Rapid Industrialzation A Boon or Curse to the Air Enviornment of Industrail Clusters (Angul –Talcher Area)

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ABSTRACT:

The objective of the study is to reveal the seasonal variation of air quality parameters such as Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM), Sulfur dioxide (SO_2), Oxides of Nitrogen (NOx).Coal Mining operation, thermal power plants, aluminum and steel plants, ancillary industries and constructions has led to significant degradation of the ambient air quality of Angul –Talcher area. The pollutants concentrations were used to calculate the Air Quality Index. This study helps us to identify the potential sources of air pollution. The major cause for the degradation of air quality was mainly due to mining and allied activities. This degraded air environment demands appropriate management strategy for curbing the pollution load within permissible levels.
Key Words: Ambient Air, Air quality index, Air quality parameters, Industrial cluster

"1. INTRODUCTION"

Rapid urbanization and industrial development during last decade have provoked some serious concerns for the environment of Angul-Talcher area. This has caused environmental stress and atmospheric concentration levels of criteria pollutants like particulate matter i.e suspended particulate matter, respirable suspended particulate matter, sulfur dioxide and oxides of nitrogen continue to pose serious public health risk for sensitive pollution in this area. The pollution levels in Angul- Talcher have been rising due to the continuous increase in the industries both small scale and large scale, non road sources such as construction activities as well as the increase in the number of vehicles. Angul –Talcher area is one of the major industrial zones. Activities in the open cast mines, power plants and aluminum smelter, sponge iron and steel plants have become the major sources of air pollution in this area. National Aluminum Company (NALCO) ,Mahanadi Coalfield limited (MCL),National Thermal Power Corporation (NTPC) are the major central PSU and Jindal Steel & Power Plant (JSPL) ,Monet Ispat & Energy Limited are two major private sectors functioning in this industrial cluster.

The present study was carried out to assess the ambient air quality levels in respect of suspended particulate matter (SPM) and respirable suspended particulate matter (RSPM), sulfur dioxide (SO_2) and oxides of nitrogen (NOx) in this developed industrial zone. Level of air pollutants depends not only on the quantity that are emitted but also on the ability of the atmosphere to absorb or disperse excess amount. Maximal concentration of SPM and RSPM are found in mining area and near the industrial and construction site and the concentration are gradually decreases with increase in distance due to transportation, deposition and dispersion of particles. So, the air pollution concentration vary spatially and temporarily with different locations and time due to changes in metrological and topographical condition.

Thus, the rapid industrialization and construction activities damage the environment and ecology because air pollutants added changes the composition of atmosphere and hence affect the biotic environment to an unacceptable degree, unless it is carefully planned and controlled. So, it's needed to maintain an ecological balance .Therefore, it's necessary to access the impact on air quality due to rapid industrialization and suggest proper abatement measures for control of air pollution.

"2. MATERIAL AND METHOD"

(a) STUDY AREA:

Angul –Talcher area in the state of Odisha(figure 1) is the oldest industrial cluster of the country. This area is situated at an average height of 139 meters above mean sea level (MSL) and about 160 km from the state capital Bhubaneswar. It's bounded between $20^0$37´N to $21^0$10´E latitude and $84^0$53´ E to $85^0$28´ E longitude. The climate of this area is continental type being arid and dry except in monsoon season.

(b)METHODS:

