

# A study on Atmospheric Poly Nuclear Aromatic Hydrocarbons near Thermal power station, Tuticorin, Tamil Nadu.

O.V. Sheebha Malar<sup>1</sup>, C. Isac Sobana Raj<sup>2</sup>, T.K. Jayasutha<sup>3</sup>

<sup>1</sup> Department of Chemistry and Research, Nanjil Catholic College of Arts and Science, Kaliyakkavilai, Tamil Nadu, India.

<sup>2</sup> Department of Chemistry and Research, Nesamony Memorial Christian College, Marthandam, Tamil Nadu, India. 629165.

<sup>3</sup> M.Phil. Scholar, Department of Chemistry and research centre, Nesamony Memorial Christian College, Marthandam, 629165.

## Abstract

Fumes of pesticides like the DDT get biomagnified and cause disorder to kidney, brain and problems of circulatory system. Accumulation-mode particles are more efficient per unit mass than coarse particles in causing visibility impairment. This paper deals with poly Nuclear aromatics hydrocarbons (PAH) for a period of three months from March 2014 to June 2014 in Tuticorin industrial area. The accumulation mode particle components principally responsible for visibility impairment are sulfates, nitrates, organic matter, and elemental carbon. Fumes from pesticides, fungicides, insect repellents can be carcinogenic. Soil dust, particularly in the fine tail of the coarse particle distribution, can also impair visibility. All of these particles scatter light to some degree, but, of these, elemental carbon plays the most significant role in light absorption. Since elemental carbon, which is a product of incomplete combustion from activities such as the burning of wood or diesel fuel, is a relatively small component of PM in most areas, visibility impairment is generally dominated by light scattering rather than by light absorption.

**Key words:** poly nuclear aromatic hydrocarbons, pollution, health effect, pollutants.

## Introduction:

In the light of the information provided, the present research was envisaged to cover the objective Study on poly Nuclear aromatics hydrocarbons (PAH) in the respirable particulate matter. The basic need in the aerosol studies requires a program for the collection and analysis of pollutants present in the aerosol particulates.

## Study Area:

Tuticorin district is a part of South Tamil Nadu, India. Located in the southeastern corner of Indian Peninsular between 8° 35' 12'' and 8° 40' 10'' N and 78° 3' 90'' to 78° 10' 26'' E bound on the North by the districts of Virudhunagar and Ramanathapuram, on the East and Southeast by Gulf of Mannar, West and Southwest by Tirunelveli district. The study area falls in the Survey of India top

sheet no, 58L/1. The climate of this region is hot and dry. This district, particularly in and around Tuticorin, is the major salt producer of the country.

### **Materials and Methods:**

Respirable particulate sampler, Envirotech APM was used to collect atmospheric aerosol particulates. This High volume sampling is an internationally accepted standard technique for measuring the concentration of suspended particulates in the atmosphere.

A large volume (~1500 cubic meters) of atmospheric air can be passed through Whatman glass microfibre filter papers over a period of eight hours. Thus measurable amount of dust samples in the area with dust levels as low as one microgram and up to 10 microns were collected for further analysis. In India, several agencies, which include central and State Pollution Control Boards and Research organizations, monitor air quality with reference to SO<sub>2</sub>, NO<sub>x</sub>, and SPM (Promontories,2002). Coal usage refining and combustion of various grades of oil, metal smelting, and refining, municipal and hazardous waste incineration are the major anthropogenic sources for the trace metals in the atmosphere(Moorthy,1991).

### **Sample Pretreatment:**

One of the filter paper collected from the study area is subjected for trace elements analysis using ICP-MS. At all stages filters were touched with clean plastic forceps and scissors, which were handled using powder free gloves to avoid contaminations. The filter paper was cut into pieces and transferred into clean, 125 mL Griffin beakers. 15 mL of mixed acid extractant (65 mL pure distilled HNO<sub>3</sub> and 182 mL pure distilled HCl were mixed and diluted to 1L with Milli-Q distilled water) was added and agitated in a hot (85°C) ultrasonic bath at 100 W powers for 60 minutes. The beakers were removed from the bath and cooled to room temperature. A vacuum filtration unit was assembled with 25 mm glass filter. The vacuum filtration unit was cleanly washed with Milli-Q distilled water and rinsed with 10 mL of clean, hot mixed – acid extractant, carefully rinsing the wall of the funnel. The sample was passed through a filter in clean 25 mL volumetric flask placed inside bell jar using vacuum, retaining the insoluble sampling medium in the beaker. The beaker was rinsed thrice with 3 mL portions of Milli-Q distilled water and the rinsed liquid was passed through the filter. The collected sample was diluted to 25 mL with Milli – Q distilled water and proceeded with further analysis. A blank was prepared in the same way with unexposed fresh filter paper.

