AIR QUALITY MONITORING IN HEAVY WATER PLANT, THOOTHUKUDI

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ABSTRACT:
The air pollution is of predominantly local origin. Air Quality monitoring will normally provide the information to support and facilitate the assessments of the air quality in a selected area. The present study deals with the analysis of Irrespirable suspended particulate (IRSP) or PM2 , Respirable suspended particulate matter (RSPM) or PM10, gaseous pollutants and heavy metals. The results indicated that the levels of IRSP (<2.5 µ), RSPM (<10 µ), gaseous pollutants such as SO_x (16µg/m^3 - 3.6 µg/m^3), NO_x (<10 µg/m^3), NH_3 (145 µg/m^3- <10 µg/m^3) & O_3 (<10 µg/m3) are within the levels as suggested by National Ambient Air Quality Standards (NAAQS). Report on the analysis of heavy metals such Cu, Cd, Pb, Ar, Zn, Hg confirm that the risk of heavy metals contamination in the air is low. It is concluded that the quality of air is good in the surroundings of Heavy Water Plant, Thoothukudi.
Key words: Air quality, Heavy water plant, IRSP, RSPM, Heavy metals

INTRODUCTION:
Air pollution is produced by the contamination of air with unwanted gaseous pollutants and dust particles in the environment. Thoothukudi is a vast polluted city because many industries & power plants are situated in this city. Air pollution in a modern city has become a serious environmental problem, because of the combined effects of various pollutants upon the physical and mental health of citizens and the quality of urban life in general [1-3]. Long-term measurements at monitoring stations may be used to investigate the relationship between the population exposure to air pollutants and the incidence rate of diseases [4,5]. The relationship between air pollutants and health effect has been widely studied - an increase in yearly average PM10 concentration increases the number of respiratory hospital admissions and the mortality rate [6]. Monitoring air quality network which involves the selection of pollutants, selection of locations, frequency, duration of sampling, sampling techniques, infrastructural facilities, man power and operation and maintenance costs. Many industries set up fixed air quality monitoring stations to monitor the air quality on a continuing basis and to measure concentrations of major pollutants. Heavy water board is a constituent unit under the Department of Atomic Energy in the Government of India. It employs the ammonia-hydrogen exchange process and it involves the production of heavy water. Hence an attempt was made to analyse Suspended Particulate Matter (SPM), Sulphur dioxide (SO2), Oxides of Nitrogen (NOx), Ozone, Ammonia, Heavy metals such as and Fe, Zn, Cu, Cd, Pb etc in the ambient atmosphere of HWP, Thoothukudi.

MATERIALS AND METHODS:
Fine Dust Sampler instrument is used for the measurement of particulate matter and gaseous pollutants in ambient air. AAS is used for the analysis of heavy metals.

Particulate Matter:
The detection of both 10 and 2.5 µ particulate matter does not carried out in a similar day it can be measured at alternative days. To evaluate particulate matter 10 µ and 2.5 µ Poly tetra fluoro ethylene (PTFE) membrane filter paper is accurately weighed. For 10 µ the filter paper is directly fixed at WINS Impactor. For 2.5µ the filter paper is dipped into the silicon oil before fixing at the impactor because the 10 µ particulate matter are settled in silicon oil only 2.5µ particulate matter allowed in the PTFE membrane filter paper. After 24 hours the filter paper is again weighed. The amount particulate matter calculated by the gravimetric method.

Gaseous Pollutants:
Gaseous pollutants which are determined for this study are ammonia, nitrogen oxides, sulphur oxides, ozone in individual methods. But the samples are collected in individual absorbing solution. These solutions are filled in the Impinger tube which is fitted in FDS instrument. The colour of the collected solutions are developed by the following methods

- Sulphur oxides: The colour was produced when p-rosaniline hydrochloride is added to the solution by Modified West & Galke Method [7]. The colour is estimated by a reading from spectrophotometer (560nm).
- Nitrogen oxides: The colour was developed by using N(1-naphthyl) ethylenediamine dihydrochloride by Modified Jawb & Hochheiser Method[8]. The colour is estimated by a reading from spectrophotometer (540nm).
- Ammonia: The colour was produced by adding Nessler's reagent by Nessler's Method [9]. The colour is estimated by a reading from spectrophotometer (530nm).

- Ozone: The colour was developed by using iodine solution by Chemical Method 411 [10]. The colour is estimated by a reading from spectrophotometer (352nm).

Determination of Heavy Metals by Atomic Absorption Spectrophotometer (AAS):

Analysis of the heavy metal was performed by Varian model AA 240 FS atomic absorption spectrophotometer (AAS). Measurements were made using a hollow electron discharge lamp (EDL) for copper, cadmium, lead, zinc and Iron at wavelengths of 220.62 nm, 228.80 nm, 283.31 nm, 193.70 nm, 240 nm and 253.7 nm respectively.

RESULTS & DISCUSSION:

The results for the detection of Particulate Matter 2.5 & 10 µ, NOx, SOx, NH_3, O_3 and heavy metals are presented in the Table:1 and Table:2

Table:1 Results of particulate matter and gaseous pollutants in air

Days	PM 2.5 (µg/m^3)	PM 10 (µg/m^3)	NOx (µg/m^3)	SOx (µg/m^3)	NH_3 (µg/m^3)	O_3 (µg/m^3)
Day 1	24	-	<10	16	345	<10
Day 2	-	33	<10	24	210	<10
Day 3	14	-	<10	23	180	<10
Day 4	-	20	<10	18	207	<10
Day 5	12	-	<10	<10	175	<10
Standard Values	60	60	80	80	400	180

The air samples were analysed for Cu, Zn, Fe, Pb and Cd using Atomic Absorption Spectrometry (AAS) Flame Unit.

Table: 2 Results of heavy metal concentration in air

Heavy metals	Copper (ng/m^3)	Zinc (ng/m^3)	Iron (ng/m^3)	Lead (ng/m^3)	Cadmium (ng/m^3)
Observed Value	8	23	117	15	0.3
Standard Value	15	47	380	36	0.8

The clean air act requires EPA to set national air quality standards for particulate matter and five other pollutants considered harmful to public health and the environment (the other pollutants are ozone, nitrogen oxides, sulfur oxides and ammonia). The law also requires EPA to periodically review the standards to ensure that they provide adequate health and environmental protection, and to update those standards as necessary. The results indicated that the levels of particulate matter (<2.5 µ) and gaseous pollutants such as SO_x (16µg/m^3 - 3.6 µg/m^3), NO_x (<10 µg/m^3), NH_3 (345 µg/m^3- 175 µg/m^3), O_3 (<10 µg/m3) and heavy metals- Copper (<15 ng/m^3), Zinc (<47 ng/m^3), Iron (<380 ng/m^3), Lead (<36 ng/m^3), Cadmium (<0.8 ng/m^3) are within the levels as suggested by National Ambient Air Quality Standards (NAAQS) and WHO[12]. The ammonia level is near to the standard value because the fertilizer manufacturing industry is situated in that place. Heavy metals present in air produce harmful disease for all living things even at low concentration. The observed value of the gaseous pollutents and heavy metals were good when compared to the standard values set by the Government of India and World Health Organisation.

CONCLUSION:

It can be concluded that the heavy metals, gaseous pollutants and particulate matter levels are in agreeable range. So the quality of air is good in the surroundings of Heavy Water Board, Thoothukudi.

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