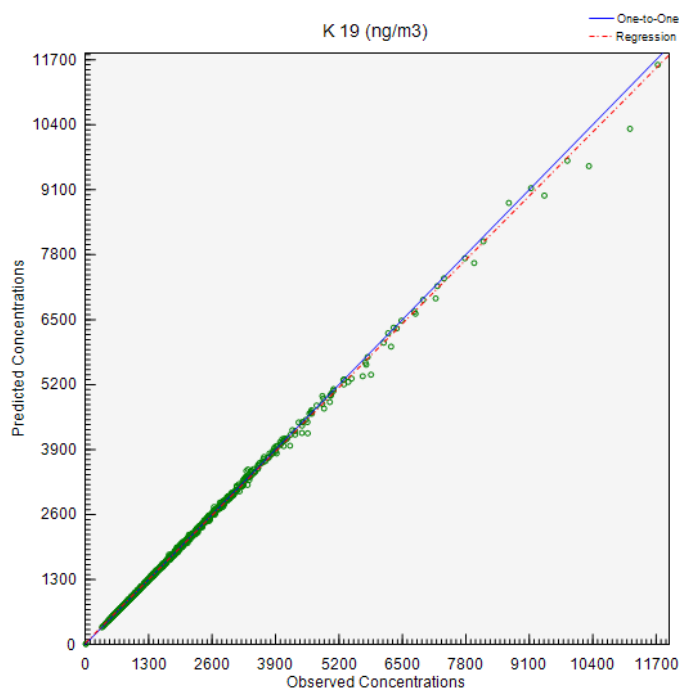
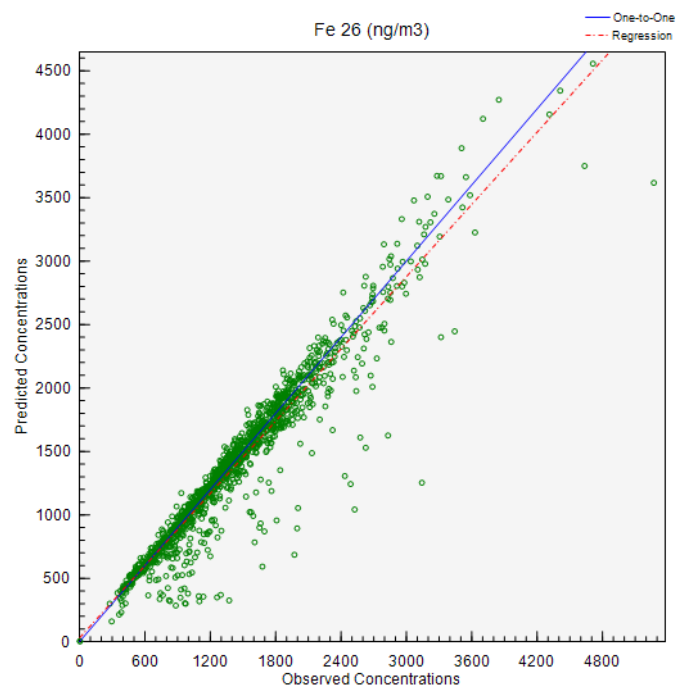**2.Model Performance:**

BC

Br 35 (ng/m3)

Ca 20 (ng/m3)

One-to-One
Regression

Predicted Concentrations

Observed Concentrations

Cl 17 (ng/m3)

One-to-One
Regression

Predicted Concentrations

Observed Concentrations

Cr 24 (ng/m3)

One-to-One
Regression

Cu 29 (ng/m3)

One-to-One
Regression

Fe 26 (ng/m3)

— One-to-One
—·— Regression

K 19 (ng/m3)

— One-to-One
—·— Regression

Mn 25 (ng/m3)

Ni 28 (ng/m3)

Pb 82 (ng/m3)

S 16 (ng/m3)

Se 34 (ng/m3)

Se 34 (ng/m3)

Si 14 (ng/m3)

Sr 38 (ng/m3)

Ti 22 (ng/m3)

Zn 30 (ng/m3)

3.Source Contribution:

Inference:The dominant source during summer is Factor no.2(contributing about 42%) to total PM2.5 contribution.

Therefore the dominant source during summer season(April-May) is Secondary Chlorides.

