

STUDY OF INTOLERABLE AIR POLLENS AND HYPERSENSITIVITY FROM SELECTED AREAS IN DELHI NCR

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Abstract:

People routinely exposed to the heavy traffic suffer from respiratory diseases like asthma, acute bronchitis due to presence of bacteria, fungi, and organic dusts in the air. Life at these areas studied became a health hazard. A survey of aerospora conducted in five selected areas of Delhi NCR showed that bacteria and fungi were present in the order of 3×10^3 and 2×10^3 respectively. 21 fungal species and 7 bacterial species were present in the present study. Many filamentous fungi known to be aeroallergens were present, *Aspergillus* being the predominant species. Pathogenic bacteria like *Pseudomonas*, *Staphylococcus* were present in many areas of study. The threshold limit value (TLV) and Biological exposure indices values should be liaised for every area in the city which will serve as guide to control health hazards.

Keywords: Microflora, Delhi NCR, *Fusarium* and *Helminthosporium*.

Introduction:

Increase of population and developmental programmes in the world have resulted in extensive urbanization regardless of environment considerations, leading to air pollution and climate

changes. These consequences are purely anthropogenic causing unpleasant effects on biotic communities, the effects often extending to large air pockets even at a distance.

Pollutants include particulate and gaseous matter. Particulate matter of biological origin can be a major cause of respiratory ailments to humans, causing allergies and pathogenic infections of the respiratory tract. In this investigation we term these pollutants as bioallergens. Allergic sensitization of the intrathoracic airways (asthma) or lung parenchyma (hypersensitive pneumonic) may be a major health problem and this is of concern in the long term for exposure to inhaled bioallergens.

Extrinsic allergic alveolitis is a serious hypersensitive response usually associated with repeated exposure to spores of thermophilic actinomycetes. Aspergillosis and Histoplasmosis are serious fungal infections of humans, initiated by spores deposited in the alveoli, they can be life threatening diseases in immune compromised people, when the fungi disseminate from the lungs to major organs of the body.

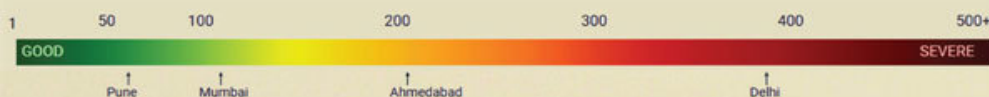
Air sampling is used routinely in developed countries to monitor the population of air particulates, and to inform the public through broadcasting. It is used by the major hospitals to monitor the population of specific allergenic particles like fungal spores so that the causes of patient's allergies can be determined.

The recognition of existing and potential dust or allergen hazards is the first step towards improving health and safety of people exposed. Health hazard evaluation requires the collection of quantitative and qualitative data on the bioallergens present in the environment. Delhi NCR is fast developing urban area which has seen steady growth of industries resulting in pollutants of all kinds. Heavy traffic and air pollution has increased several folds adversely affecting the health of people living in and around Delhi. A study has therefore been undertaken to 1) Quantify the microbial population in the air in some selected areas of the city and 2) identify the potent bioallergens which cause various types of allergies.

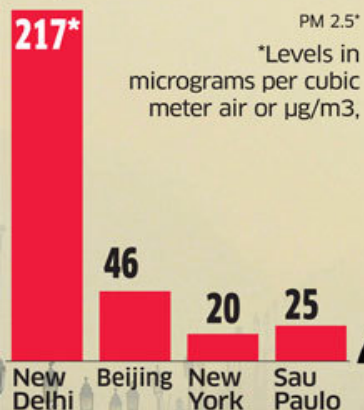
POLLUTION WATCH

Delhi's pollution level is at 'very poor' level due to two main causes: Wind has slowed down, reducing ventilation in the sky; and crop harvesting has peaked in Punjab because of which farmers are burning off residue to prepare the field for next crop

Delhi more polluted than other cities in India



Delhi also fares poorly when compared to major cities in the world



PM 2.5
forecast
for New
Delhi
today:
234



Delhi has a very high amount of fine particulate matter called PM 2.5, but it is slightly better off in terms of other pollutants

