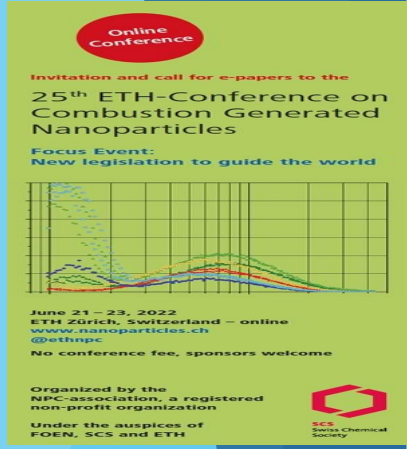

25th ETH-Conference on Combustion Generated Nanoparticles

[21-June-2022]

"Assessment of Sub-Micron Particulate Matter and associated Poly aromatic hydrocarbons in indoor and outdoor air of Lucknow city: Capital of the most populated state of India"

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AIR POLLUTION -Indian Scenario

- According to State of global air report released by Washington's Institute for Health Metrics and Evaluation, the Health Effects Institute India stands at the 3rd position in PM2.5 pollution exposure.
- More than 2.6 crore cases of acute respiratory infections reported every year in the country- Health and Family Welfare Ministry
- More than 90% of pollution-related deaths occur in low-income and middle-income countries.
- A record number of over 6000 cities in 117 countries are now monitoring air quality, but the people living in them are still breathing unhealthy levels of pollutants.
- 94% people live in areas where it exceeds India's own air quality standard.

'Air pollution cuts lives short by 5 yrs in India'

Country 2nd Most Polluted After B'desh: AQLI Analysis

Vishwa.Mohan
@timesgroup.com

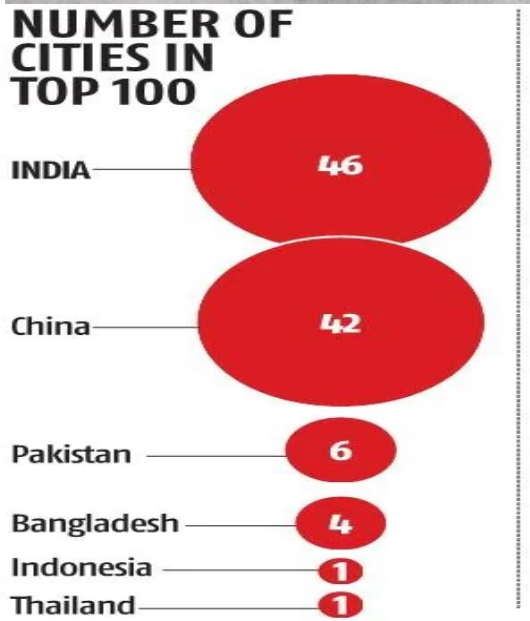
New Delhi: Air pollution shortens average life expectancy in India, the second most polluted country in the world after Bangladesh, by five years, relative to what it would be if the new stringent WHO guidelines were met, according to a new Air Quality Life Index (AQLI) analysis released on Tuesday. In fact, pollution would cut 7.6 years of life expectancy of 40% of Indians who live in the Indo-Gangetic plains.says the the report released by the Energy Policy Institute at the University of Chicago (EPIC).

While most of the world breathes unsafe air shaving off two years off global life expectancy, the report noted air pollution is the greatest threat to human health in India, reducing life expectancy by five years whereas child and maternal malnutrition reduces it by about 1.8 years and smoking reduces by an average 1.5 years.

►Continued on P 22

File photo/PTI

In the case of Delhi, the world's most polluted capital, people would lose 10 years of their lives in a business-as-usual scenario



Source: The 2020 World Air Quality Report

MOST POLLUTED CITIES 2020

The most polluted cities, according to the data aggregated from over 80K data points

1	Hotan (China)	110.2
2	Ghaziabad	(India)
3	Bulandshahr	(India)
4	Bisrakh Jalalpur	(India)
5	Bhiwadi	(India)
6	Noida	(India)
7	Greater Noida	(India)
8	Kanpur	(India)
9	Lucknow	(India)
10	Delhi	(India)

(PM 2.5 MICROGRAM/M³)

With inputs from *Al Jazeera*

SOURCES

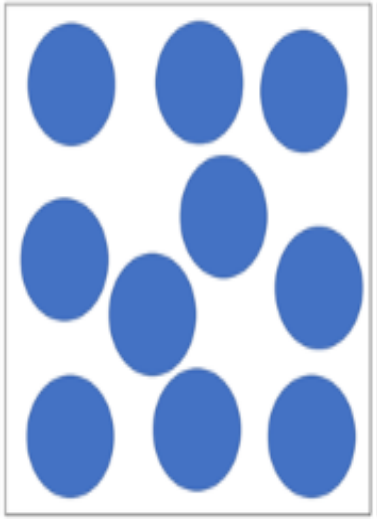
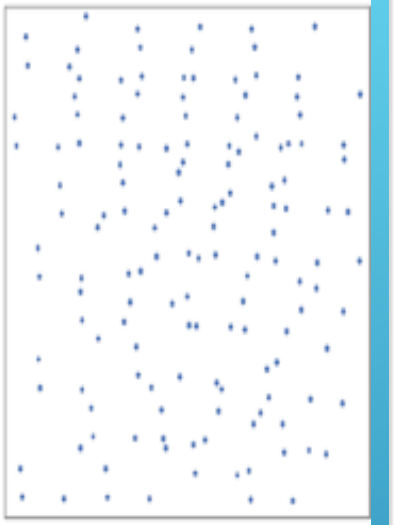
Lead based paints ,flooring, carpets ,smoking, upholstery etc.