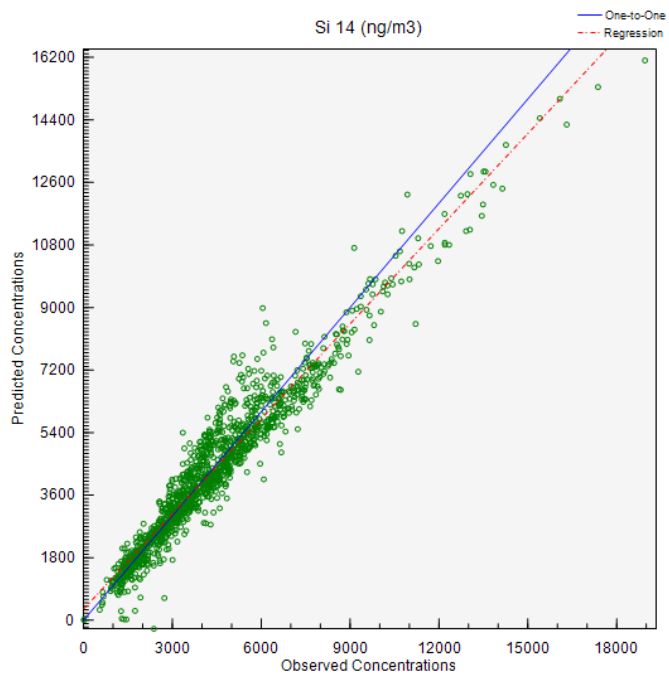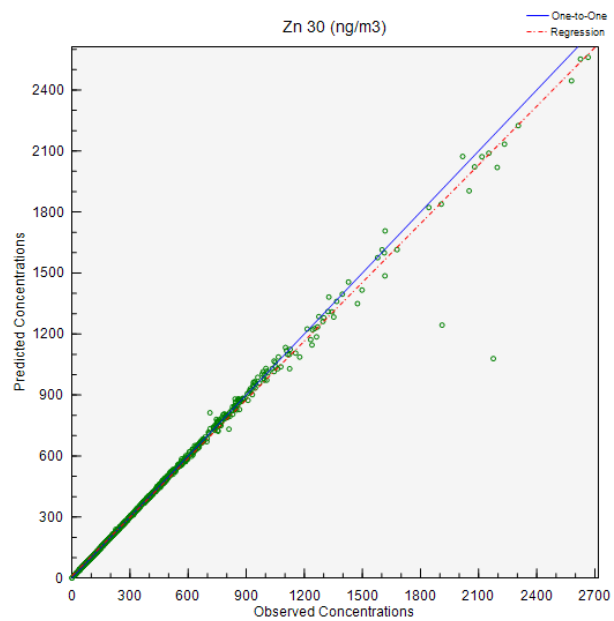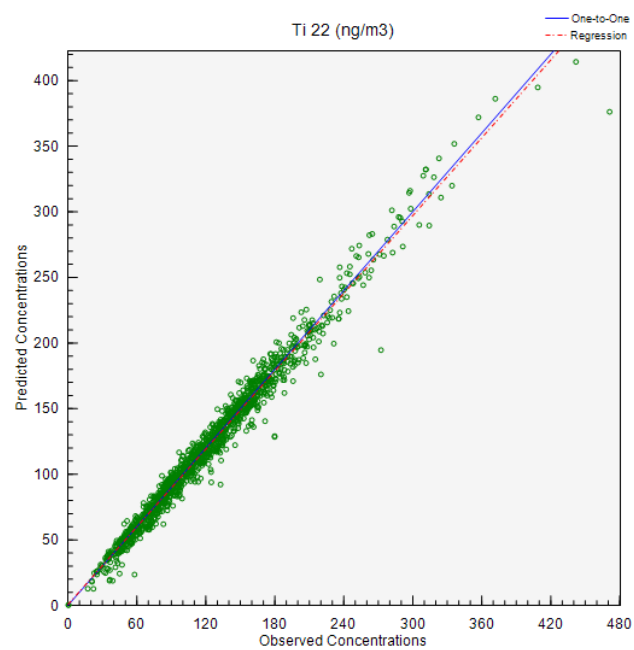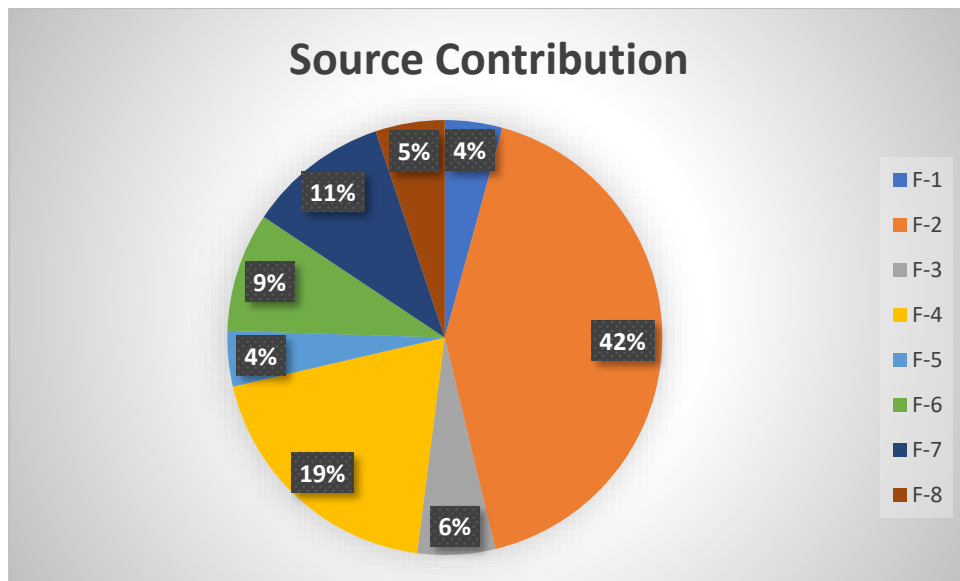**Quantification of the contribution of each source to total PM2.5(elements+BC fraction of PM2.5):**

