

# “Monitoring of Anthracene & Benzo(e)Pyrene (PAHs) in Ambient Air of Meerut Area of NCR & Purification of Air by Yagyaroma”



Nidhi Rani, Abhishek Kumar Singh

**Abstract:** The main objective of this paper is to analyze the impacts of air pollution on the health of peoples of Meerut area of NCR & give brief description for purification of air by Yagyaroma by using odeniferous substance in Yagya samigri special reference to sandal wood & camphor etc. The practical work was carried for a duration approximately two years. Sampling of Anthracene & Benzo (e) pyrene (PAHs) was carried Monthly basis & 24 hours twice in a month & data was collected. The present study is very useful to regulatory authorities & administration to understand problems of air pollution in the Meerut area of NCR & helpful in prevention of Air Pollution. Anthracene & Benzo (e) pyrene (PAHs) are considered as a carcinogenic and toxic contaminants of ambient air of Meerut area of NCR. Anthracene & Benzo (e) pyrene (PAHs) are carcinogenic and hazardous to biotic life and no safe level of exposure can be recommended. In Meerut City, the sampling locations are residential area, commercial and industrial area during four seasons viz. summer, Monsoon, Post monsoon & Winter. Variations in levels of Anthracene & Benzo (e) pyrene (PAHs) were observed during these seasons.

**Keywords-**Polynuclear Aromatic Hydrocarbons, High Volume Sampler, Glass Fibre Filter, GasChromatography-Flame Ionisation Detector, Yagyaroma.

## I. INTRODUCTION

The air pollution has become one of the serious issues of modern times leading to the degradation of air quality so it is very necessary to take drastic steps to fight and prevent air pollution. It causes due to many construction and highway projects and cutting of hundreds of trees in Ghaziabad area of NCR. Industrial processes and motor vehicles are the major sources of PAHs in the environment. PAHs are carcinogenic & very harmful to human health. Long term exposures can result in bone marrow depression, fatigue, headache, and appetite loss, leukemia or cancer. PAHs is produced during the process of making gasoline & other fuels from crude oil, making coke from coal etc. PAHs are the group of chemicals formed during incomplete combustion & known for carcinogenic & Mutagenic effects. The common sources of PAHs are Carbon black, petroleum, Coke oven & Aluminium industries, are the main sources of PAHs..

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Industry gives out a lot of PAHs & air is polluted with a result of that PAHs have been found even in rainwater & snow samples. Approximately 150,000 deaths estimated in South Asia alone due to the exposure of air pollutants<sup>10</sup>. In the present study measurements of concentrations of the Anthracene & Benzo (e) pyrene (PAHs) have been carried out. The tests were conducted at residential, commercial & Industrial site in three different locations in Meerut Area in four different seasons, Summer season (March to June), Monsoon season (July to September), Winter season (December to February) & Post Monsoon season (October to November) were considered.

## II. MATERIAL & METHODS

**Sampling sites:** Meerut is a developing city of Uttar Pradesh after Ghaziabad & Noida in Delhi NCR. In U.P, Meerut rank is 4<sup>th</sup> in terms of population. It is also the sports capital of India & also developing as industrial hub. Meerut is a Metropolitan city & biggest city in Delhi in Delhi NCR. A large number of people commute to Delhi, Noida, Greater Noida & Ghaziabad every day for work. Meerut covers an area of approx.2500 sq.km. It is located between the plains of two prominent rivers-Ganga& Yamuna. There are four railway stations in Meerut that connect it to rest of the country. The sampling locations were selected based on land used patern, i.e residential, commercial, and industrial areas. The sampling locations were as follows:

**1. Shastri Nagar (Residential):** It is purely residential area. The sample location was built on the roof single stored building. C block, vasundhara colony, Tejgarhi, Ansal colony, B block are the nearby localities to shastri Nagar.

**2. Begumpul (Commercial):** It is predominated commercial area. The sampling location was on the roof of a single stored building. Abu lane, Meerut college & Kachahari road are the nearby localities to Begumpul.

**3. Partapur Industrial Area (Industrial):** Partapur is home to a large spectrum of commercial organization like Dayal Fertilizers, Dayal Infotech, Parag dairy and Kanohar electrical etc. It is purely industrial area mainly comprising heavy & Medium Industries.

**4. Sampling & Storage of PAHs-** the high volume sampler was used to collect Anthracene & Benzo (e) pyrene (PAHs) with an average flow rate of approximately 1.1m<sup>3</sup>/minute on a glass fibre filter (GFF) of size “8 x 10” (whatmann filter paper). These filter paper are most widely used in high volume sampler due to its good mechanical strength & low cost as compared to PTFE.

