A STUDY ON AIR QUALITY ASSESSMENT OF NEYVELI, TAMILNADU, INDIA

Total Suspended particulate matter which includes PM_{10} and TSPM serves as an important tool to determine the ambient air quality. This study reveals the concentration of PM_{10}, TSPM, NOx, SO_2 and CO at all the sampling stations to be dangerous to plants, animals and human beings. The sampling stations fall under the category of industrial, residential and sensitive zones. As the industries happen to be the main establishment of this area it is highly important to understand about the ambient air quality. The statistical analysis reveals a positive correlation for Neyveli township between the Pre and Post monsoon of TSPM and the correlation was found to be a bit lesser between PM_{10}, TSPM, NOx, SO_2 and CO during both period of all the areas. But, still there is no negative correlation noticed between the data.

Key words: Air quality, PM_{10},TSPM, NOx, SO_2 , CO and Neyveli.

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Air pollution is thus defined as "the presence of any substance in the atmosphere in such a concentration that may be or tend to be injurious to human beings, other living creatures, plants or to the atmosphere itself". In other words, it is the presence of undesirable contaminants in the air in the form of gas, smoke, fume, mist and dust, etc., in such quantities and of such duration as to become injurious to human, plant and animal life, harmful to our living, and to historical monuments and other structures. Various gases and particulate matters emitted into the atmosphere by industrial stacks land energy generating units, in concentrations significantly

Air pollution is the introduction of chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms or cause damage to the natural environment or built environment, into the atmosphere. The atmosphere is a complex dynamic natural gaseous system that is essential to support life on planet earth. Stratospheric ozone depletion due to air pollution has long been recognized as a threat to human health as well as to the Earth's ecosystems. Indoor air pollution and urban air quality are listed as two of the world's worst pollution problems in the 2008 Blacksmith Institute World's Worst Polluted Places report.

Environmental Quality (EQ) by definition has two major meanings, the first deals with the physical environment, while the second deal with the perceived environment. The immediate meaning of environmental quality is the material aspects of the physical environment like air, water pollution, depletion of resources, domestic and industrial pollution, and consequence of over population and

noise, etc (Abbassi, 1998). It is mainly in the twentieth century that the impact of human activities on the environment increased, in association with population increase and the major technological upheavals of the industrial revaluation. The release of contaminants in to an environment causes instability, disorder, harm or discomfort to the ecosystem (physical system or living organisms). That is why the major problem at the end of the twenty first century is the preservation of environmental health since it has become clear that the health of human populations depends to a large extent on the quality of their environment.

Code:

```
# importing Randomforest

From sklearn.ensemble import AdaBoostRegressor

From sklearn.ensemble import RandomForestRegressor

# creating model

M1 = RandomForestRegressor()

# separating class label and other attributes

Train1 = train.drop([‘air_quality_index’], axis=1)

Target = train[‘air_quality_index’]

# Fitting the model
M1.fit(train1, target)
‘’’RandomForestRegressor(bootstrap=True, ccp_alpha=0.0, criterion=’mse’,

                Max_depth=None, max_features=’auto’, max_leaf_nodes=None,

                Max_samples=None, min_impurity_decrease=0.0,

                Min_impurity_split=None, min_samples_leaf=1,

                Min_samples_split=2, min_weight_fraction_leaf=0.0,

                N_estimators=100, n_jobs=None, oob_score=False,

                Random_state=None, verbose=0, warm_start=False)’’’

# calculating the score and the score is  97.96360799890066%

M1.score(train1, target) * 100

# predicting the model with other values (testing the data)
# so AQI is 123.71

M1.predict([[123, 45, 67, 34, 5, 0, 23]])

# Adaboost model
# importing module

# defining model

M2 = AdaBoostRegressor()

# Fitting the model
M2.fit(train1, target)

‘’’AdaBoostRegressor(base_estimator=None, learning_rate=1.0, loss=’linear’,

            N_estimators=50, random_state=None)’’’

# calculating the score and the score is  96.15377360010211%
```

```
M2.score(train1, target)*100

# predicting the model with other values (testing the data)
# so AQI is 94.42105263

M2.predict([[123, 45, 67, 34, 5, 0, 23]])
```

Materials and Methods Ambient Air quality

To assess the ambient air quality, station were identified in the population density areas. Calibrated Respirable Dust Samplers (Enviro tech APM 460) with flow rate ranging between 1.2 -
1.45 m^3/min were used for monitoring of SPM and RPM. Gaseous samples were collected by integrated gas sampling assembly (Envirotech APM 411). A tapping provided in the hopper of the sampler was utilized for sampling of SO_2, NO_X and CO, with proper flow controller and a flow 1.0 l/min. Envirotech Organic Vapour Sampler (APM 850) and a digital imported personnel sampler Drager Multiwarm II BD were used for monitoring CO. The pollutants were monitored on 24 hourly basis in twice in month or season wise.