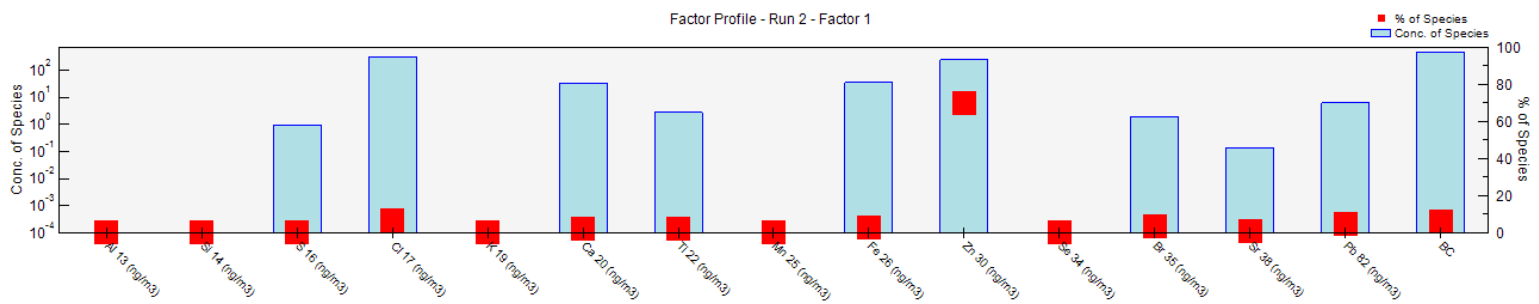|	Contribution	Assigning factor name	Source apportionment for that factor
Factor-1	4%	Waste-Incineration	Zn
Factor-2	42%	Secondary chlorides	Cl
Factor-3	6%	Power plants	S
Factor-4	19%	Dust	Ca,Al ans S
Factor-5	4%	Pb rich or local combustion	Pb
Factor-6	9%	Biomass burning	Black carbon(BC)
Factor-7	11%	Industrial	Br
Factor-8	5%	Vehicular emission	Mn

4.Factor Profiles:

Fig.Factor Profile for Factor-1.

Zn has max.contribution to factor no.1.

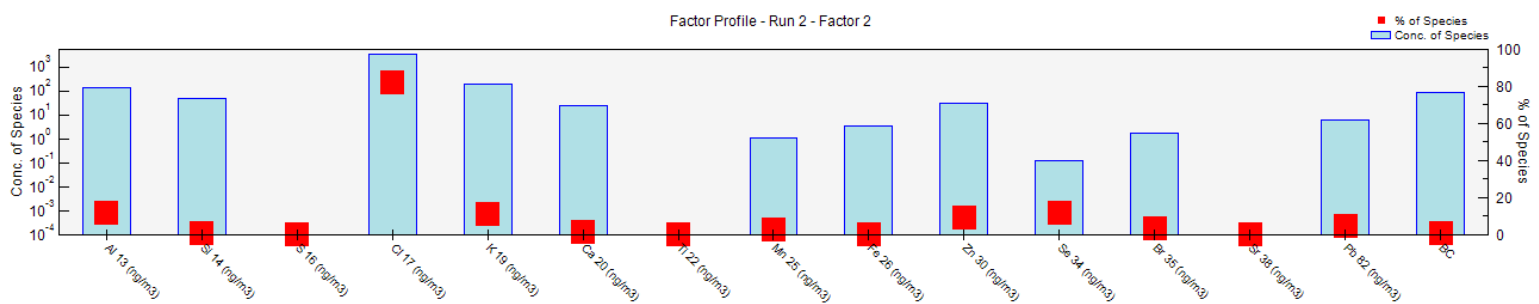Therefore Factor-1 is Waste Incineration.

Fig.Factor Profile for Factor-2.

Cl has max.contribution to factor-2.

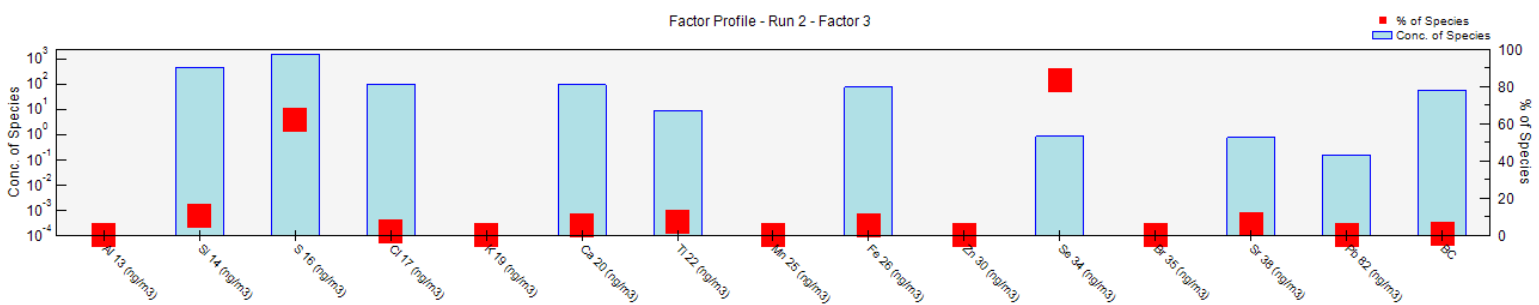Therefore Factor-2 is Secondary Chloride.

Fig.Factor Profile for Factor-3.

S has max.contribution to factor-3.
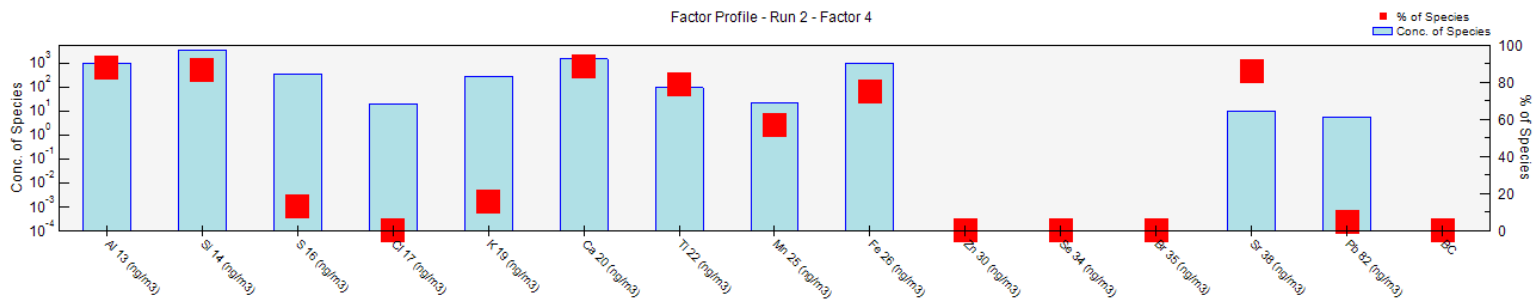
Therefore Factor-3 is Power Plants.