For analyzing the air quality of the above study area systematic monitoring of the air quality parameters i.e. suspended particulate matter (SPM) and respirable suspended particulate matter (RSPM), sulfur dioxide (SO_2) and oxides of nitrogen (NOx) were done as per the Standard Procedures prescribed by the Central Pollution Control Board (CPCB) / APHA (1998).All these air quality parameters i.e. SPM, RSPM, SO_2,NOx were collected every first week of the month from all four sampling stations i.e. industrial estate of Angul , Nalco Nagar ,Angul, TTPS, Talcher and coal field area ,Talcher using High volume sampler/Respirable dust sampler (Envirotech made Model APM460) with attached glass fiber filter paper and thermoelectrically cooled impinge attachment for gaseous sampling 24-hourly ambient air samples were collected for SPM,RSPM,SO_2 and NOx. These samplers were operated at an average flow rate of 1.1 -1.2 m^3/min for sampling or collection of SPM and RSPM levels .Measurement of SO_2 was done by drawing the gases and vapors in a known volume of air in separate attachment of high volume sampler and gases was passed through the absorbing medium, i.e. Sodium Tetrachloromercurate(0.1N) with bleached Pararosaniline formaldehyde(West-Gaeke method).Similarly the oxides of nitrogen was determined by absorbing in sodium hydroxide – sodium arsenate (modified Jacob and Hochheiser method).

"3.AIR QUALITY INDEX"

An air quality index (AQI) is a number used by government agencies to communicate to the public how polluted the air is currently or how polluted it is forecast to become. As the AQI increases, an increasingly large percentage of the population is likely to experience severe adverse health effects. So, it's a measure of the condition of air relative to the requirements of one or more biotic species or to any human need or purpose. The index of specific pollutant is derived mainly from the physical measurement of pollutants like SPM, RSPM, SO_2 and NOx. There are several methods and equation used for determining the AQI (Inhaber, 1974).The Oak Ridge National Air Quality Index (ORNAQ)) can be considered for the relative ranking of an overall air quality status at different location of the study area.AQI for each location in the study area has been estimated with the help of a mathematical equation developed by the Oak Ridge National Laboratory (ORNL), USA as given below:

AQI = [39.02 S Xi /Xs] 0.967

Where Xi = value of air quality parameters (SPM, RSPM, SO2 and NO2)

Xs = Standard and prescribed for Air quality parameters.

TABLE 1: Relative AQI and Scale

INDEX VALUE	DESCRIPTION	HEALTH EFFECT
0-25	Clean air	None or minimal health effects
26-50	Light air pollution	Possible respiratory or cardiac effect for most sensitive individuals.
51-75	Moderate air pollution	Increasing like hood of respiratory and cardio vascular systems and illness.
76-100	Heavy air pollution	Aggravation of heart lung diseases .Increased risk of death in children. Increased effect in general population.
>100	Severe air pollution	Serious aggravation of heart or lungs diseases; increased risk of premature death. Serious risk of cardio respiratory symptoms in general.

"4.Results and Discussion"

Comparison of seasonal variation of ambient air quality with respect to SPM, RSPM, SO_2 and NOx during the period of July 12 to June 13 as shown in the figure 2, 3, 4.In this period SPM value ranged from 219.0µg/m³ to 349.2 µg/m³ at coal field area, Talcher sampling station .The highest value was found in the pre monsoon season .Similarly at the same sampling station, the RSPM value ranged from 124.0 µg/m³ to 163.8 µg/m³, having highest concentration in the pre monsoon season. For SO_2 and NOx the lowest concentration values are 11.4 µg/m³ and 23.6 µg/m³ respectively, the highest being 14.9 µg/m³ and 27.4 µg/m³ respectively. The highest concentration of SO_2 and NOx was found in pre monsoon and post monsoon season.

The higher value of SPM, RSPM was found during the month of winter and summer in the coal field area. Similarly SO_2 and NOx concentration were found to be little higher in the township areas and mining areas(may be due to the close proximity of the NALCO Captive power plant ,Thermal power plant,Jindal).This may also attributed to prevailing wind direction to this area. In all the other sampling station it was found that SPM and RSPM values were nearly close or slightly exceeding the standard values set by the CPCB. But the SO_2 and NOx concentration were in the permissible limit as stated by CPCB (NAAQS-2004). The average AQI value gives us an idea that Nalco Nagar, Angul is moderately polluted but it's near to the range of heavy air pollution. Similarly, Industrial Estate, Angul and TTPS, Talcher are heavily polluted. But the coal field area is severally polluted.