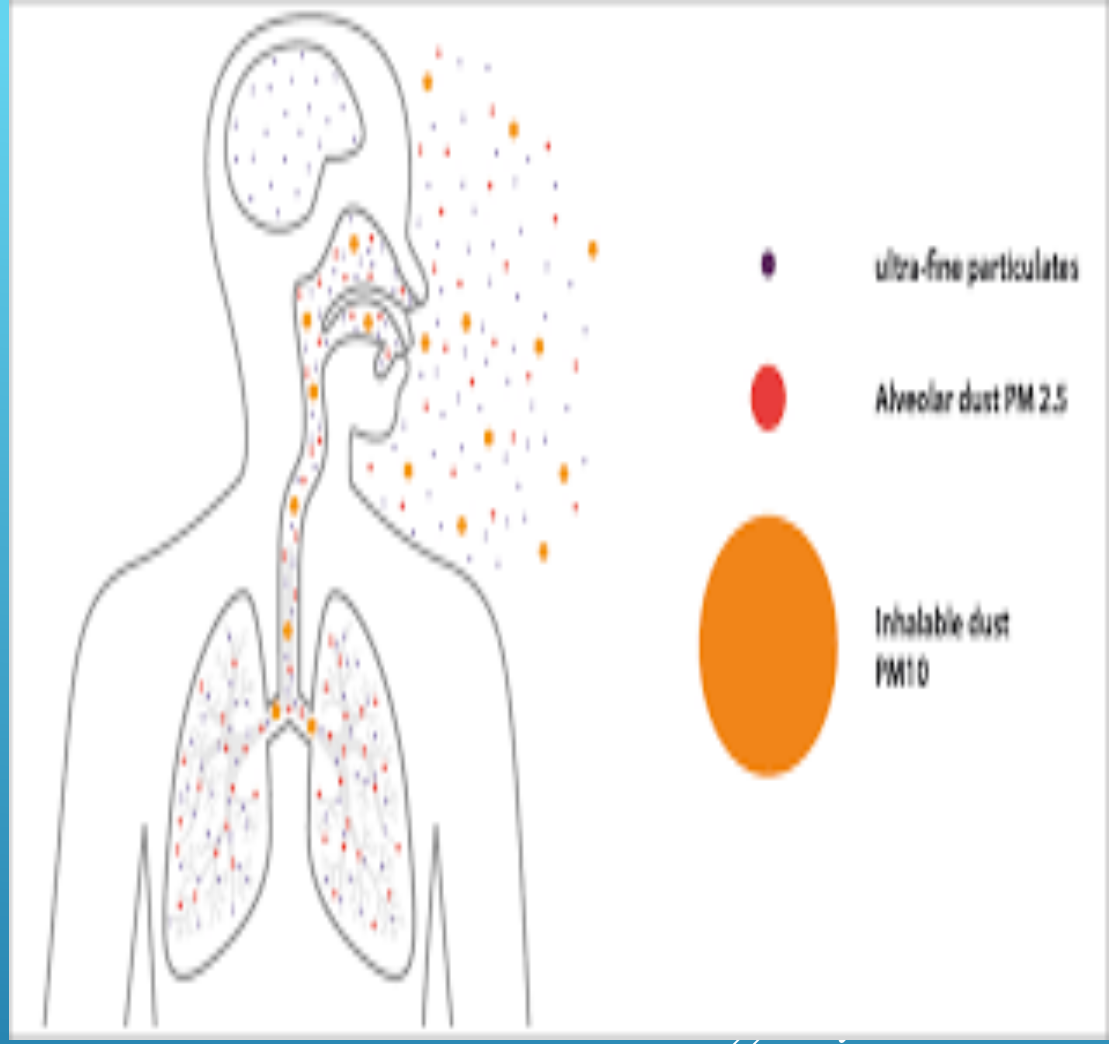
Gas cooktop, chimney, kerosine heaters , cooking , appliances such as toasters, pilot light etc.

Incense, burning of candles, outdoor air, furniture etc.

Chemical based soaps, shampoo, deodorants , other cosmetic and cleaning products.

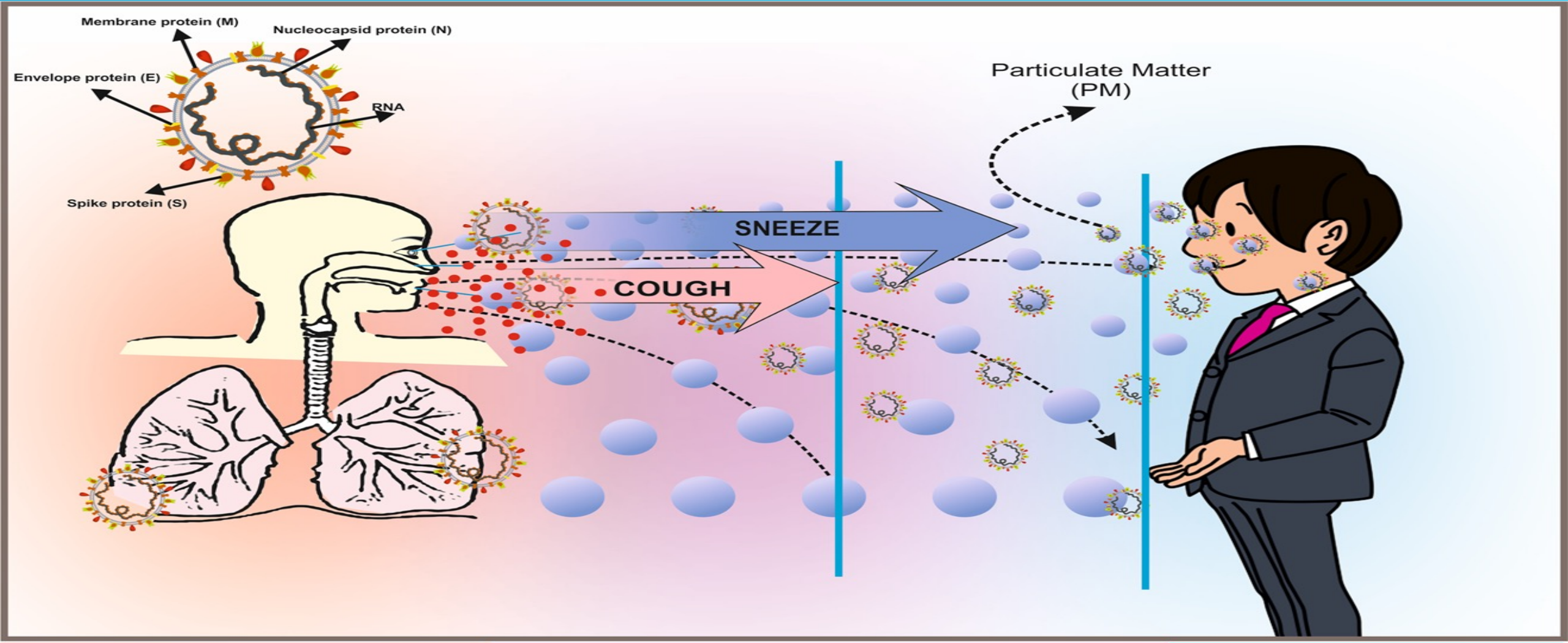
Wooden furnishing ,fragrance ,cosmetics ,toys etc

	10 µm (Coarse)	2.5 µm (Fine)	0.1 µm (Ultrafine)
			
Total mass	1	1	1
Particle number	1	64	1,000,000
Surface area per particle	1	0.0625	0.0001
Total surface area per mass	1	4	100
	• Filtered in proximal airway • May irritate skin, mucosa	• Reaches peripheral airway • Cannot enter systemic circulation	• Higher adsorbed toxic material on surface • May enter systemic circulation



Contribution to particle mass is small but > 90% of the particles in air are UFPs.