Fig.Factor Profile for Factor-4.

Ca,Al and S contribute max.to Factor-4.

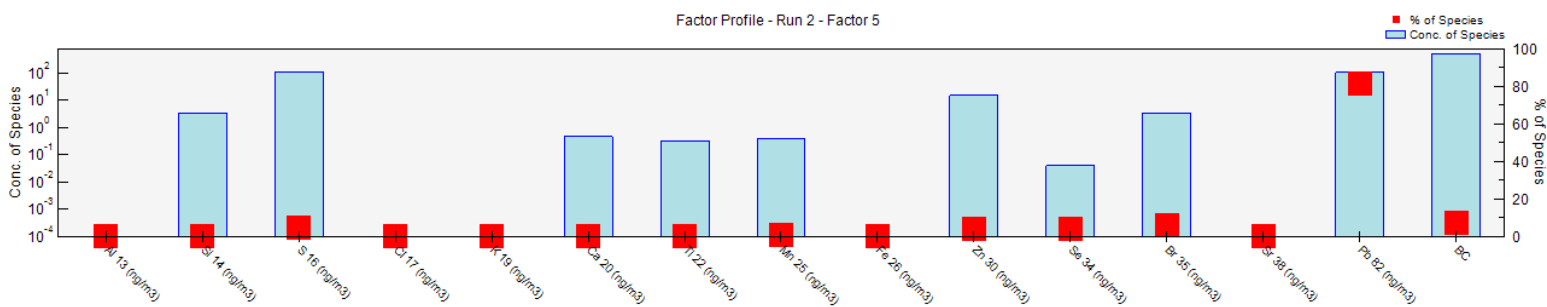**Hence Factor-4 is Dust**

Fig.Factor Profile for Factor-5.

Pb has max.contribution to Factor-5.

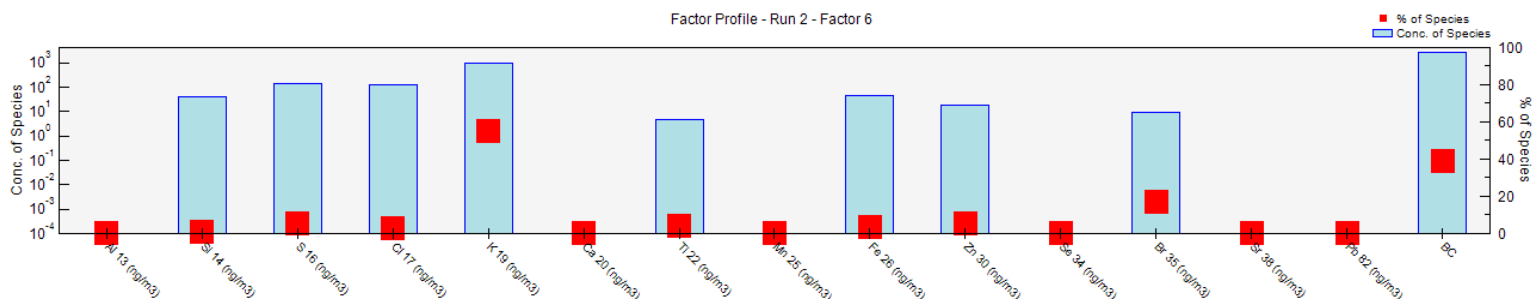**Hence Factor-5 is Lead Rich or local coal combustion.**

Fig.Factor Profile for Factor-6

BC contributes signifactly to factor-6.

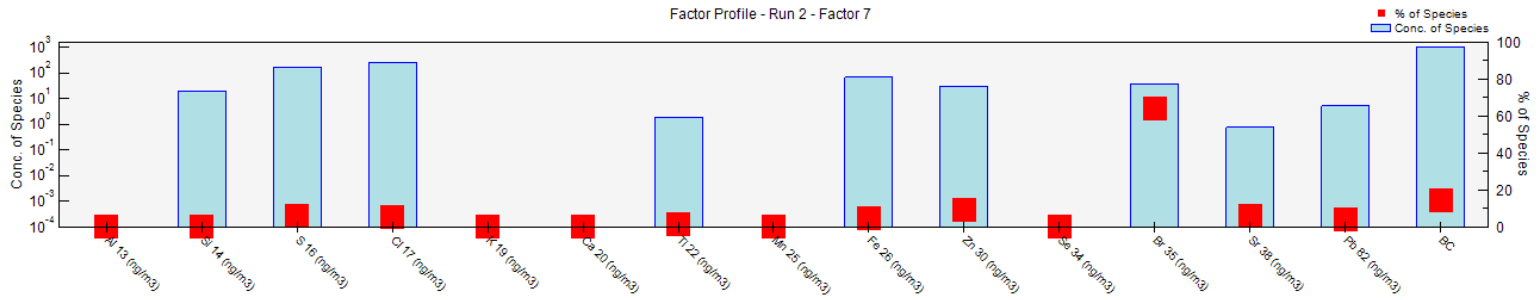**Hence Factor-6 is Biomass Burning.**

Fig.Factor Profile for Factor-7.