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The use of HVS is recommended by regulatory agencies of India & its use is very cheapest. HVS. High Volume sampler were placed on the roof of a single stored building ,

where free flow of ambient air takes place without any hindrance. Collect the samples 8 hrly & 24 hrly. for analysis. Anthracene & Benzo (e) pyrene (PAHs) samples stored in cool and dark places. These samples are hygroscopic in nature so keep in desicator for 24 hrs., then wrapped in Aluminium foil & transfer to a laboratory for analysis.

**5. Analysis:** Anthracene & Benzo (e) pyrene (PAHs) Samples were collected & then extracted using Benzo(e)pyrene & concentrated on Buchi rota evaporator up to nearly dryness (waterbath temperature 40°C, vacuum 40-50m bar). Purified the Anthracene & Benzo (e) pyrene (PAHs) samples by Column Chromatography technique (column 200 mm length & 100 mm). The residue was dissolved in 1 ml of Benzo(e)pyrene and analyzed by using Gas chromatograph (GC) fitted with and Flame ionization Detector (FID).

## 6. Purification of Air by Yagyaroma:

sandel wood , Camphor & other odoniferous substances are present in yagya samagri. These substances plays a very important role in the purification of air and disease control because these substances having lot of medicinal properties. Some air purifying & medicinal properties of sandal wood and camphor are giving as follows.

Sandal wood + O<sub>2</sub>(Oxygen) → α-santalol + β-santalol  
Santalol is a aromatic herbs burn in atmosphere, their fragrance removes the foul air & purifies the atmosphere, when they burn at the time of Vedic Yagya.

Camphor also plays a very important role in yagya due to its anti-infantant & healing property.

Camphor + O<sub>2</sub> (Oxygen) → Borneol + Eucalyptol (C<sub>10</sub>H<sub>18</sub>O)

On burning camphor is converted in to borneol and eucalyptol. Eucalyptol is used in many brand of mouthwash so it has property to kill germs whereas Borneol improve digestive system by stimulating the production of digestive juices, tones the heart & improve blood circulation & treat bronchitis, cough, cold, reduces swelling & relieve stress.

A France scientist Trelow studied that air gets purified when it comes in contact with Yagya fire & becomes lighter. This process is continued until the yagya surrounding air is not purified. Generally, mango wood have been used in this process. when Mango wood burn in oxygen it formaldehyde & this formaldehyde gas kills the harmful bacterias & thus helps to purified the atmosphere

Mango Wood + O<sub>2</sub>(Oxygen) → HCHO  
(Formaldehyde)

The aqueous solution of formaldehyde is known Formalin which is used to preserve the Specimens & Vegetables in biology practical Laboratory.

Dr. Shirowic –Russian Scientist proves that during Yagya process Cow’S Ghee is burn with wood with chanting Mantra remove the effects of radiation from the atmosphere & kills the bacteria of number of disease like T.B, Measeles, small pox etc. & their equation are as follows.

Ghee + O<sub>2</sub> (burnt) → combine with dust particles  
→ washout as Rain

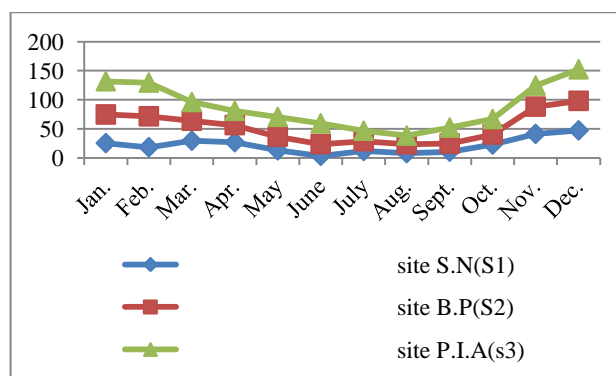
fumes of yagya By the burning of Mango wood with cow’ghee , also librates O<sub>2</sub> to a large extent, which shown in equation as-

CO<sub>2</sub> + H<sub>2</sub>O + 112,000 calorie → HCHO + O<sub>2</sub>  
So it is proved that Yagyaroma is very useful to neutralize the effects of pollutants & purify the air of Meerut.