PM_{10} & TSPM

Calibrated Respirable Dust Sampler is used with Whatman GF/A microfibre filter paper for the determination of PM_{10}. The PM_{10} is a measure of particulate matter having size <10 microns. Respirable Dust Sampler (RDS) is attached with a cyclone. Air enters a vertical cylinder with swirling (Vortex) motion and particle larger than design cut-off are deposited on the on the inner surface of the cylinder, whereas particles below 10 microns are deposited on the whatman GF/A microfibre filter paper. PM_{10} was calculated by taking the difference between final and initial weight of the filter paper and dividing volume of the air sampled. TSPM was calculated taking the difference between final and initial weights of dust collection bottle plus filter paper dividing of volume of air sampled.

SO_2 (Modified West-Gaeke Spectrophotometric Method)

Sulphur dioxide is collected in a scrubbing solution of sodium tetrachloro - mercurate and is allowed to react with HCHO and then with Pararosaniline hydrochloride. The absorbance of the product red-violet dye was measured using digital spectrophotometer at a wavelength of 560 nm. SO_2: Modified West & Gaeke method (spectrophotometric) was adopted. SO_2 was collecting in a scrubbing solution of sodium tetrachloro mercurate (TCM) and was allowed to react with sulphuric acid, formaldehyde and then with pararosaniline hydrochloride. The absorbance of the product red-violet dye was measured using UV Visible Spectrophotometer at a wavelength.

NO_X (Jacob and Hocheiser Modified Method)

Nitrogen oxides as nitrogen dioxide are collected by bubbling air through sodium hydroxide solution to form a stable solution of sodium nitrite. The nitrite ion produced during sampling was determined using digital spectrophotometer at a wavelength of 540 nm by reacting the exposed absorbing reagent with phosphoric acid, sulfanilamide and N (1-naphthyl) ethylamine di-hydrochloride.

Carbon monoxide (CO)

An imported digital CO detector (Drager's Mini Warn) is used for monitoring of CO. The dust particles having size >10 microns are being collected in the cyclone and measured. This along with RPM value gives TSPM (RPM & SPM). Results and Discussion

RESULT

The environmental quality in terms of air quality parameters were assessed at different stations of the four selectedstations namely Neyveli township, Mantharakuppam, Puthu kudieruppu and Mines - I of Neyveli and were given in figure - 1 to 4. The level of PM_{10}, TSPM, SO_2 and NOx recorded at various sampling stations was tabulated in the following tables and figuratively represented too. During

2012, the highest PM_{10} level (46.55 g/m^3) has been recorded at Neyveli township (Premonsoon). Similarly, the highest TSPM level has been recorded at Neyveli town (Pre-monsoon) (128.2 g/m^3) respectively. The values of SO_2 and NOx 8.9 g/m^3 and 12.8 g/m^3 respectively in Neyveli township (Pre monsoon). During 2013, the highest PM_{10} level (35.45 g/m^3) has been recorded at Neyveli township (Pre-monsoon). Similarly, the highest TSPM level has been recorded at Neyveli township (Pre-monsoon) (114.48 g/m^3) respectively. The values of SO_2 and NOx 8.52 g/m^3 & 13.13 g/m^3 respectively in Neyveli township (Pre monsoon). During post monsoon the highest value of PM_{10} was seen in Neyveli township and it was 32.19 g/m^3. During

2014, the highest PM_{10} level (63.98 g/m^3) has been recorded at Neyveli township (Premonsoon). Similarly, the highest TSPM level has been recorded at Neyveli township (Pre-monsoon) (137.26 g/m^3) respectively. The values of SO_2 and NOx 8.69 g/m^3 & 12.15 g/m^3 respectively in Neyveli township (Pre-monsoon). In the post monsoon period the highest PM_{10} & TSPM was at Neyveli township and the values were 43.45 g/m^3 & 109.05 g/m^3. During 2015, pre monsoon period the highest $PM_{10,}$ TSPM, SO_2 and NO_X has been reported at Neyveli township and the values were 54.92 g/m^3, 118.16 g/m^3, 8.21 g/m^3 & 11.58 g/m^3 respectively. In the post monsoon also the higher values were recorded in the Neyveli township itself.

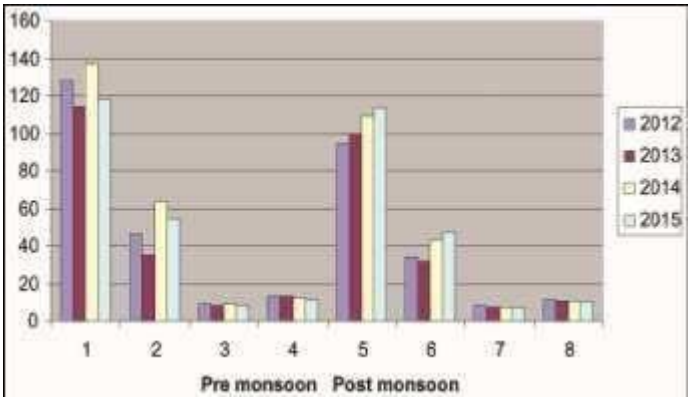

Fig - 1: Diagrammatic representation of TSPM, PM_{10}, SO_2 and NO_X of Neyveli township sampling station during 2012 – 2015