PROBABLE MECHANISM

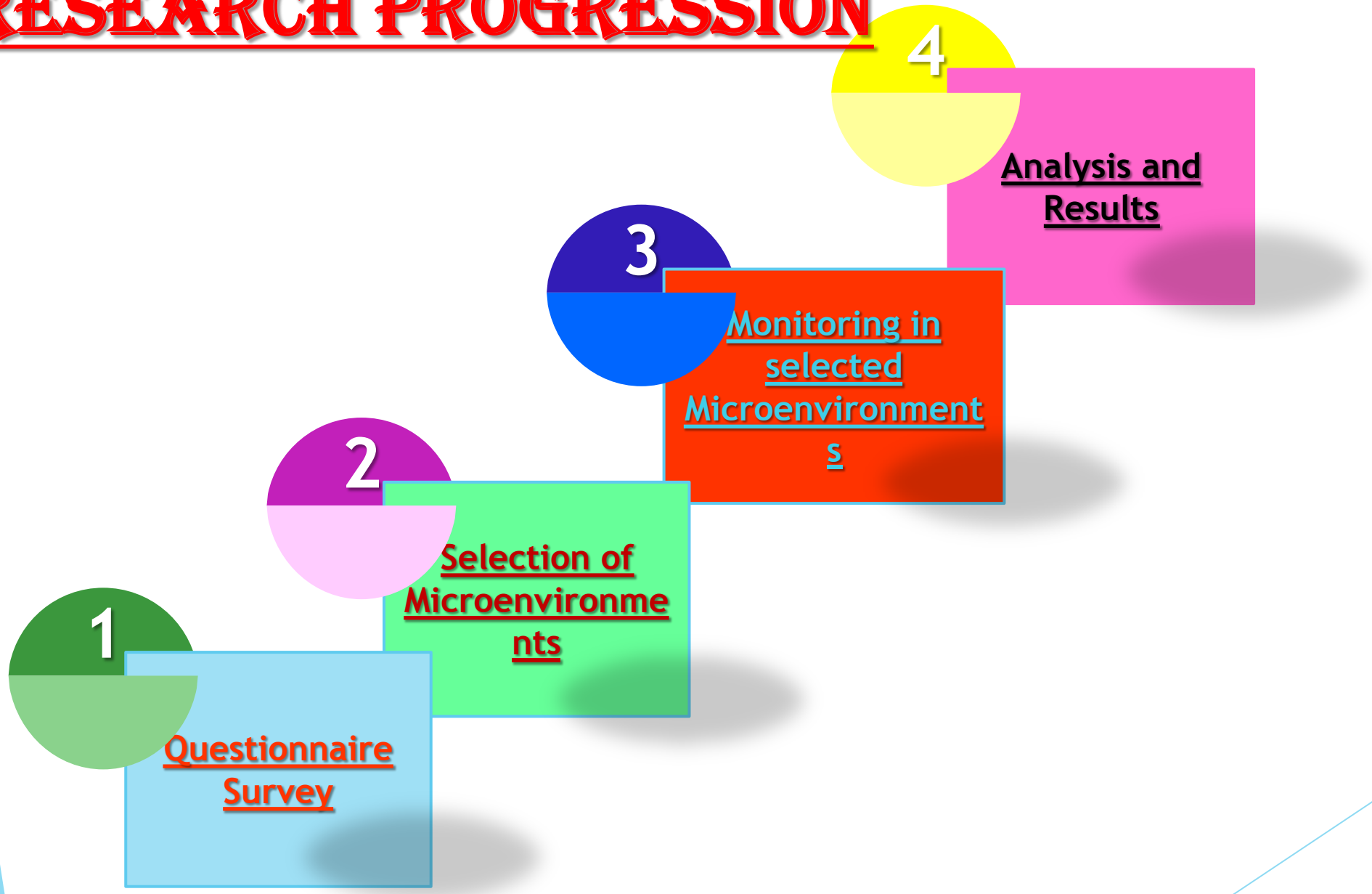


SOURCE | MEDIUM | RECEPTOR

OBECTIVES

- Questionnaire Survey
- Quantification of Fine Particles [PM2.5]
- Quantification of sub-micron Particles [$PM_{>2.5}$, $PM_{1.0-2.5}$, $PM_{0.50-1.0}$, $PM_{0.25-0.50}$ and $PM_{<0.25}$]
- Quantification of Polyaromatic Hydrocarbons PAHs associated with PM2.5

RESEARCH PROGRESSION



Indoor Air Quality and its Health Impact on Children: A Survey

All personal information will remain anonymous & no personal or identifying information from the survey will be shared on any platform.

The information collected from this survey will be only used by students/teachers for research purpose.

We would appreciate your views/comments about the Indoor air quality & its possible health outcomes on your child .We would be grateful if you can give your precious 5 minutes in filling & submitting this survey.

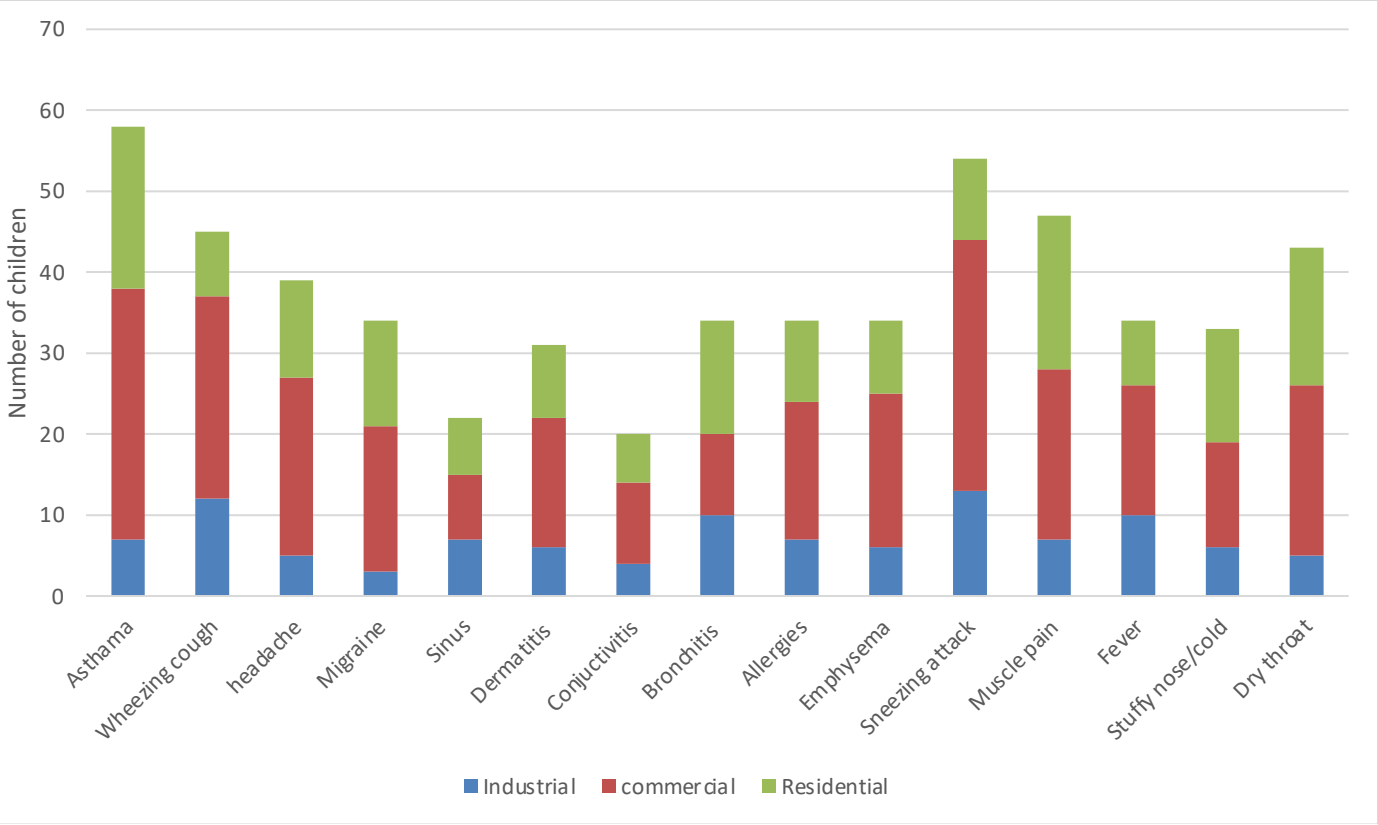
Note: The survey is conducted by Department of Chemistry, Isabella Thoburn College, Lucknow.