## III. RESULT & DISCUSSION

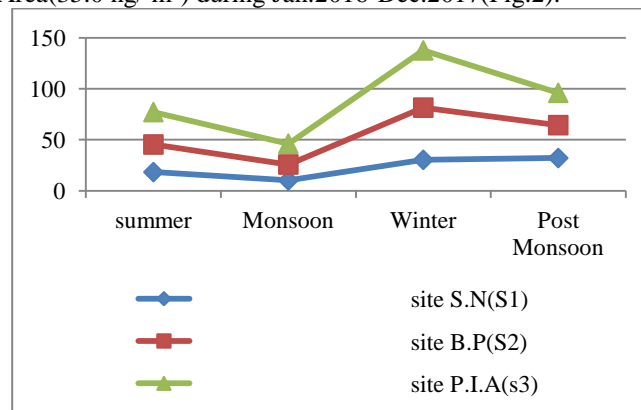
Anthracene & Benzo (e) pyrene (PAHs) were monitored at three sites in Meerut on monthly basis during Jan.2016-Dec.2017. PAHs compounds measured using GC-FID technique.

**1. Anthracene (PAHs) (Seasonal, Annual Variations & their statistical data analysis ):** The result of Monthly (8 hrly.) data for two years study during Jan2016-Dec.2017 shows that Anthracene Conc. in Meerut area of NCR varies between 21.5±13.4 ng/m<sup>3</sup> at Shastrinagar, 30.9±15.3 ng/ m<sup>3</sup> at Begumpul & 35.0±14.6 ng/ m<sup>3</sup> at Partapur Industrial area Meerut. The Combined two years of seasonal & total average value of Anthracene Conc. (ng/ m<sup>3</sup>) During Jan. 2016-Dec.2017 (fig.1).



**Fig.1 Combined 2 years of Seasonal & Total Average value of Anthracene Conc. (ng/ m<sup>3</sup>) During Jan. 2016-Dec.2017.**

Two year monthly Maximum & Minimum value were recorded at Shastrinagar i.e 47.23 ng/ m<sup>3</sup> during December & 3.4 ng/m<sup>3</sup> during June in Meerut area of NCR. The Combined two year of monthly & total average value of Anthracene Conc. (ng/ m<sup>3</sup>) during Jan.2016-Dec.2017(Fig.2) Two year combined annual average value in order of increasing Conc. at different sites were as Shastrinagar (21.5 ng/ m<sup>3</sup>) < Begumpul (30.9 ng/ m<sup>3</sup>) < partapur Industrial Area(35.0 ng/ m<sup>3</sup>) during Jan.2016-Dec.2017(Fig.2).



**Fig.2 The combined 2years seasonal (8 hrly.) Anthracene Conc. (ng/ m<sup>3</sup>) during Jan.2016-Dec.2017.**

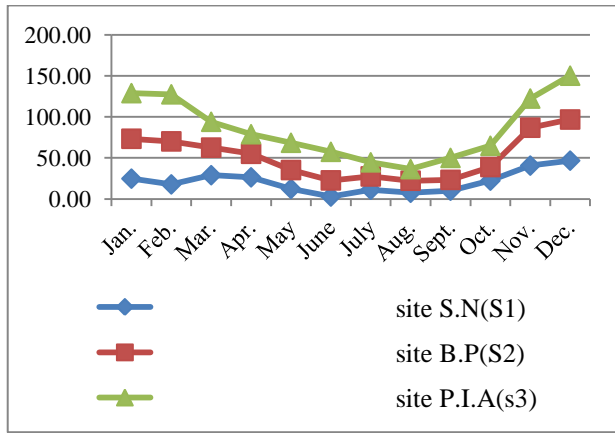


Fig.3: Monthly & Average Conc. of Anthracene (ng/ m<sup>3</sup>) during Jan.2016-Dec.2016.

The monthly & average cons. of Anthracene was shown that the highest & Lowest variation in 8 hrly concentration were observed at Shastrinagar (% CV = 46.91) & at Partapur Industrial Area (% CV = 44.26) respectively during 2016 was shown in figure 4.