It was found from the above studies and measurements that the high SPM concentration in the residential area (as per ISI standard) in the particular locality is alarming. This may be due to hectic coal mining like open cast mining, heavy transportation of coal, raw materials and finished products from the industries and lack of continuous water spraying in the area.

TABLE 2: Average Concentrations of Different Air Quality Parameters of the Study Area 2012-2013

LOCATION	SEASON	SPM (in µg/m³)	RSPM (in µg/m³)	SO_2 (in µg/m³)	NOx (in µg/m³)	AQI
Indus-trial Estate Angul	Pre-monsoon	275.4	125.6	6.7	20.3	99.08
	Rainy	190.0	100	4.5	19.1	75.57
	Post-monsoon	281.8	124.4	7.1	20.8	100.091
Nalco Nagar ,Angul	Pre-monsoon	197.6	96.4	7.7	18.2	76.57
	Rainy	142.0	74.0	7.2	17.7	59.77
	Post-monsoon	193.0	93.0	8.6	19.1	75.45
TTPS ,Talcher	Pre-monsoon	253.4	111.6	10.3	19.0	91.93
	Rainy	168.0	89.0	8.0	18.3	69.50
	Post-monsoon	259.8	113.4	10.7	20.0	94.11
Coal Field Area, Talcher	Pre-monsoon	349.2	163.8	14.9	27.4	129.33
	Rainy	219.0	124.0	11.4	23.6	92.68
	Post-monsoon	294.8	153.2	13.0	28.4	116.86