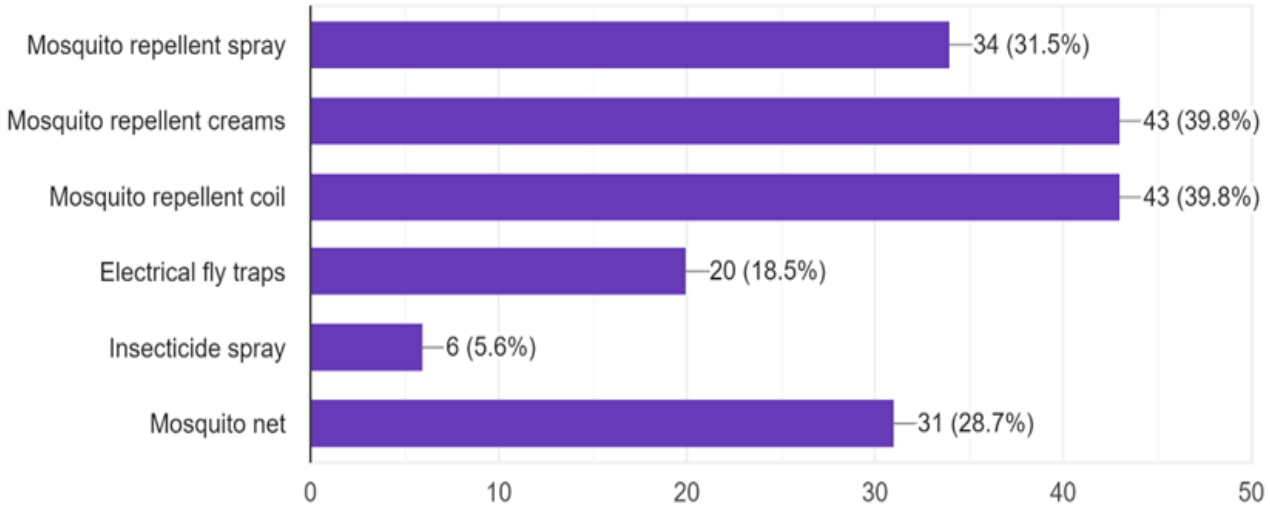
Child's Name *

Short-answer text

Child's Age *

Short-answer text





Study Location

SUB-MICRON MONITORING

Leland Legacy sample pump (SKC Cat. No. 100-3002; Inc. Eighty-Four PA USA) with five-stage Sioutas Cascade Impactor was used to collect PM in the size range of $PM_{>2.5}$, $PM_{1.0 - 2.5}$, $PM_{0.50 - 1.0}$, $PM_{0.25 - 0.50}$, $PM_{<0.25}$ on 25 mm PTFE filter paper and 37 mm (for $PM_{<0.25}$) with pore size 0.5 µm.

The instrument was set at air flow rate of 9 l $min^{-1}$for 24 h.

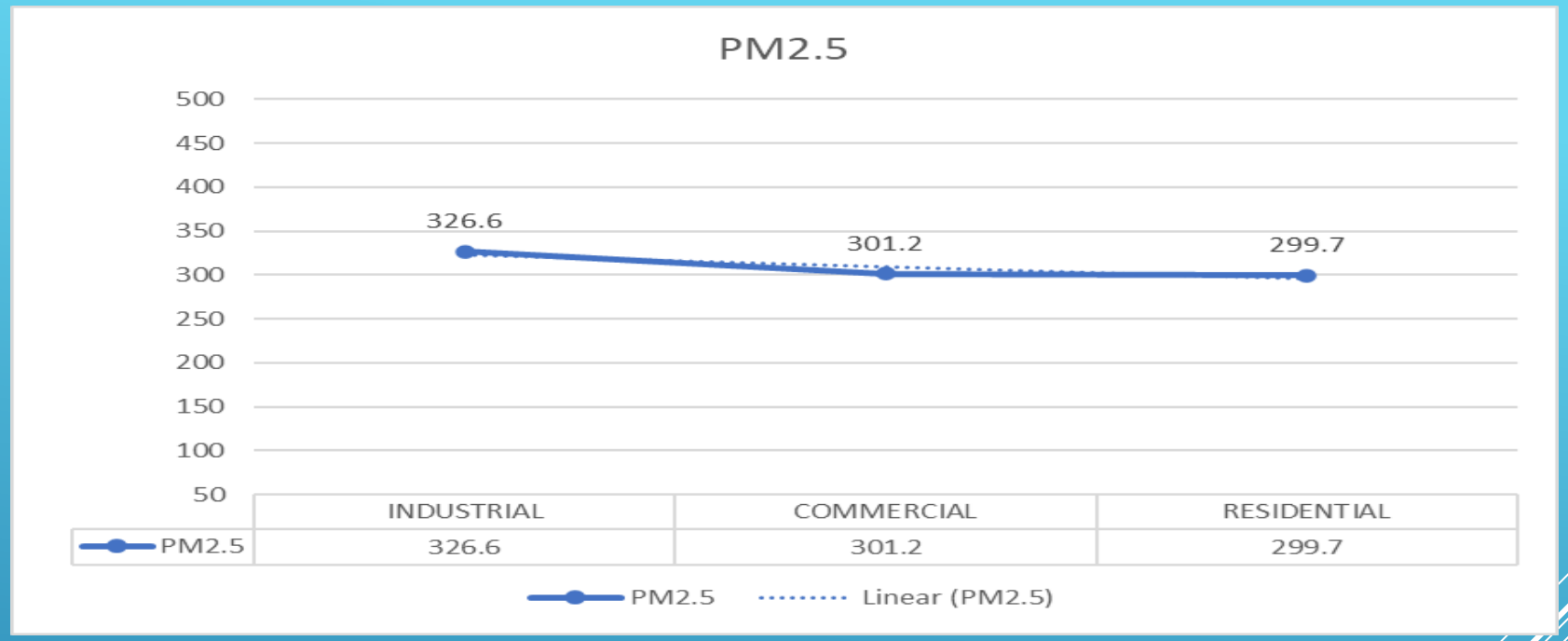
$PM_{2.5}$ SAMPLING INSTRUMENT

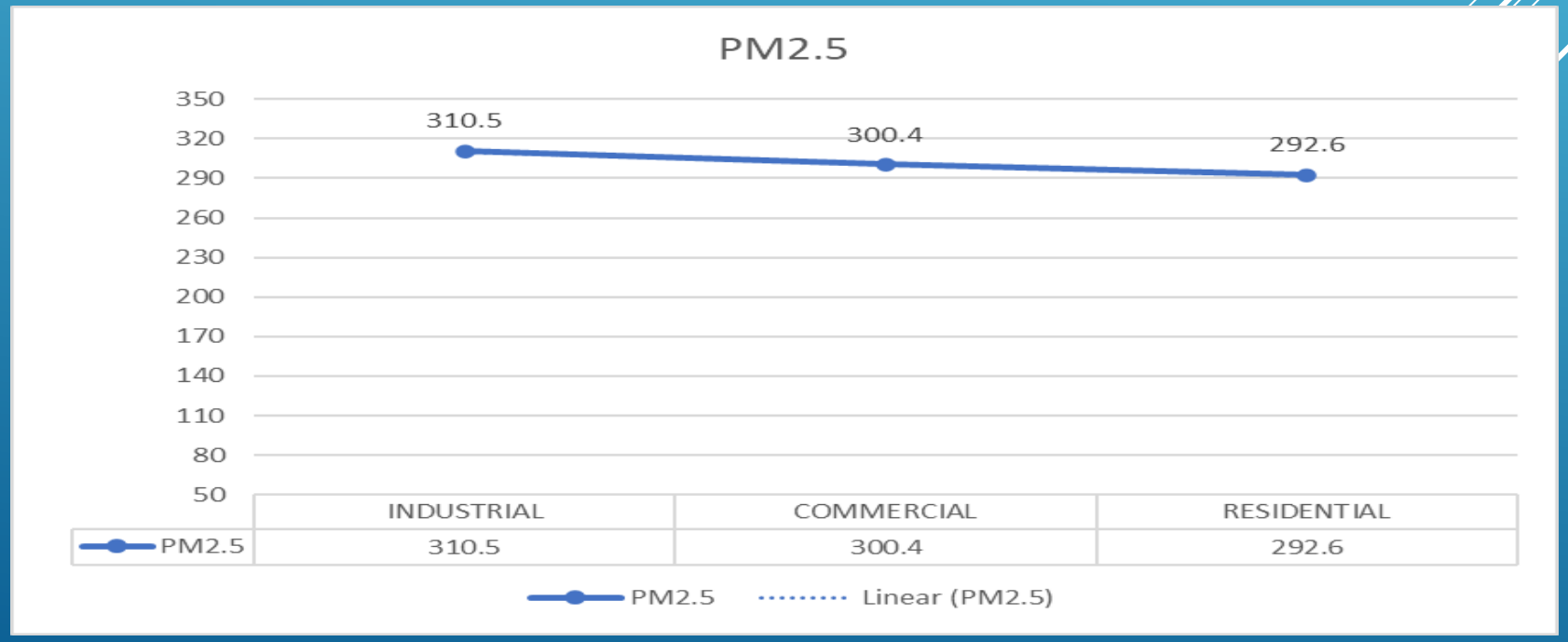
ENVIORNTECH APM 550 set at a flow rate of 17.57lpm for 24 hours.