Br has max.contribution to Factor-7.

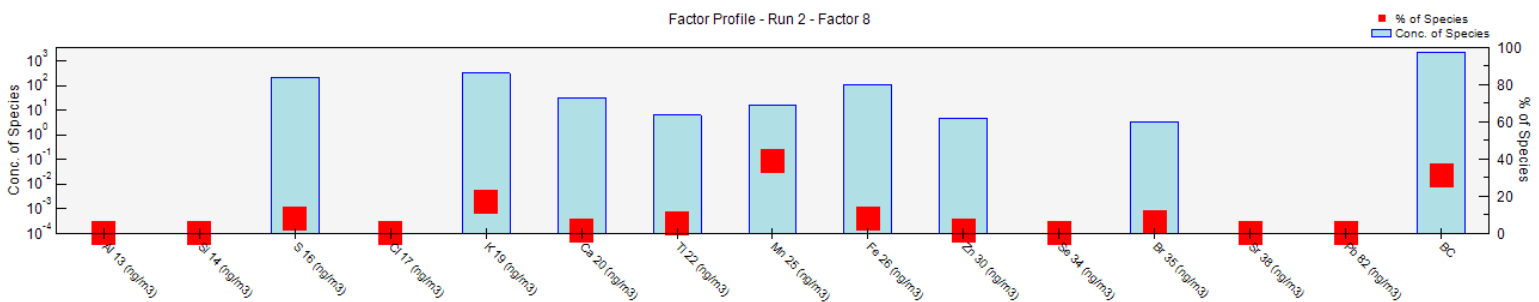**Hence Factor-7 is Industrial emissions.**

Fig.Factor Profile for Factor-8.

Mn has max.contribution to factor-8.

Hence Factor-8 is Vehicular Emission.

Naming of Factors:-

Factor-1: Waste Incineration.

Factor-2: Secondary Chloride.

Factor-3: Power Plants.

Factor-4: Dust

Factor-5: Lead Rich or local coal combustion.

Factor-6: Biomass Burning.

Factor-7: Industrial

Factor-8:Vehicular Emission

4.1 Factor Name Designation Results Table:

Factor-1	Factor-2	Factor-3	Factor-4	Factor-5	Factor-6	Factor-7	Factor-8
Waste Incineration.	Secondary Chloride.	Power Plants.	Dust	Lead Rich or local coal combustion.	Biomass Burning.	Industrial	Vehicular Emission

5.Error Estimation:

5.1 Bootstrap Result:

Explanation of possible error codes if encountered:

- **insufficient or poor-quality input data** – If your dataset has missing values or highly correlated species, the model might not converge properly.
- **Factor misalignment** – If bootstrapped factors do not map well to base model factors, it could indicate instability in the factorization.
- **Low correlation R-values** – If the correlation R-value of bootstrap results is too low, it suggests poor reproducibility of factor profiles.
- **Excessive Unmapped Factors** – If a large number of bootstrapped solutions do not align with the base factors, it may indicate model misfit.