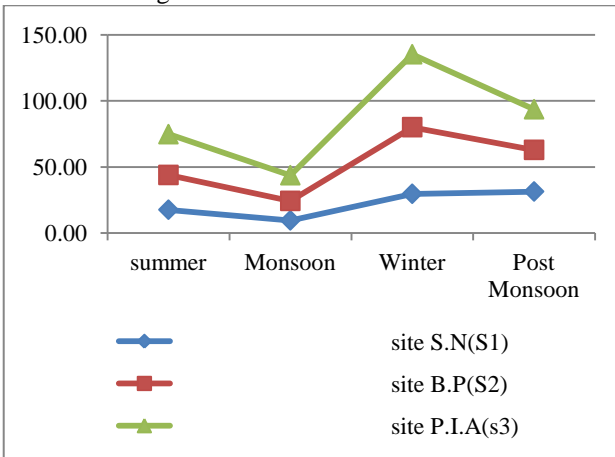


Fig.4 Seasonal conc. Of Anthracene (ng/m<sup>3</sup>) (8hrly) During Jan.2016-Dec.2016.

Total Annual average values for Meerut (all sites combined) has increased from (22.11 ng/ m<sup>3</sup>), at Shastrinagar to (35.83 ng/m<sup>3</sup>) at Partapur Industrial area during 2017. The Monthly & Average Conc. of Anthracene (ng/m<sup>3</sup>) During Jan.2017-Dec.2017 (Fig.5)

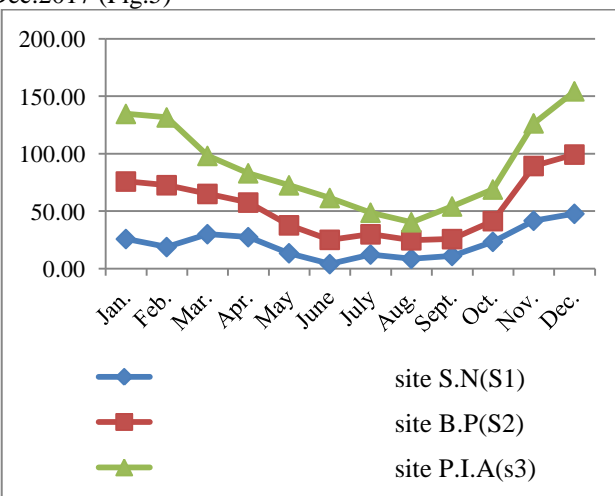


Fig.5: Monthly & Average Conc. of Anthracene (ng/m<sup>3</sup>) During Jan.2017-Dec.2017).

The seasonal (8 hrly.) Conc. of Anthracene (ng/ m<sup>3</sup>) during Jan.2017-Dec.2017 (fig.6).

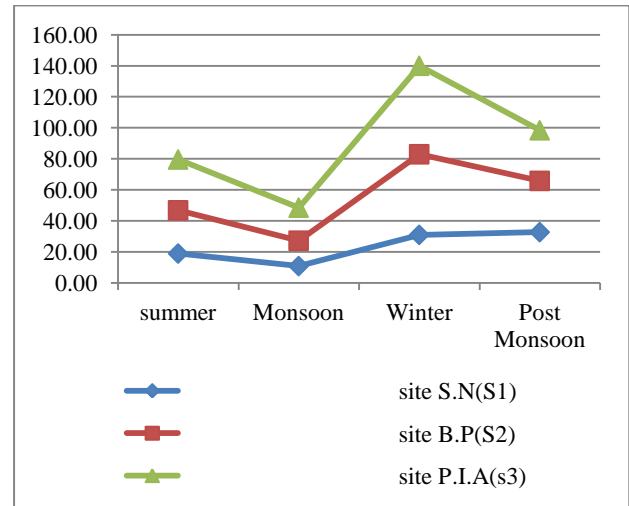


Fig.6 Seasonal (8 hrly.) Conc. Of Anthracene (ng/ m<sup>3</sup>) during Jan.2017-Dec.2017.

2. *Benzo (e) pyrene (PAHs) (Seasonal, Annual Variations & their statistical data analysis):* The result of Monthly (8 hrly) data for two years study during Jan2016-Dec.2017 shows that Benzo(e)pyrene Conc. in Meerut area of NCR varies between  $36 \pm 11.4$  ng/ m<sup>3</sup> at Shastrinagar,  $42 \pm 16.5$  ng/ m<sup>3</sup> at Begumpul &  $44.7 \pm 10.8$  ng/ m<sup>3</sup> at Partapur Industrial area Meerut. The Combined two years of monthly & total average value of Benzo(e)pyrene Conc. (ng/ m<sup>3</sup>) During Jan. 2016-Dec.2017 (fig.7).