All the glassware used for sample preparations were cleaned with double distilled water. After preparation, the samples were stored in well-cleaned polythene sampling bottles. The polythene bottles used for sample storage were washed with distilled water, and were filled with 3N HNO<sub>3</sub> solution for one day and agitated ultrasonically for 15 minutes. After a second wash with distilled water, they were rinsed with double distilled water and air-dried. Thus, clean polythene containers

were used for sample storage to avoid any external contamination. Ultra pure analytical grade reagents, distilled acids, and Milli-Q distilled water were used in each step of analysis.

### **Filter Equilibration**

The blank filter papers were kept in a desiccators cabinet 24 hrs before weighing to maintain a uniform atmospheric condition. The same condition was also provided to the collected samples by keeping them in the same desiccators' cabinet for 24 hrs before getting their final weight.

### **Filter weighing:**

Filters were pre weighed on the electronic balance carefully. The filter was placed in the weighing chamber and the balance was adjusted to the equilibrium position. The stable reading was noted. Each filter was placed carefully in separate jackets once weighing was completed. The jackets were sealed and blank filters were taken to the field for sampling.

### **Locations of Air Sampling:**

In order to determine the chemical composition of collected aerosol particles the sampling area was selected near to the thermal power plant camp - I where a residential area is also located near by the sampling station. Sampling station was selected based on the prevailing meteorological conditions, and easy accessibility. Respirable High Volume Air Samplers, used for collection of air samples, were located four meters above the ground level. Due care was taken to avoid permanent physical obstructions like buildings, trees etc., within the space bound by the right circular cone with its vertex at the collector and opening upwards in a 120° angle.

### **Period of Sampling:**

Polynuclear aromatic hydrocarbons (PAH) for a period of three months from March 2014 to June 2014 in Tuticorin industrial area. In order to obtain an average concentration of the pollutants, air samples were collected for 24 hours continuously throughout a day. This is expected to cover all the usual emissions from various mobile and fixed sources in and around the Tuticorin urban area. The suspended particulate matter was collected on Whatman glass microfibre filter papers. After collection, filters were folded carefully, and kept in clean polythene covers, labeled about the station number, date, and period of sampling over the polythene covers using stickers, and transported to the laboratory for immediate analysis (Table.1).

**Results and discussion:****Table 1****Study on Poly Nuclear Aromatic Hydrocarbons.**

S.NO	Parameter	Protocol	Result
1	Poly Nuclear Aromatic hydrocarbons (PAH)	USEPA 8270 for analysis	Less than 0.1 mg/m <sup>3</sup>

. The present result does not show the presence of PAH in the collected samples sent for analysis. The result shows that it is less than 0.1mg/m<sup>3</sup>. The reason for the lower concentration may be due to the lesser volume of sample sent for analysis. Further studies specific to the Polycyclic aromatic hydrocarbons in the aerosols with higher volume of sample may be done in the future studies. The usual pollutants in urban air include sulphur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>), and suspended particulate matter (SPM). Out of these, SPM, also often termed as aerosol, contain toxic sulphate compounds, nitrate compounds, organic compounds, elemental carbon, and inorganic trace elements, is emerging as the most serious air pollutant ( Dejmek, 2000). Increased levels of fine particles in the air are linked to health hazards such as heart disease, (Cass,1983) altered lung function and lung cancer. Polycyclic aromatic hydrocarbons are associated with health hazards (Henning Richter,2000). Composition processes are major sources of Polycyclic aromatic hydrocarbons in the atmosphere (Dockery,1993). Many Polycyclic aromatic hydrocarbons identified in aerosol have been found to be mutagenic(Durant,1996). Respirable suspended particles sampled are subsequently analysed with GC-MS

Most of the Polycyclic aromatic hydrocarbons compounds remain adsorbed on soot particles that are formed as a residue of combustion of fuel in power plants and automobiles. To some estimate, it accounts for 50% of the particulate load in urban areas. Chemically it is highly condensed product of poly nuclear aromatic hydrocarbons, consisting of several thousand interconnected crystallites, i.e. graphic platelets each have about 100 condensed aromatic rings.