Lodhi Road
Mon, Oct 29, 2018 17:01:33 pm

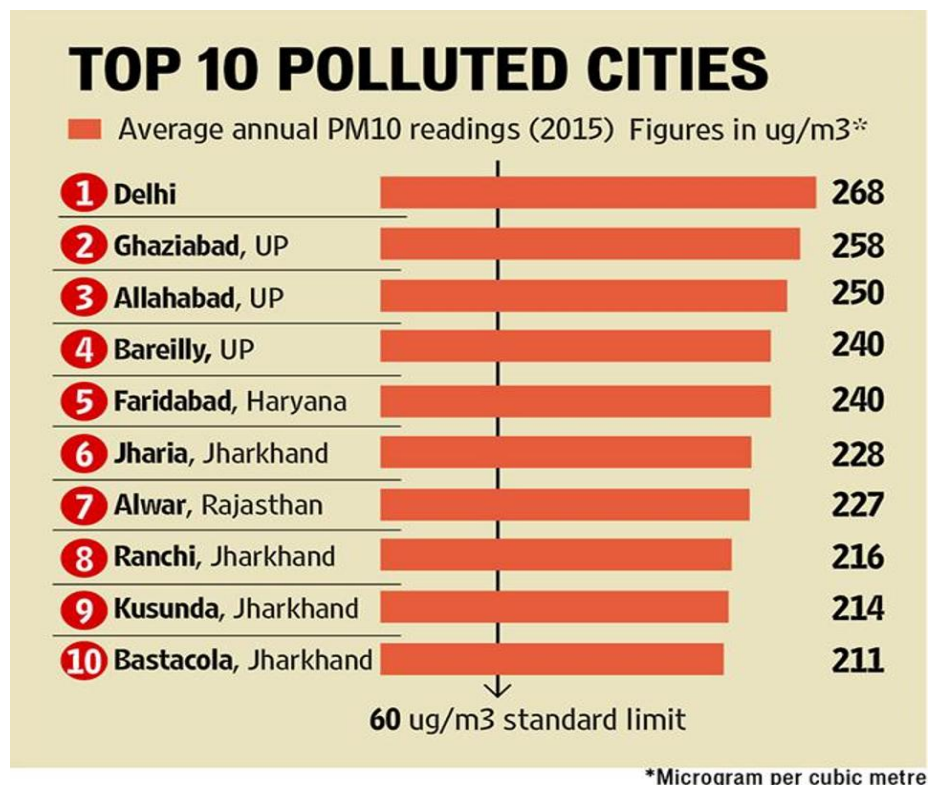
Pollutant	AQI	Category
PM10	262	Poor
PM2.5	361	Very Poor
NO2	74	Satisfactory
CO	137	Moderate
O3	75	Satisfactory

Air quality in the capital region will deteriorate sharply in the next two days because of a significant rise in emissions from field fires from Punjab, low surface wind and atmospheric conditions that trap pollutants, the official pollution monitoring agency of the government has warned.

Farmers in Punjab have stepped up burning of crop residue after the harvest to prepare their fields for the next round of planting. This has a direct bearing on the air quality particularly when surface.

According to the 2011 census of India, the population of NCT of Delhi is 16,753,235. The corresponding population density was 11,297 persons per km² with a sex ratio of 866 women per 1000 men, and a literacy rate of 86.34%. In 2004, the birth rate, death rate and infant mortality rate per 1000 population were 20.03, 5.59 and 13.08, respectively. In 2001, the population of

Delhi increased by 285,000 as a result of migration and by 215,000 as a result of natural population growth, which made Delhi one of the fastest growing cities in the world. Dwarka Sub City, Asia's largest planned residential area, is located within the National Capital Territory of Delhi. Urban expansion has resulted in Delhi's urban area now being considered as extending beyond the NCT boundaries to incorporate the towns and cities of neighbouring states including Gurgaon and Faridabad of Haryana, and Ghaziabad and Noida of Uttar Pradesh, the total population of which is estimated by the United Nations at over 26 million. According to the UN this makes Delhi urban area the world's second-largest, after Tokyo, although Demographia declares the Jakarta urban area to be the second-largest. The 2011 census provided two figures for urban area population: 16,314,838 within the NCT boundary and 21,753,486 for the *Extended Urban Area*. The 2021 regional plan released by the Government of India renamed the *Extended Urban Area* from *Delhi Metropolitan Area (DMA)* as defined by the 2001 plan to *Central National Capital Region (CNCR)*



Experimental

Sample sites

Five randomly selected areas in Delhi NCR representing different environmental conditions were chosen in the present study.

1. ITDC Bus station.
2. Cannaught Place
3. Rajiv Chowk
4. Old Delhi Railway Station
5. Gurgaon-Delhi NH

Isolation and identification of Microflora:

For isolating fungi present in the air, Petri dishes containing Rose Bengal Agar with chloramphenicol were exposed for a period of 30 minutes. The exposed plates were incubated for 5 days in an incubator at 26°C. The fungi developed after seven days were observed under a compound microscope after staining with cotton blue. The cultural and morphological characteristics of fungi were identified by the use of pictorial atlas of soil and seed fungi.

