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Measurement of Airborne Particulate Matter Concentration Levels in the Ambient Atmosphere

Sapan Bhatnagar[1] and Shubham Dadhich[2]

[1]Department of Chemical Engineering ISM Dhanbad (Jharkhand), INDIA
[2]Department of Civil Engineering NIT Warangal (Andhra Pradesh), INDIA
E-mail: [1]sapan.2216@yahoo.in

Abstract—*Micron size particles emitted from different sources and produced by combustion have serious negative effect on human health and environment. Particulate matter is one of the major concerns, with PM_{10} and $PM_{2.5}$ being especially hazardous. Existing emission standards impose restrictions on the total mass concentration of emitted particulates, PM_{10} and $PM_{2.5}$. While particulates below $PM_{2.5}$ size threshold provide only a small contribution to the overall mass. It is worthwhile to determine the amount of these particulates present in the atmosphere per cubic meter to monitor the ambient air quality. Particulate matter samples are collected for twenty four hours with the starting time 00:00 am to 11:00 pm in the month of July 2014, and by gravimetric analysis, concentration of PM_{10} and $PM_{2.5}$ in the atmosphere is determined. The existing concentration of pollutants were compared with ambient air quality standards.*

Keywords: *Particulate Matter, Air Quality, En Environment, Gravimetric*

1. INTRODUCTION

Particulates a re d ust-sized pol lutants dispersed i n t he atmosphere. They can originate from num erous s ources s uch as aut omobiles, power pl ants an d m ines. Particulate m atter, one o f t he si x cri teria pol lutants regulated by t he Environmental Protection Agency (EPA) through the National Ambient Air Quality Standards (NAAQS) is th e generic term for dust an d other di verse types of p articles in the air. Particulate m atter em issions are o f p aramount im portance. Numerous studies c onducted within l ast several years suggested th at th ese so lid PM can be hazardous t o human health, co ntributing t o th e i ncreased m ortality an d sickn ess, $PM_{2.5}$ and P M_{10} can have a magnified ef fect. Therefore, measurement of particulate matter conc entration levels i n t he ambient atmosphere is

one o f t he m ajor i mportance t o understand t he e ffects o f particulates on h uman heal th. Present st udy to m easure the concentration levels of PM_{10} and $PM_{2.5}$ is focused on the local environmental im pact of Bharat Petrol eum Corporat ion Limited, Ko chi Refin ery. All sam ples have bee n taken i n t he area between refi nery a nd the city entrance at the wind direction. Env ironmental Pro tection Agency sets th e lim it for the concentration level for major air pollutants. For each of the pollutants, EPA h as estab lished national air quality stand ards to protect public h ealth. The ex isting con centration of pollutants were th en co mpared with amb ient air qu ality standards. The dat a o btained co uld be useful t owards t he ai r pollution a batement pr ograms and f or futuristic st udy of particulate matter concentration in Kochi.

2. EXPERIMENTAL METHODOLOGY

2.1. Site Description

Kochi is a m ajor port city on th e west coast o f In dia i n th e state of Kerela. It l ies between 9 , 58" North l atitude an d 76,13" East longitude. It is the most densely populated city in the state, af fected by inc reasing air po llution lev el as a result of con centrated indu strial activ ities an d urbanization. One o f these indu stries that has a p articularly h igh rank on th e list o f pollutants is Bharat Petroleum Corporation Plant.

2.2. Measurement

In th is stud y, Particu late matter sam ples are co llected for twenty four hours with th e starting time 00:00 am to 11:00 pm in the month of July 2014, in the area between refinery and the city entrance at the wind dir ection. For m easuring par ticle concentration Gravimetric method is used. In t his m ethod, high volume p ump is situ ated in an app ropriate lo cation preferably a little b it h igher from th e ground lev el (2 m). The flow rate of pump would be adjusted, considering the location of pollutants dispersion in the environment. A fiber glass filter is placed in t he filter holde r a nd sam pling is done. Fil ters before being used, are kept for 24 h in silica gel desiccators to equilibrate to the te mperature an d relative h umidity h eld at constant values. Thereafter, t he filters are weighted using an exact scale. After sampling, th e m oistures of filters are absorbed ag ain, t he differences b etween th e filter's weights before an d after th e sam pling are m easured and also the amounts of particulates per volume unit are measured and the concentration of PM $_{10}$ and $PM_{2.5}$ is d etermined. The ex isting concentration of particulates are com pared with the concentration li mit set b y EP A. According to EP A concentration limit:

Table 1

Parameter	Limit by EPA (μg/m^3)
PM_{10}	100
$PM_{2.5}$ 60	

3. RESULT

After sampling is done twenty-four hours a day for two days a week for three weeks, PM_{10} concentrations were 68.61, 80.76, 70.76, 79.51, 72.70, 70.27 μg/m^3 and for $PM_{2.5}$ concentrations were 20.00, 32 .00, 2 3.00, 30.00, 2 5.00, 21.00 μg/m^3 in th e area bet ween refinery a nd t he c ity entrance , which are under the 24 -h PM $_{10}$ and $PM_{2.5}$ Natio nal Ambient Air Quality Standard (N AAQS) of the C entral Pol lution Control Board (CPCB) of India. The mean concentrations of PM_{10} and $PM_{2.5}$ were 73.77 μg/m^3 and 25.17 μg/m^3 respectively. These values are less t han th e EPA co ncentration limit 100 μg/m^3 and 60 μg/m^3 for PM $_{10}$ and $PM_{2.5}$ respectively. So t hese concentrations are satisfa ctory a nd acce ptable for general public. Air pollution po ses little o r no risk. Air in th e atmosphere is clean and there is no associated health concern for general public.

Table 2

Concentration Levels (μg/m^3)	
PM_{10}	**$PM_{2.5}$**
68.71	20.00
80.76	32.00
70.76	23.00
79.51 30.00	
72.70 25.00	
70.27 21.00	

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