In recent time fine aerosol particles are studied worldwide due to its potential toxicity and accumulation in different environmental compartments influencing climate change, global warming etc. The size of aerosol particles in the atmosphere varies over four orders of magnitude, from a few nanometers to micrometers. The largest particles, called the coarse fraction (or mode), are mechanically produced by the break-up of larger solid particles. These particles can include wind-blown dust from agricultural processes, uncovered soil, unpaved roads or mining operations. Traffic produces road dust and air turbulence that can re-entrain road dust. Near coasts, evaporation of sea spray can produce large particles. Pollen grains, mould spores, and plant and insect parts are all in this larger size range. Smaller aerosol particles, called the fine fraction or mode, are largely formed

from gases. The smallest particles, less than 0.1  $\mu\text{m}$ , are formed by nucleation, that is, condensation of low vapour- pressure substances formed by high-temperature vaporization or by chemical reactions in the atmosphere to form new particles (nuclei). Particles in this nucleation range or mode grow by coagulation, that is, the combination of two or more particles to form a larger particle, or by condensation, that is, condensation of gas or vapour molecules on the surface of existing particles. Coagulation is most efficient for large numbers of particles, and condensation is most efficient for large surface areas. Submicron aerosol particles are also produced by the condensation of metals or organic compounds that are vaporized in high-temperature combustion processes. They can also be produced by condensation of gases that have been converted in atmospheric reactions to low vapour - pressure substances (Lacis (1995), Kaufman(2002), Lewtas(1993), Martin Eberet(2012)).

### Conclusion:

Air pollutants have no boundary. Tuticorin is also filled with different categories of industries with different kinds manufacturing activities with different raw materials process like fertilizer, copper smelter, chemicals etc. The shifting winds in Tuticorin, a coastal area, mix up various types of aerosol particles from different sources, which enhance the secondary reaction in the boundary layer. This phenomenon put difficulty in ascertaining the actual source of pollution. Appropriate planning shall be done before commissioning any industrial establishments to isolate the human population from direct hit by pollutants. Hospitals, schools, and dwelling complexes have to be located away from pollution sources and these may be established at places after carefully studying the meteorological aspects and the pattern of dispersion of air pollutants.

### References:

1. Cass, G. R., Mc Rea, G. J. (1983) Source–receptor reconciliation of routine air monitoring data for trace metals. An emission inventory assisted approach. *Environ. Sci. Technol.* 17, 129–139.
2. Dejmek, J., Jelinek, R., Solanskyy, I., Benes, I., Sram, R. J. (2000) Fecoundability and Parental Exposure to Ambient Sulfur dioxide. *Environ. Health. Perspect.* 108, (7) 647–654.
3. Dockery, D.W., Pope, C.A., Xu, X., Spengler, J.D., Ware, J.H., Fay, M.E., ferris, B.G., and Specizer, F.E., (1993) *N. Engl. J. Med.* 329 1753 – 1759.
4. Durant, J. L., Busby, W.F., and Lafleur, A.L., Penman, B.W., and Crespi, December 1996 C.L ,Human cell mutagenicity of oxygenated, nitrated and unsubstituted polycyclic aromatic hydrocarbons associated with urban aerosols, *Mutation Research/Genetic Toxicology*, Volume 371, Issues 3–4, Pages 123-157.
5. Henning Richter, Timothy G, Benish, Oleg A, Mazyer, William H. Green and Jack B. Howard, (2000) Formation of polycyclic aromatic hydrocarbons and their radicals in a nearly sooting premixed benzene flame. *proceedings of the combustion Institute.* 28, 2609-2618.
6. Kaufman, Y. J., Didier, T., and Boucher, O. (2002) A satellite view of aerosols in the climate system. *Nature*, 419 215–223.

7. Lacis, A. A., and Mishchenko, M. I. (1995) Climate forcing, Climate sensitivity and climate response : A radiative modelling perspective on atmospheric aerosols in aerosol forcing of climate, R. J. Charlson and Heintzeberg, (Eds) John Wiley, New York. 11– 42.
8. Lewtas, J. Complex mixtures of air pollutants. (1993) Characterizing the cancer of polycyclic organic matter. Environ. Health. Perspect 100, 211–218.
9. Mac Gregor, J. T., Farr, S., Tucker, J. D., Heddle, J. A., Tice, R. R., Turtletaub, K. W., (1995) New molecular end points and methods for routine toxicity testing. Fund. Appl. Toxicol.
10. Martin Eberet, Dorthe Muller-Ebert. (2012) Source apportionment of aerosol particles near a steel plant by electron microscopy Vol 10.1039/c 2 cm 3069.
11. Moorthy, K. K., Nair, P. R., Murthy, B. V. K. (1991) Size distribution of Coastal aerosols; Effects of local sources and sinks. Journals of applied Meteorology. 30, 844–852.
12. Promontories, V., Petsas, N., and Moutsatsou, (2002). Levels and composition of Atmospheric Particulates (PM<sub>10</sub>) in Mining – Industrial Site in the city of Lavrion, Greece. Air & Waste Manage. Assoc, 52, 1263–1273.