5.4 Bootstrap results:

Variability in Percentage of Species - Run 2 - Factor 2

Variability in Concentration of Species - Run 2 - Factor 2
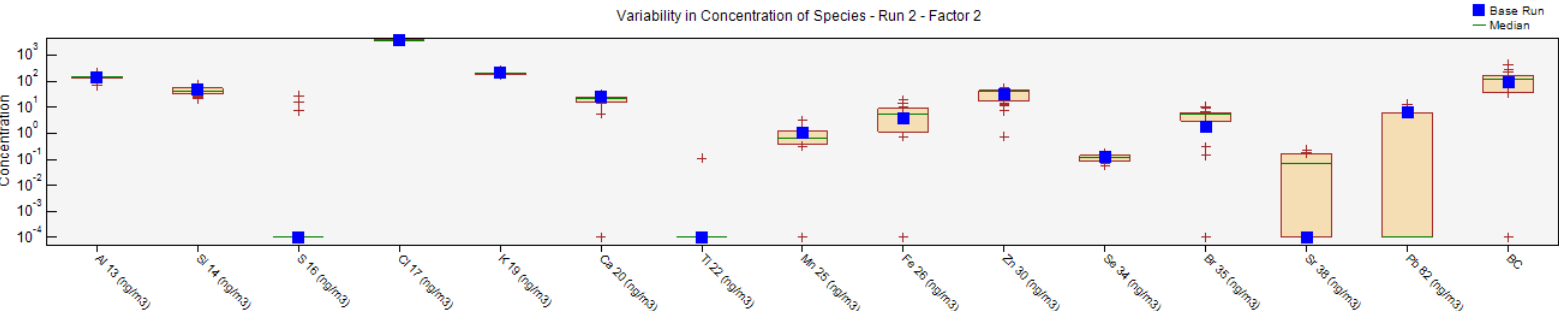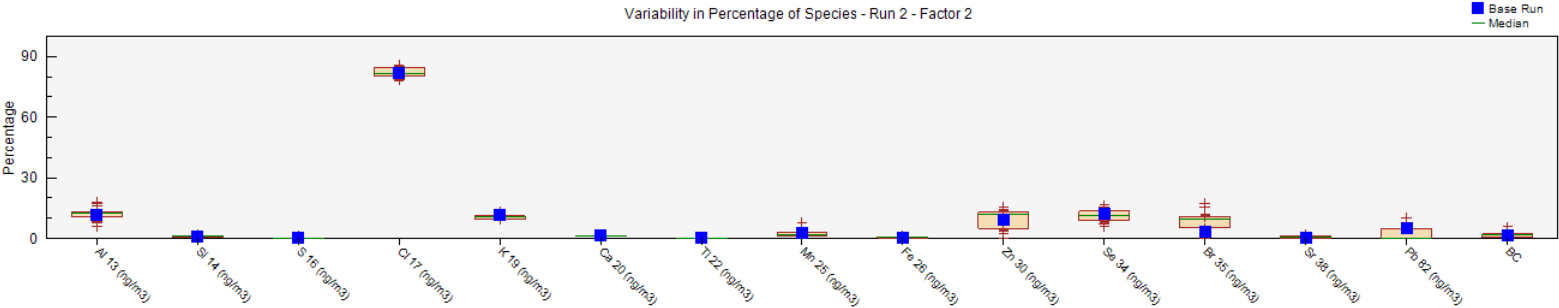