For isolating bacteria nutrient agar plates were exposed to air for 30 minutes and incubated at 37°C. Bacterial isolates were identified based on the morphological characters like colony colour, texture, followed by biochemical tests performed according to standard protocols (Table 1).

Results and Discussion:

Occurrence of Microflora

Various test sites showed the presence of bacterial and fungal contaminants as given in the table 2 and 3. A total of 21 fungal and 7 bacterial species were isolated from the sampling stations.

The air borne particulate matter collected from all the 5 areas in the present study viz. 1. ITDC Bus station. 2. Cannaught Place 3. Rajiv Chowk 4. Old Delhi Railway Station 5. Gurgaon-Delhi NH showed abundant bacterial and fungal propagates. Bacterial population was more in the air in all the samples compared to the fungal population. While the bacterial population ranged from 2×10^3 to 3×10^3 cfu, fungal population ranged from 3×10^2 to 1×10^3 cfu (Table 4).

Respiratory diseases were noticed in the workers of factories exposed to *pseudomonas* and *Bacillus subtilis*. In the present study these two genera are present in all the sampling sites posing a potential risk of respiratory allergies (table3). Filamentous fungi represent a major hazard for people exposed to organic dusts. The β -D glucans, the basic polyglucose constituents of fungal cell wall occurring in the air in the concentration of 10^{-2} to 10^2 ng/m³ can cause chronic lung inflammation and evoke disease. In the present study many fungal species were observed in the air which exerts adverse effects on the respiratory tract of exposed people. Among them the most important are *Aspergillus flavus*, *Mucor recemosus* dominant in ITDC area. As this species is known to be potential aeroallergen it could well be a health hazard of all people travelling regularly from this bus station (Table 2), *Bacillus subtilis*, in the Cannaught Place and *Escherichia coli* in the Rajiv Chowk area. (Table 3) also causes severe health hazard to the people residing around.

According to Lacey and Dutkiewicz *Rhizopus* is known to cause organic dust toxic syndrome (ODTS). In the present study spores of *Rhizopus* are abundantly found market and old Delhi Railway station areas. (Table 3).

Bacillus subtilis and *Proteus* was predominant microflora in the Delhi Gurugram NH. The presence of pathogenic bacteria like *Staphylococcus*, *Streptococcus* and *Pseudomonas* is dangerous and preventive hygiene and safety measures for eradication of these bacterial strains should be the first priority.

The bacterial population was highest in the air samples collected from ISBT area. This can be explained by the presence in the vicinity of sampling area a slum improper sanitary conditions and garages for the mechanical workshops. Further the presence of waste oil and dusty roads are conducive for bacterial growth. *E.Coli* was predominant in this area. (Table 3). The presence of *E.Coli* warrants the need to take safety measures. In this context hygiene living conditions like cleaning of drains and spraying of antibacterial chemicals have to be implemented.

The fungal population in this area comprises plant pathogens like *Fusarium* and *Helminthosporium*.

Rajiv chowk and Cannuaght place are the two important areas of Delhi NCR with a dense vehicular traffic releasing noxious gases like CO, CO₂, SO₂ and NO₂ into the air. Such vehicular traffic conditions, the bacterial and fungal spores seem to range around 10² to 10³ cpu/m³ as compared to 10⁶-10⁹ cpu/m³ in the farming atmosphere. This range is not an alarming figure and hence not a serious health hazard. However, the present project covered only duration of 3 months (December to March). Studies throughout the year covering different seasons may indicate significant differences in the levels of aerospora in different areas of Delhi NCR. Results of this investigation were compared with the allowed standards of developed countries.

Establishing of occupational exposure limit:

The **American conference of government industrial hygienists (ACGIH)** publishes a book containing **TLV (Threshold limit value) and BEI (Biological exposure indices)**. These values listed are used by hygienists as guidelines to assists in the control of work place hazards.

The knowledge about health risks due to mold exposure is not widespread and health authorities in developing countries may not be aware of the potentially serious reactions that the exposure can evoke.

To the best of our knowledge so far the **occupational exposure limit (OEL)** or threshold limit values (TLV) for aerospora have not been elaborated and introduced as legislations anywhere in our country. The necessity of such values is unquestionable.