[47mm PTFE Filter paper]

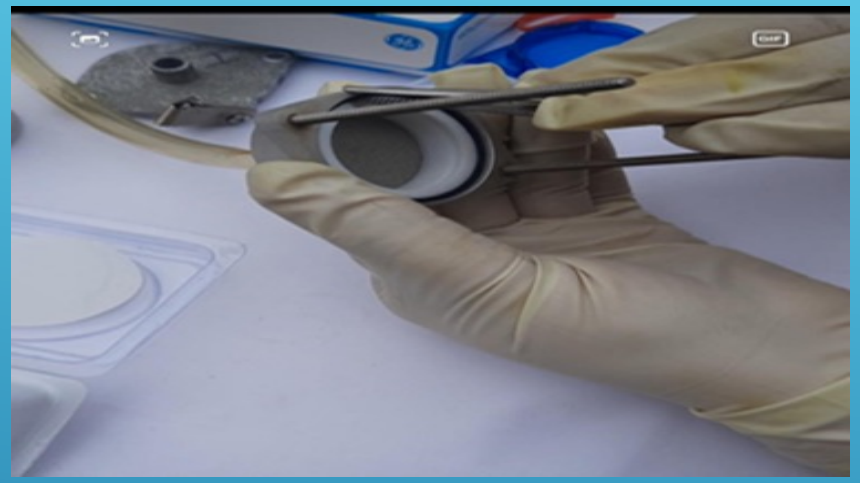
Average outdoor concentration of $PM_{2.5}$.

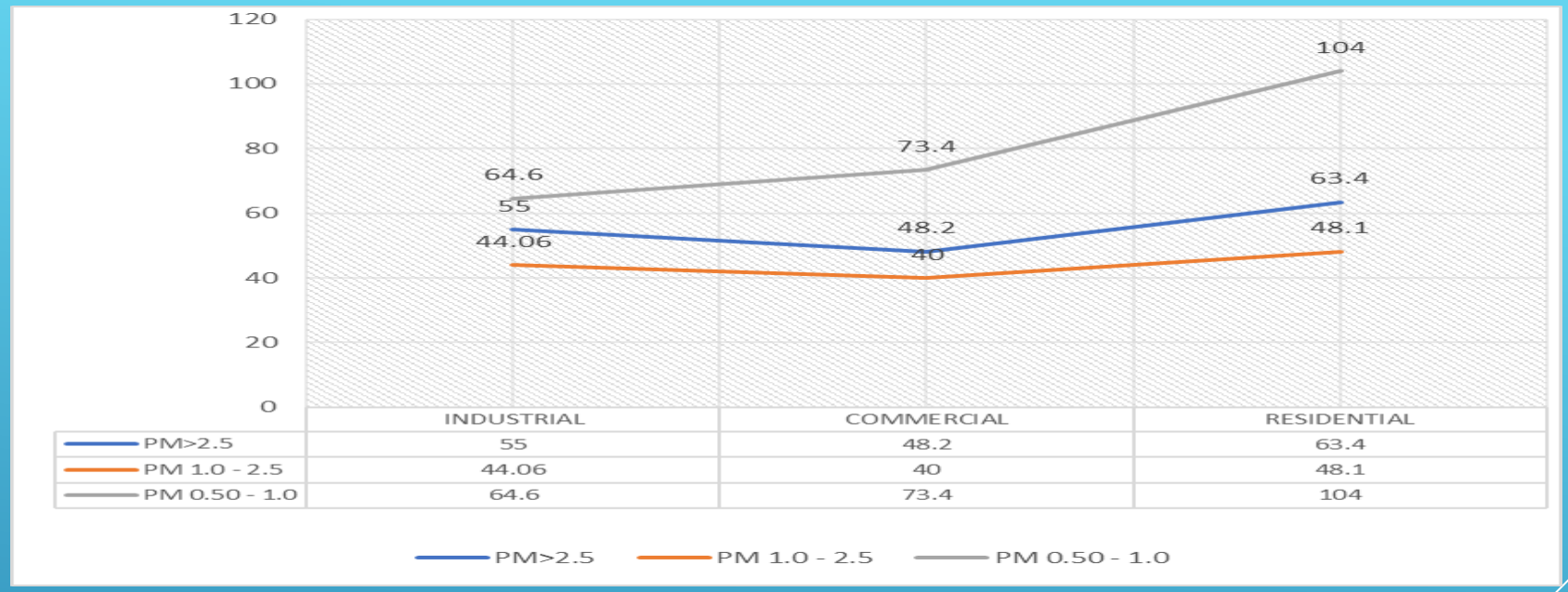
Average indoor concentration of $PM_{2.5}$.