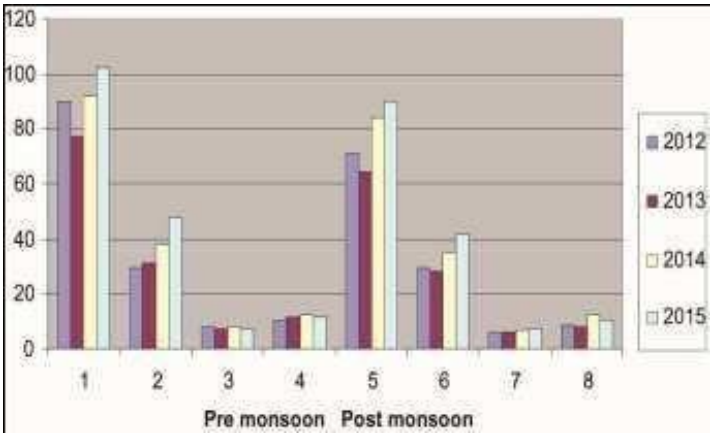

Fig – 2: Diagrammatic representation of TSPM, PM_{10}, SO_2 and NO_X levels of Mantharakippam sampling station

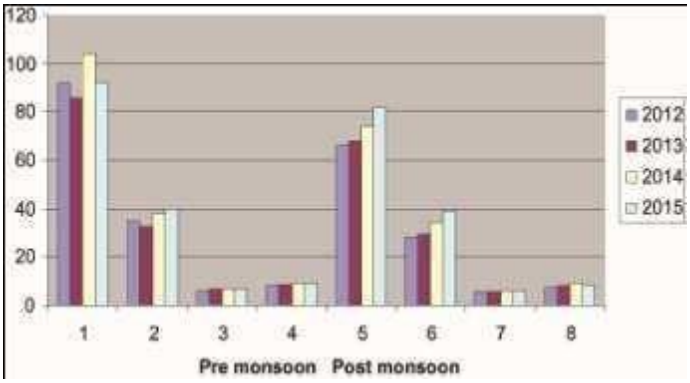

Fig - 3: Diagrammatic representation of TSPM, PM_{10}, SO_2 and NO_X levels of Pudhu kudieruppu sampling station during 2012-2015

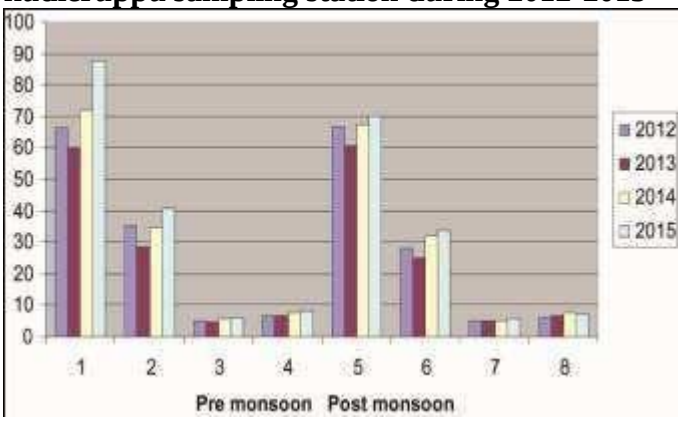

Fig – 4: Diagrammatic representation of TSPM, PM_{10}, SO_2 and NO_X levels of Mines - I sampling station during 2012 – 2015

With the overall observation, it is clear that a different place of Neyveli describes the probability of increase of the TSPM concentration. Normally, the TSPM are directly emitted into atmosphere through natural & anthropogenic activities (Adachi and Tainosha, 2004; Viana *et al.*, 2006). The increased SPM concentration in these places can be contributed to the increased vehicular pollution due to the increased population and also may be due to the increased industrial activities along with sand quarrying (Dilipkumar Jha *et al.*, 2011). Jayasree (2000) in her study stated the air pollution is a major environmental problem faced by many Indian cities. One important factor that brings air pollution is automotive emissions. Attempts to identify the various types of pollutants emitted by automobiles in Thiruvananthapuram city area have disclosed that speed limit in the city and various operating modes of vehicles determine the amount of pollutants released by them. Sarin *et al.* (1999) studied that Delhi, one of the twenty mega cities of the world, is facing serious air pollution problems mainly from vehicular sources, which contribute 64 % of the total emissions. Gutpa *et al.* (1997) made a study on the suspended particulars matter and oxides of nitrogen in residential and industrial areas of Paonta Sahibe during 1994 – 1996. In the residential area maximum SPM were recorded as 722.0 $\mu g/m^3$ in 1996. Corresponding values in the industrial area were 928.27 $\mu g/m^3$ of SPM and 19.30 $\mu g/m^3$ of NO_x. Monthly average values of SPM and NO_x were well below the prescribed standards in Industrial areas of Paonta Sahib.