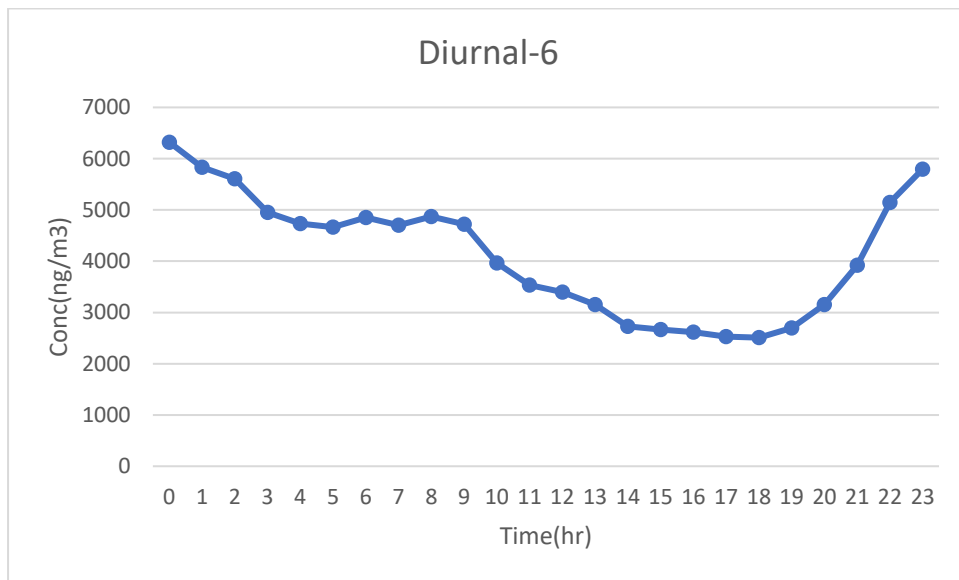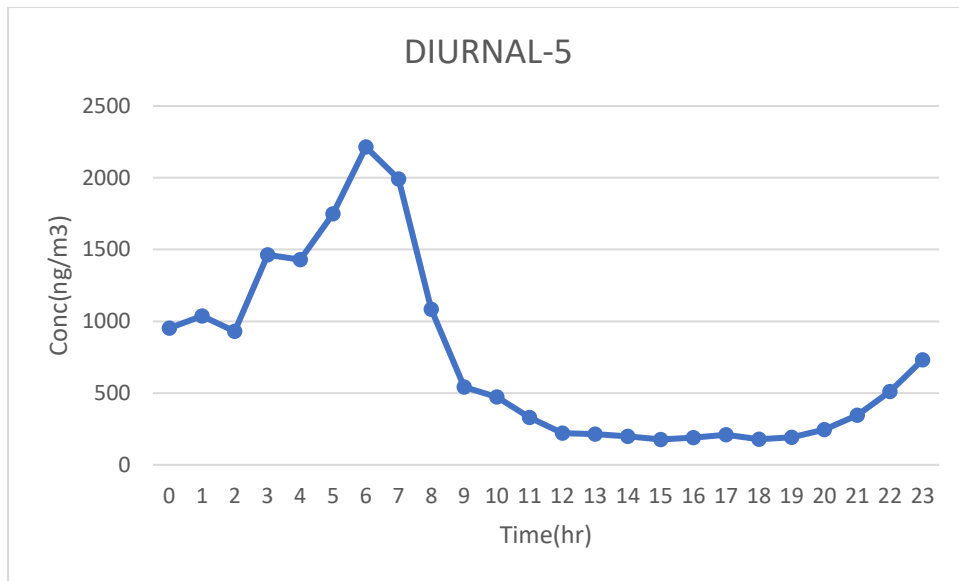
6.Time series Analysis:
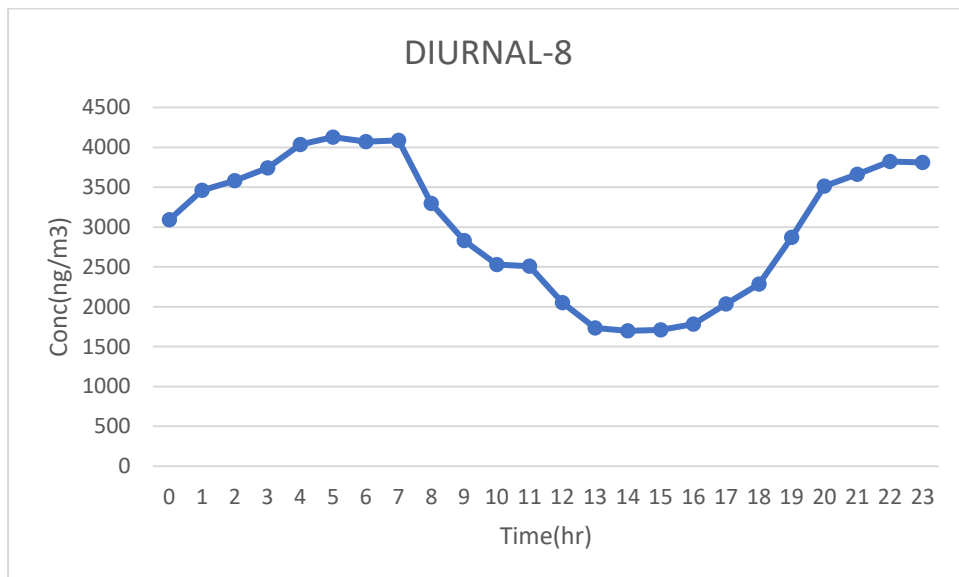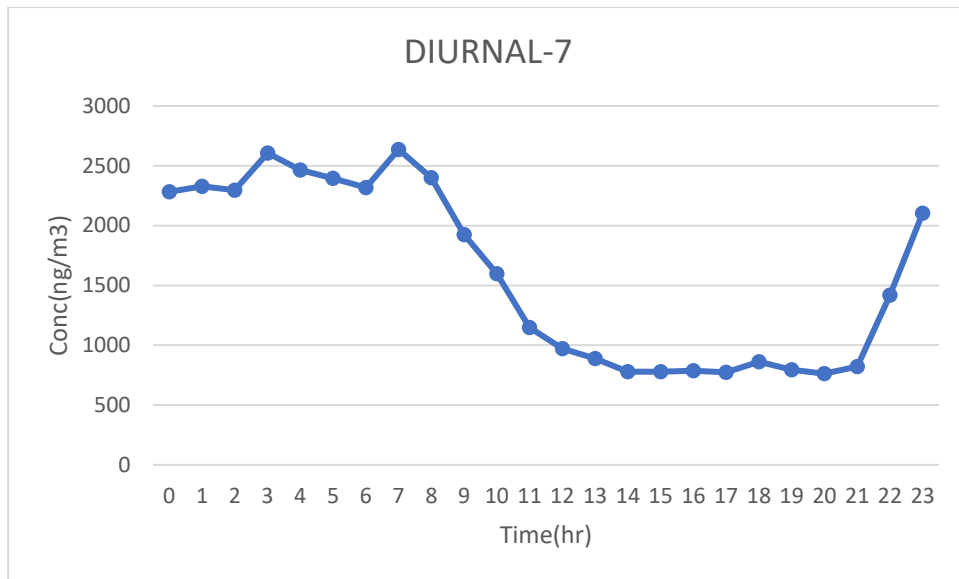
Diurnal Variation:

The diurnal variation shows the variation of conc. Of the species wrt time(per hour of the day).

The breaks/gaps in the graphs represent that there was missing data during that period of time.

DIURNAL-1

DIURNAL-2

DIURNAL-3

DIURNAL-4

DIURNAL-5

Diurnal-6

DIURNAL-7

DIURNAL-8
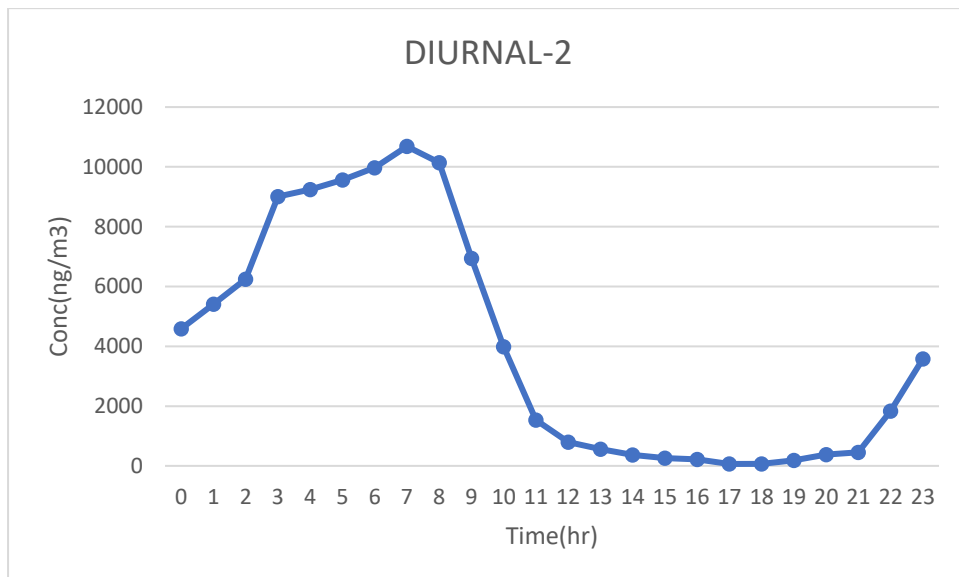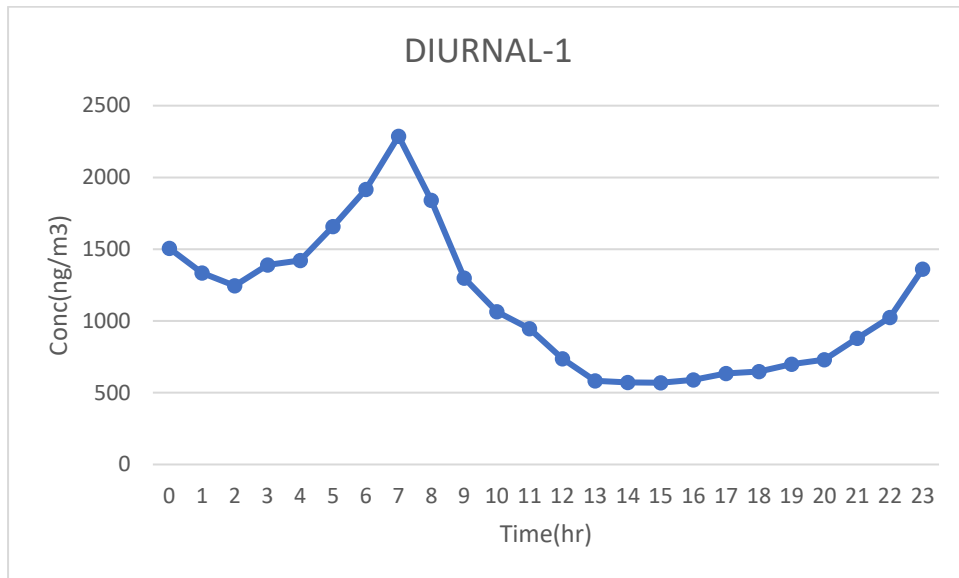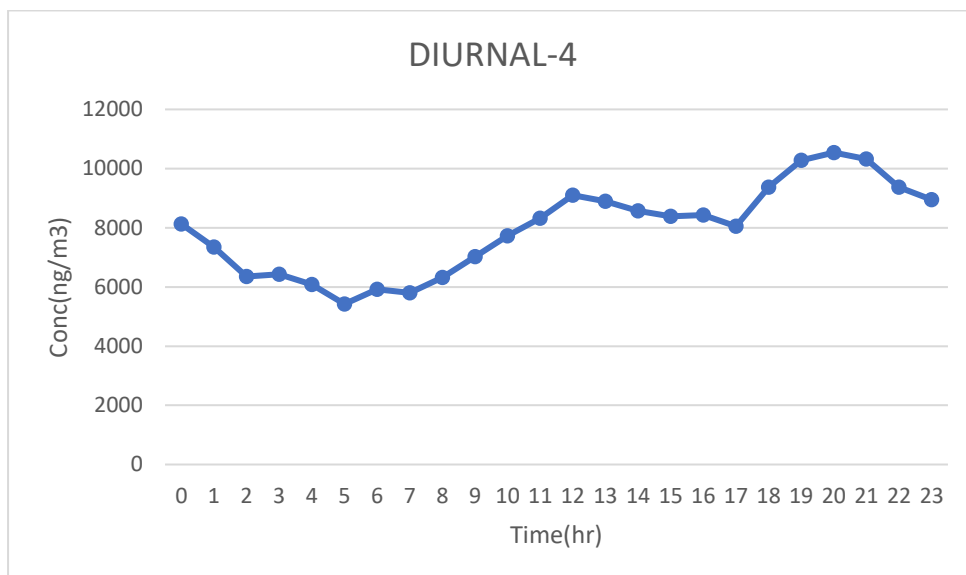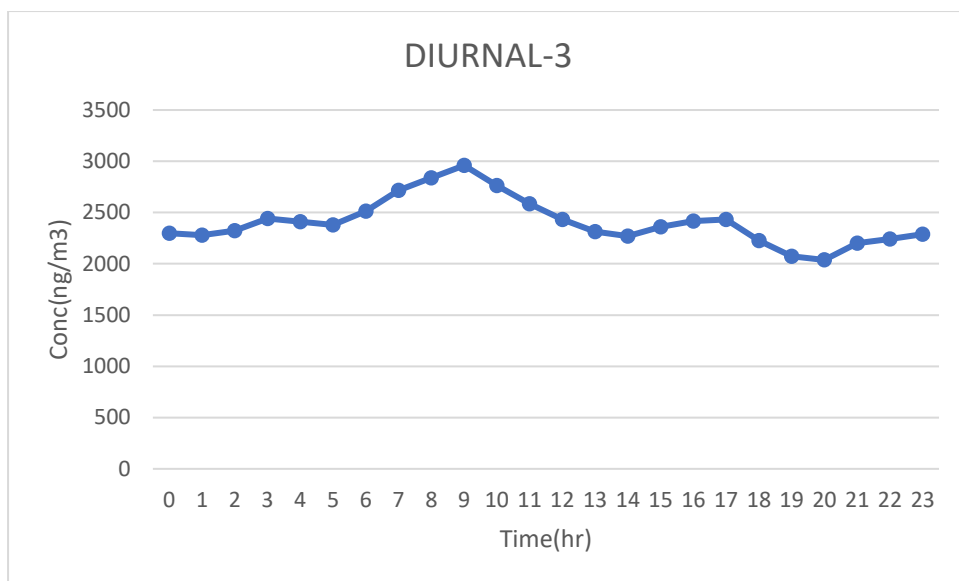
Daily Variation:

The daily variation shows the variation of conc. Of the species wrt time(per day over different no. of days).

The breaks/gaps in the graphs represent that there was missing data during that period of time.

Daily-3

DAILY-4

DAILY-5

DAILY-6

DAILY-7

DAILY-8