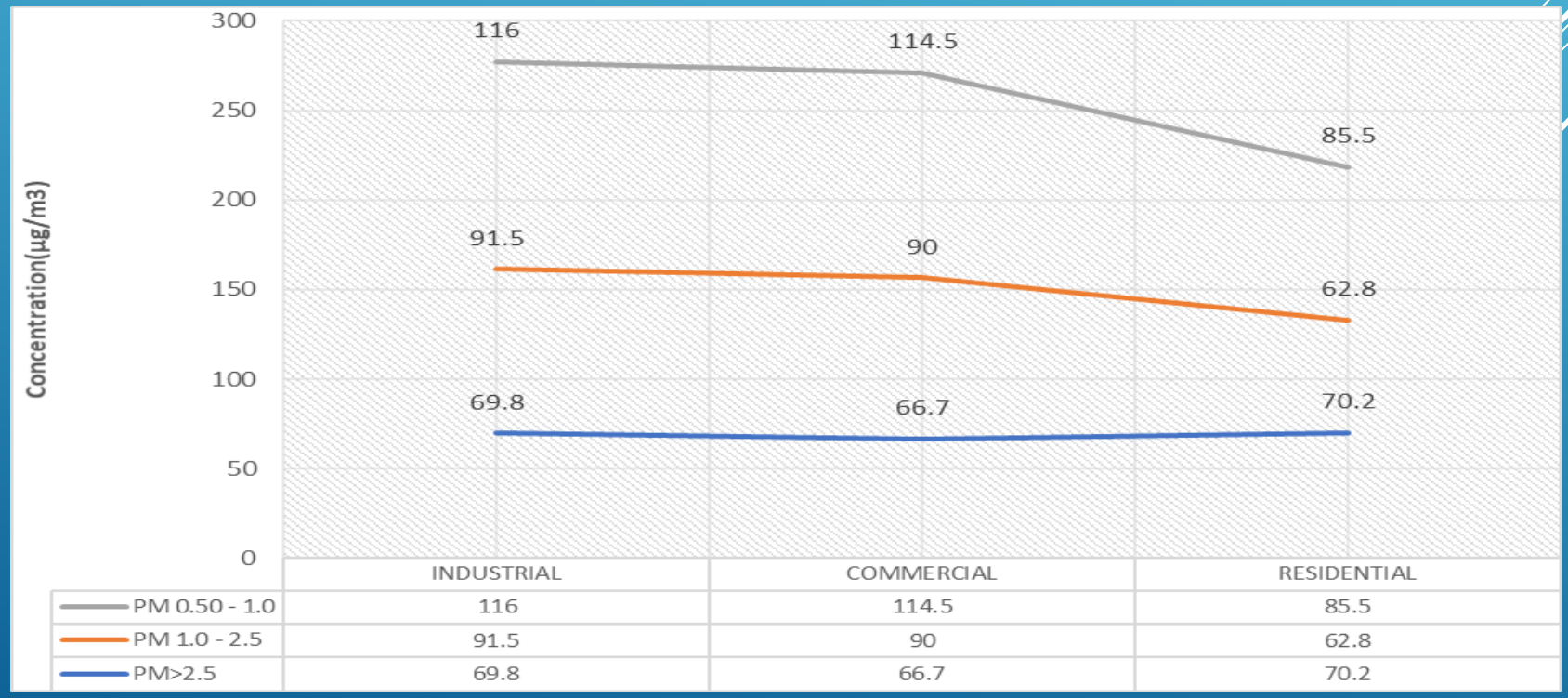


Average concentration of sub-micron in outdoors

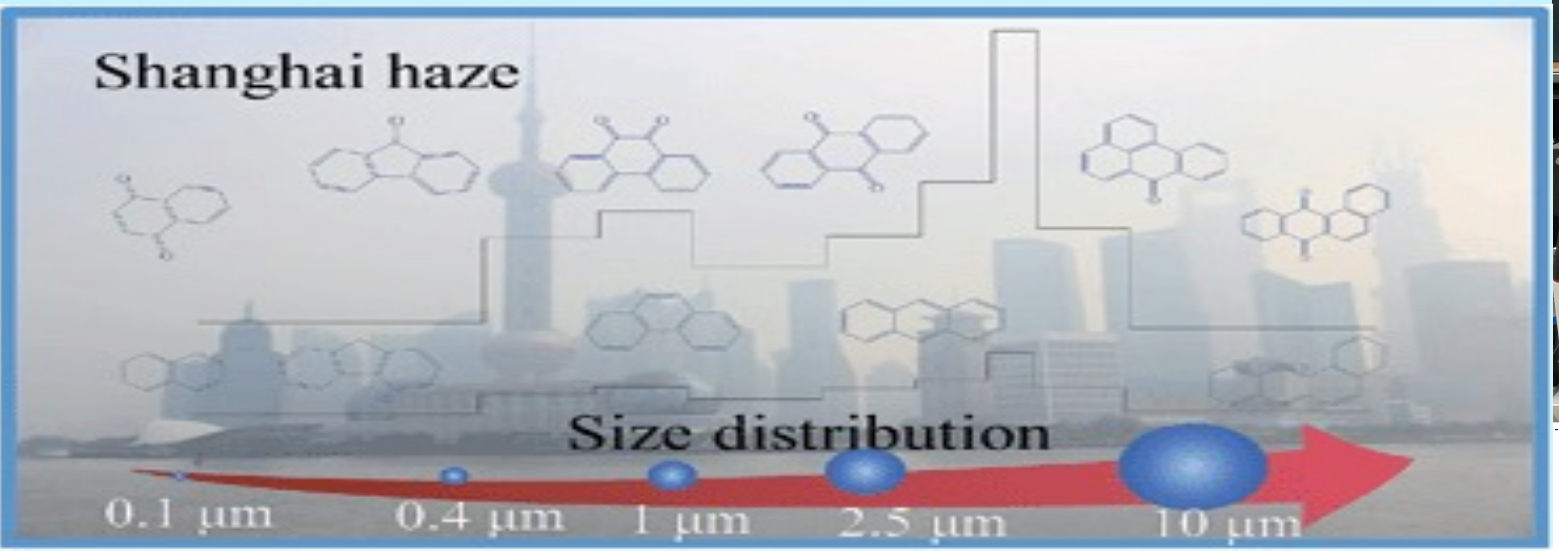


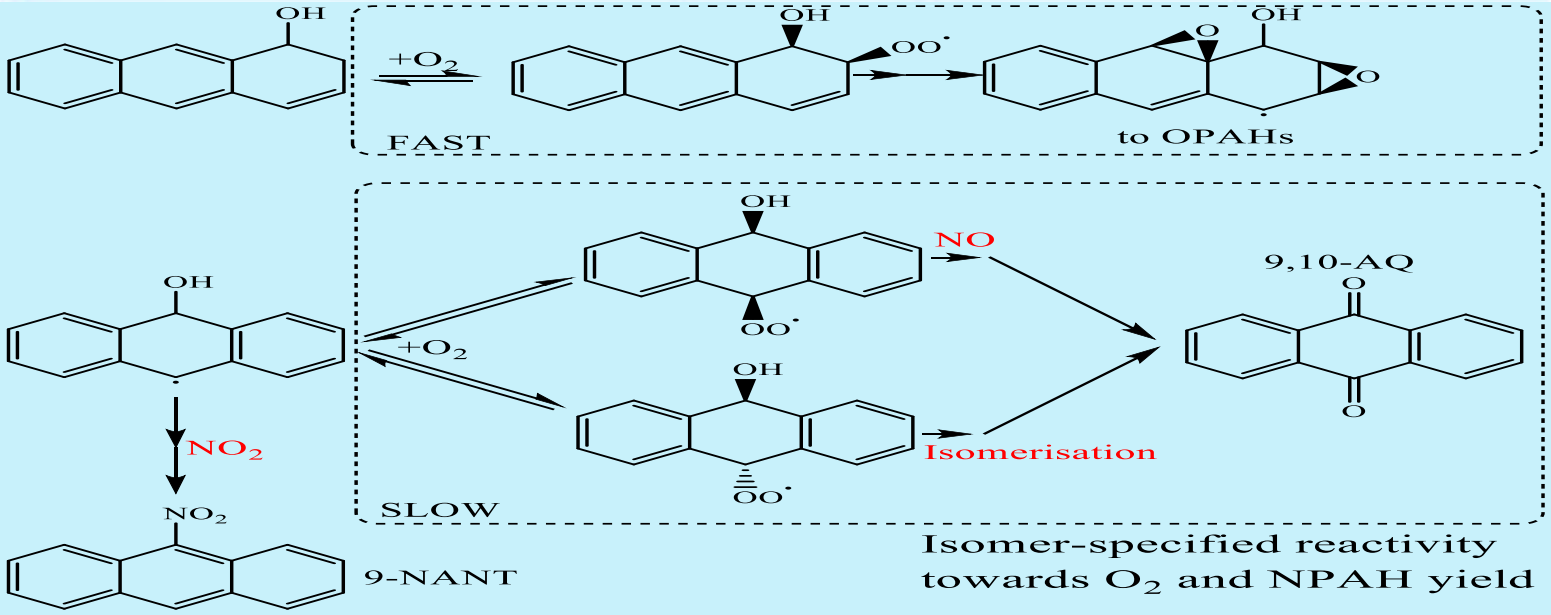


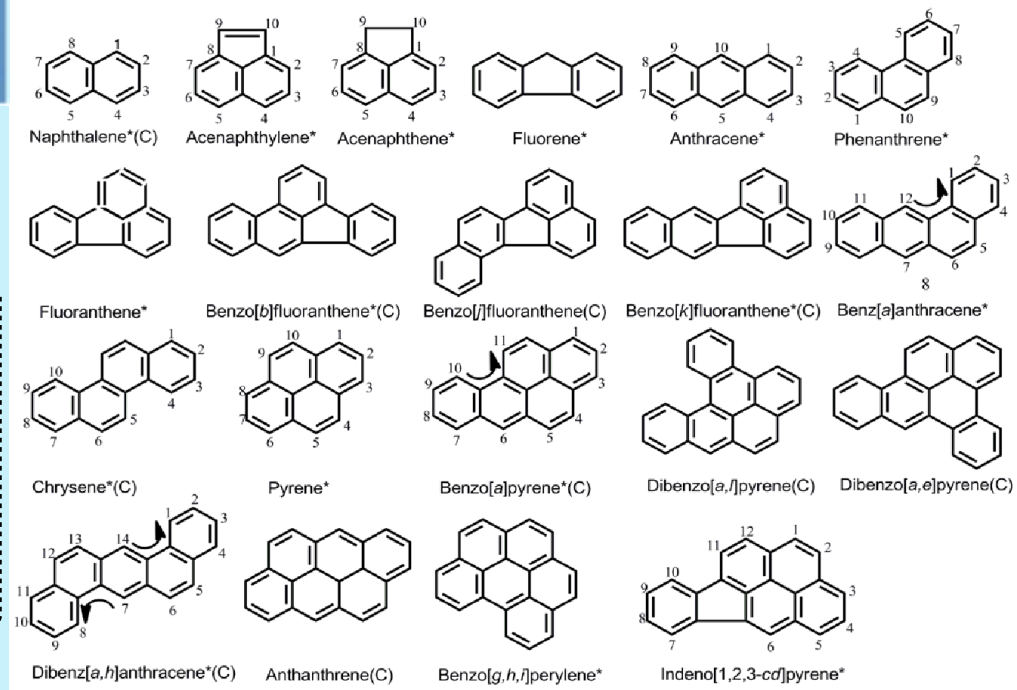
Average concentration of sub-micron in indoors