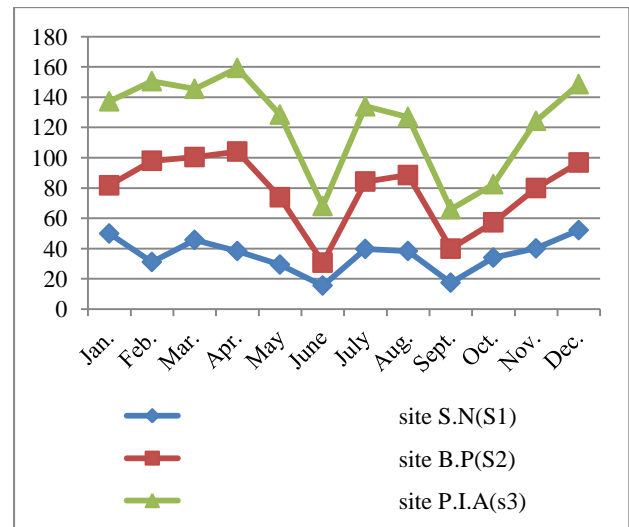
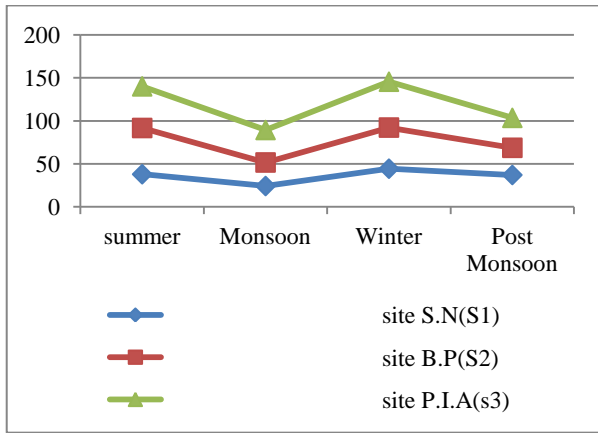


Fig.7 Combined 2 year of Benzo(e)pyrene Cons.(ng/ m<sup>3</sup>) during Jan.2016-Dec.2017.

Two year monthly Maximum & Minimum value were recorded at Shastrinagar i.e.  $52.15$  ng/ m<sup>3</sup> during December &  $15.55$  ng/m<sup>3</sup> during June in Meerut area of NCR. Two year combined annual average value in order of increasing Conc. at different sites were as Shastrinagar ( $36$  ng/ m<sup>3</sup>) < Begumpul ( $42.0$  ng/ m<sup>3</sup>) < Partapur Industrial Area ( $44.7$  ng/ m<sup>3</sup>) during Jan.2016-Dec.2017. The Combined two years of seasonal & total average value of Benzo(e)pyrene Conc. (ng/ m<sup>3</sup>) During Jan. 2016-Dec.2017( fig.8).

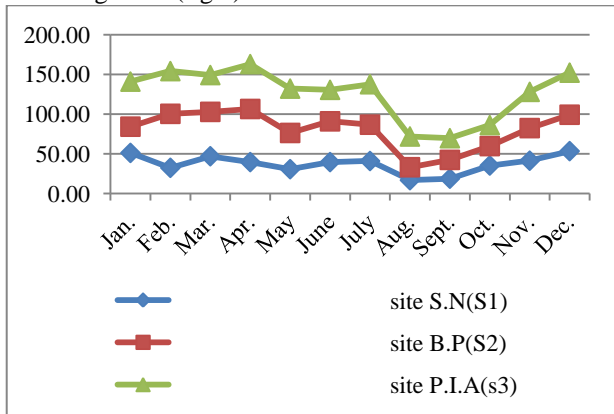


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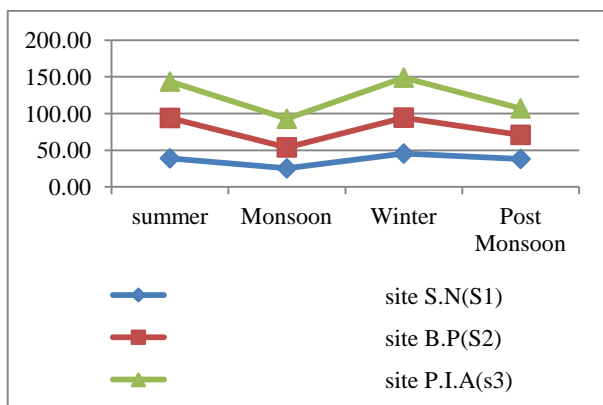
**Fig.8 Two year combined seasonal (8 hrly.) Conc. of Benzo(e)pyrene (ng/m<sup>3</sup>) During Jan.2016-Dec.2017.**

Two year combined seasonal & total average Benzo(e)pyrene level for Meerut (all sites combined) worked out to be 140.1, 89.4, 145.4, 103.5 & 119.6 ng/ m<sup>3</sup> for summer, monsoon, winter, post monsoon & total average respectively. Total Annual average values for Meerut (all sites combined) has increased from (37.08 ng/ m<sup>3</sup>) at Shastrinagar to (45.96 ng/m<sup>3</sup>) at Partapur Industrial area during 2017 (fig 9).