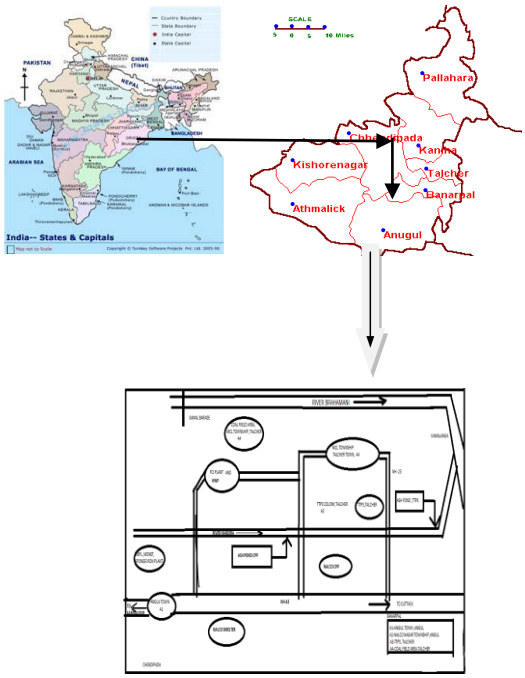

Figure 1: Location of Angul Talcher Area -Rough sketch of study area

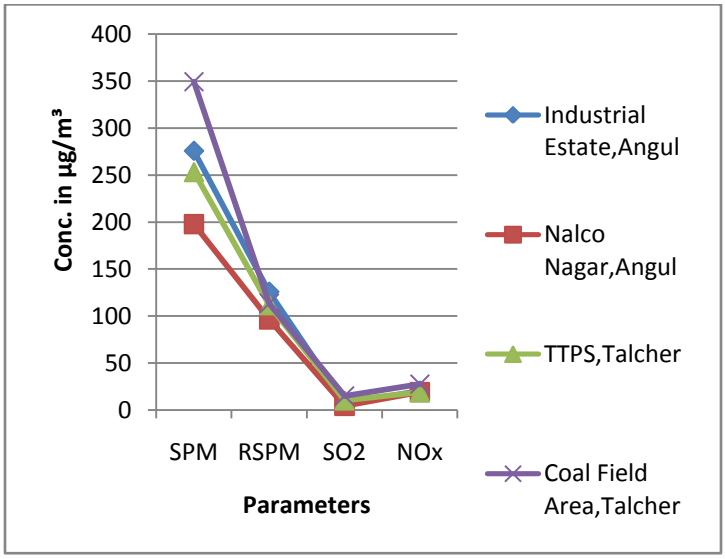

Figure 2: Graphical representation of pollutants for pre monsoon season

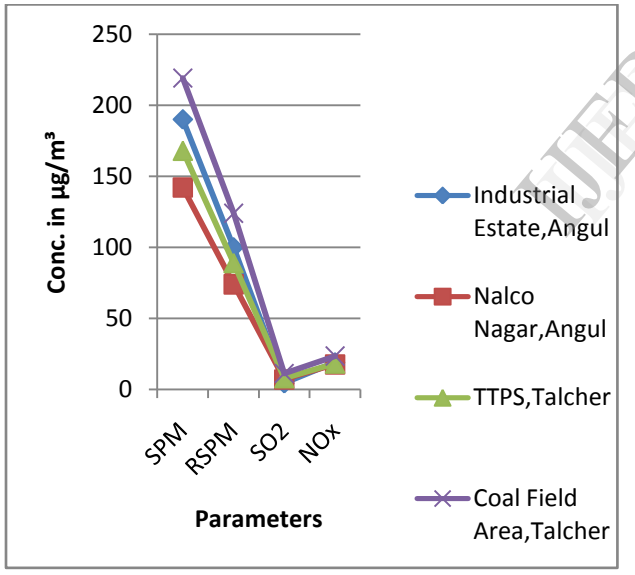

Figure3: Graphical representation of pollutants for monsoon season

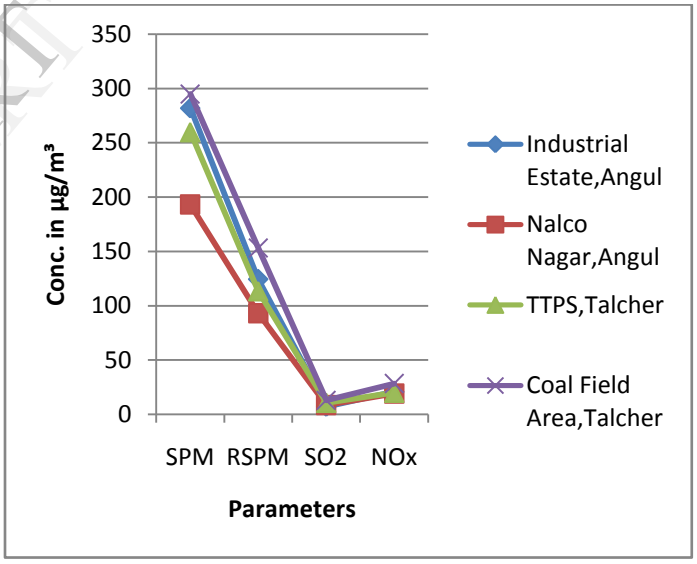

Figure 4: Graphical representation of pollutants for post monsoon season

"5.CONCLUSION"

Air pollution measured in the form of Air Quality Index is used to provide a meaningful assessment of air pollution in the common man perception. It can be concluded that SO_2 and NOx were within the permissible limit but SPM and RSPM in the entire study area are nearly close or excess to the permissible limits as specified by Central Pollution Control Board (CPCB). It's found that SPM and RSPM are higher in most location in the pre monsoon and post monsoon seasons. The air quality of Angul – Talcher area has deteriorated significantly due to rapid industrialization activities. Excess air pollution load considerably deteriorates the air quality and subsequently responsible for harmful consequence of the exposed population. It's now high time to undertake an integrated air pollution management program which includes appropriate measures at the polluting sources, development of green belt, and establishment of dust extraction systems. Up gradation and proper operation of dust control measures adopted in the mining and industrial areas will definitely control the level of concentration of particulate in the ambient air of the study area.

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