PAH(S)

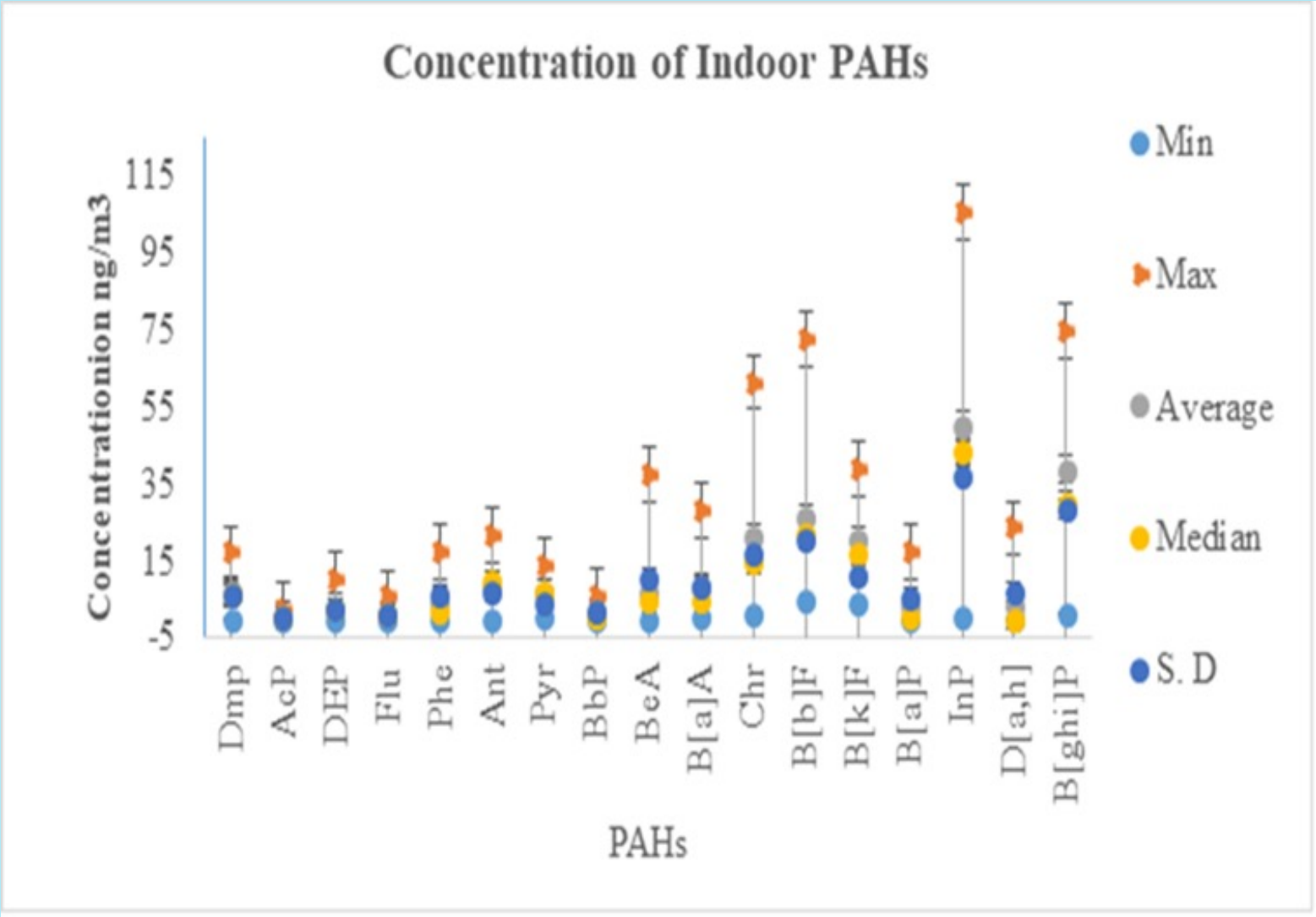




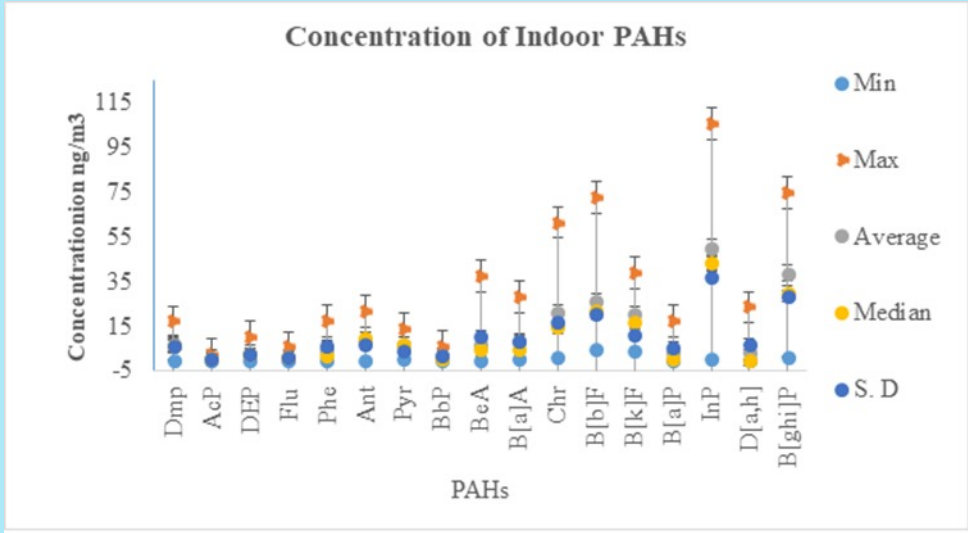


An asterisk denotes a United States Environmental Protection Agency priority pollutant. (C) indicates that the compound is carcinogenic by