Conclusions:

1. The recognition of potential bioallergen hazard is the first step towards protecting against dust exposure.
2. Health hazard evaluation requires the collection of qualitative and quantitative data.
3. Time studies across different seasons of the year would indicate the levels of dust people are being exposed to in different parts of the city.
4. The threshold limit value (TLV) and biological exposure indices (BEI) values should be liaised for every area in Delhi NCR which could be used as guide line to control health hazards.

5. Occupational exposure limit (OEL), levels of particulate matter should be determined and proper legislation made to ameliorate the hazards of dust pollution.

Table 1: Identification of bacteria

S.No	Test	<i>Bacillus</i> sp.	<i>Staphylococcus</i> <i>aureus</i>	<i>Escherichia</i> <i>coli</i>	<i>Enterobacter</i> <i>aerogenes</i>	<i>Proteus</i> <i>vulgaris</i>	<i>Pseudomonas</i> <i>aeruginosa</i>
1	Gram staining	Rod, G+	Coccus, G+	Rod, G-	Rod, G-	Rod, G-	Rod, G-
2	Cultural characteristics	Abundant opaque white waxy growth	Abundant, opaque golden growth	White moist glistening	Abundant thick white glistening	Abundant thin blue grey swarming growth	Abundant thin white, medium turns green
3	Gelatin liquefaction	+	+	-	-	+	+
4	Starch hydrolysis	+	-	-	-	-	-
5	Lactose fermentation	-	A	AG	AG	-	-
6	Dextrose fermentation	A	A	AG	AG	AG	-
7	Sucrose fermentation	A	A	A	AG	AG	-
8	H ₂ S production	-	-	-	-	+	-
9	Indole production	-	-	+	-	+	-
10	MR reaction	-	+	+	-	+	-
11	VP reaction	±	±	-	+	-	-
12	Citrate utilization	-	-	-	+	-	+
13	Urease	-	-	-	-	+	-
14	Catalase	+	+	+	+	+	+
15	Oxidase	+	-	-	-	-	+
16	Specific medium/ character	Spore formation	Growth on mannitol salt agar medium	Metallic sheen on EMB agar medium			Growth on cetrimide agar, production of green colour

Table 2: Percentage of different fungal species at sampling stations:

S.No	Fungal species	ITDC Bus station	Cannaught Place	Rajiv Chowk	Old Delhi Railway Station	Gurgaon - Delhi NH
1	Alternaria alternate	1	-	2	13	6
2	Aspergillus flavus	12	8	7	14	11
3	Aspergillus fumigatus	3	12	6	-	14
4	Aspergillus niger	2	11	4	8	3
5	Botrytis sp.	-	-	-	6	11
6	Cercospora sp.	-	-	11	-	16
7	Chaetomium sp.	-	-	-	3	-
8	Cladosporium	-	12	9	-	-
9	Curvularia sp.	6	-	-	-	10
10	Fusarium solani	13	6	11	19	15
11	Gonatobotrys sp.	-	-	-	-	-
12	Helminthosporium sp.	7	11	-	8	16
13	Mortierella hyaline	2	-	-	-	-
14	Mortierella zonata	-	-	-	7	11
15	Mucor microspores	-	-	23	4	-
16	Mucor racemosus	20	-	4	3	1
17	Penicillium sp.	1	13	13	21	-
18	Rhizopus oryzae	-	-	9	12	13
19	Rhizopus stolonifera	-	-	2	6	-
20	Verticillium sp.	-	-	-	5	-
21	Yeast cells	14	18	-	23	-

Table 3: Percentage of different bacterial species at sampling stations:

S.No	Bacterial species	ITDC Bus station	Cannaught Place	Rajiv Chowk	Old Delhi Railway Station	Gurgaon - Delhi NH
1	Bacillus subtilis	18	16	21	46	22
2	Escherichia coli	13	11	09	11	40
3	Proteus vulgaris	-	16	14	19	10
4	Pseudomonas sp.	29	21	13	13	10
5	Staphylococcus aureus	5	12	10	15	11
6	Enterobacter aerogenes	-	16	11	18	7
7	Enterobacter aerogenes	2	-	-	2	-

Table 4: Bacterial and Fungal Colony Forming Units (CFU) in the air of Delhi NCR

S.No.	Sampling area	Bacterial	Fungi
1	ITDC Bus station	2.1×10^3	1.1×10^3
2	Cannaught Place	2.4×10^3	1.2×10^3
3	Rajiv Chowk	2×10^3	1.4×10^3
4	Old Delhi Railway Station	2×10^3	2.5×10^2
5	Gurgaon-Delhi NH	3×10^3	3.4×10^2

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