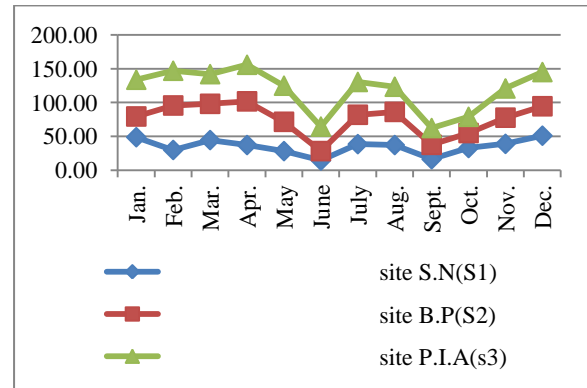
**Fig.9 Benzo(e)pyrene Conc. (ng/ m<sup>3</sup>) During Jan.2017- Dec.2017.**

The seasonal (8 hrly.) Conc. Of Benzo(e)pyrene (ng/ m<sup>3</sup>) during Jan.2017-Dec.2017 (fig 10).

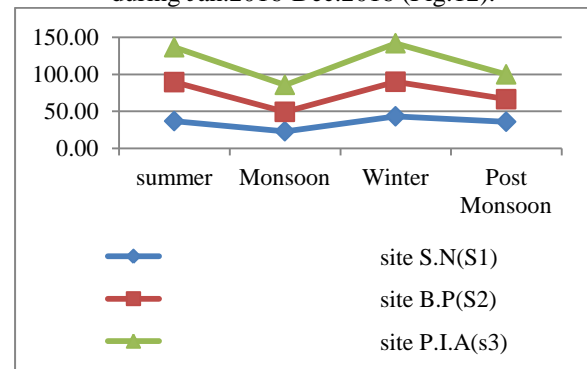


**Fig.10 Benzo(e)pyrene Conc. (ng/ m<sup>3</sup>) seasonal (8hrly.) During Jan.2017-Dec.2017.**

The seasonal & Total average Conc. (ng/ m<sup>3</sup>) of Benzo(e)pyrene During Jan.2016-Dec.2016 (fig.11). The highest & Lowest variation in 8 hrly concentration were observed at Shastrinagar (% CV = 32.62) & at Partapur Industrial Area (% CV = 24.90) respectively during 2016.



**Fig.11 seasonal ( 8hrly.) Conc. (ng/m<sup>3</sup>) of Benzo(e)pyrene during Jan.2016-Dec.2016.**  
The Seasonal (8 hrly.) Conc. Of Benzo(e)pyrene (ng/m<sup>3</sup>) during Jan.2016-Dec.2016 (Fig:12).



**Fig.12: Seasonal (8 hrly.) Conc. Of Benzo(e)pyrene (ng/ m<sup>3</sup>) during Jan.2016-Dec.2016.**

## IV. CONCLUSION

This paper describe the two years (Monthly & total seasonal (8 hrly.) average value of Concentration of Anthracene & Benzo(e)pyrene & their Monitoring in Ambient Air of Meerut Area of NCR. The conclusion of this study is that the concentration of Benzo(e)pyrene (119.6ng/ m<sup>3</sup>) found greater than Anthracene (39.2 ng/ m<sup>3</sup>) in all sites of Meerut area of NCR. The Result & Discussion of this paper showed that minimum levels were obtained for Anthracene than Benzo(e)pyrene were found. The overall level of Benzo(e)pyrene was approximately 3 times greater than the level of Anthracene. This paper also describe the brief description of Purification of Air by Yagyaroma. Yagyaroma means odoneferous substance used in yagya samigri during Yagya for purification of air, which plays a very great role in air purification. The future work is to find out the role of other substances involved in air purification. The Pollutants levels were highest during winter season & lowest during monsoon season at all sites as expected due to inversion & low wind conditions during winter (less mixing & dispersion of pollutants in the atmosphere), while due to washout during monsoon.

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