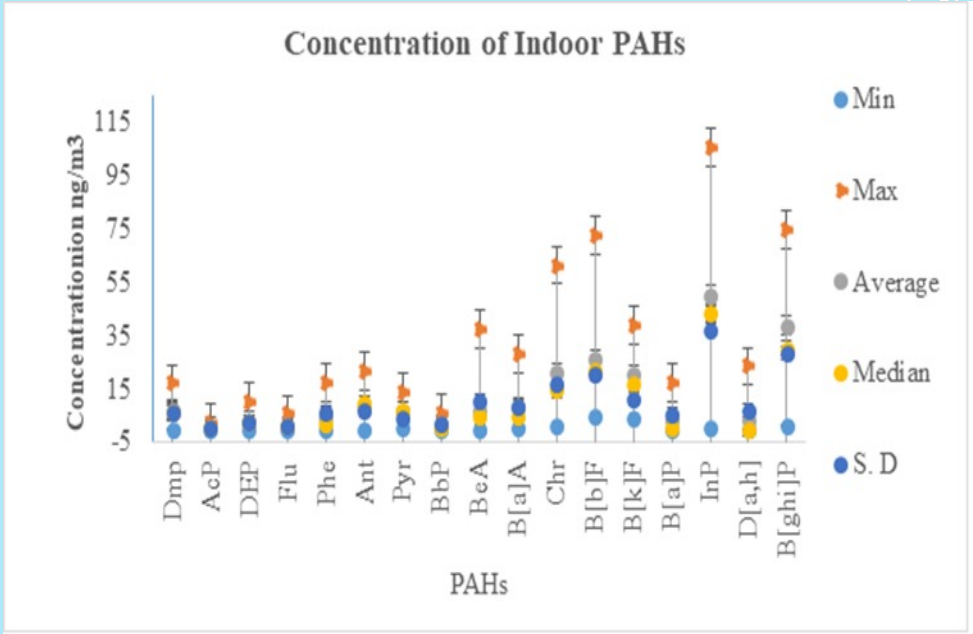
Average of the data obtained



Industrial Microenvironment



Residential Microenvironment



Commercial Microenvironment

PAHS RESULTS-

	RANGE	MEAN	MEDIAN	S.D	% OF PAHS
DmP	17.1-0.09	7.16	6.3	6.31	3.37
AcP	2.4-0.09	0.87	0.41	0.87	0.41
DEP	10.1-0.08	2.98	2.45	2.94	1.4
Flu	5.6-0.08	1.32	0.9	1.54	0.62
Phe	17.3-0	4.24	1.65	6.49	1.99
Ant	21.6-0	8.7	9.6	7.09	4.09
Pyr	13.7-0.7	6.99	7.25	4.33	3.29
BbP	6-0.1	1.6	0.8	1.84	0.76
BeA	37.4-0	7.05	4.5	10.5	3.32
B(a)A	28.4-0.25	8.17	4.55	8.49	3.84
Chr	61.5-1.4	21.03	14.9	17.16	9.9
B(b)F	72.5-4.9	26.15	22.05	20.41	12.31
B(k)F	39.2-3.78	20.37	17.2	11.15	9.59
B(a)P	17.4-0	3.25	0.7	5.52	1.53
InP	105.7-0.3	50.3	43.45	37.45	23.69
D(a,h)A	23.5-0	3.33	0.05	6.87	1.56
B(ghi)P	74.6-0.9	38.74	30.15	28.3	18.24
7PAHcarcinogen	105.7-0	18.94	11.85	23.55	62.45
PAH LMW	21.6-0	4.5	1.4	5.88	10.59
PAH HMW	105.7-0	15.83	6.55	22.09	89.4

Pearson's correlation coefficient among PAHs in air particles (PM2.5)

PAH(abbreviated)	AcP	DEP	Flu	Phe	Ant	Pyr	BbP	BeA	B(a)A	Chr	B(b)F	B(k)F	B(a)P	InP	D(a,h)A	B(ghi)P
DmP	0.36	-0.09	0.11	-0.22	0.19	-0.62	-0.26	-0.32	-0.18	-0.3	-0.45	-0.17	-0.06	0.07	-0.15	-0.72
AcP		0.09	0.42	0.55	-0.14	0.15	-0.29	0.3	-0.06	-0.05	0.27	0.03	0.22	0.67	0.15	0.1
DEP			0.87	0.53	-0.12	0.24	0.59	0.79	-0.14	-0.1	0.65	-0.18	0.55	0.04	0.86	0.43
Flu				0.61	-0.1	0.24	0.49	0.79	-0.08	-0.05	0.7	-0.28	0.64	0.18	0.89	0.36
Phe					-0.63	0.39	-0.02	0.71	-0.34	-0.24	0.67	0.01	0.59	0.17	0.47	0.45
Ant						-0.1	0.3	-0.42	0.43	0.38	-0.29	0.11	-0.58	0.4	-0.12	-0.17
Pyr							0.34	0.42	0.65	0.74	0.81	0.12	0.02	0.33	0.34	0.92
BbP								0.42	0.24	0.29	0.44	0.2	0.13	0.08	0.58	0.44
BeA									-0.13	-0.06	0.81	-0.19	0.71	0.05	0.88	0.62
B(a)A										0.98	0.32	-0.11	-0.34	0.22	0.05	0.46
Chr											0.41	-0.04	-0.33	0.27	0.08	0.57
B(b)F												-0.2	0.49	0.15	0.78	0.84
B(k)F													-0.43	0.46	-0.43	0.08
B(a)P														-0.24	0.68	0.17
InP															-0.02	0.26
D(a,h)A																0.5

Conclusion

1. The study is first of it's kind in this part of the country.
2. Sub-micron particles and PAHs has been assessed first time in indoor as well as outdoor environment of the city and found to be very high which is alarming as ultrafine particles goes deeper to veins and even blood.
3. The survey results give a better insights of the possible diseases/symptoms which may be caused by indoor pollutants.
4. The results so far obtained reveals that outdoor concentrations are higher than indoors at industrial and commercial microenvironments but indoor sources are dominating at residential areas.
5. The study is ongoing. We are still evaluating data for summer and rainy season for seasonal variation comparison which may help the decision makers .
6. The results have provoked to not only monitor theses toxic and carcinogenic pollutants but also work on economic abatement techniques using industrial solid waste.

OUR TEAM

Dr. Alfred Lawrence, Samridhi Dwivedi, Anam Taushiba, Farheen Zehra,Neha Shukla.

THANK YOU