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A Comparative Study of Three Pond Ecosystem for Physico-Chemical Parameters in Kota Rajasthan

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Abstract:
This study was conducted in 2020-2021 with the help of the regional office Rajasthan state pollution control board Kota Rajasthan. Water was collected from different places of Sultanpur, Ganeshganj and Ayana ponds, to investigate the physico-chemical parameters like temperature, pH, electric conductivity, dissolving oxygen, biology O2 demand, COD, total alkalinity, Cl and NO3. Vegetation and ecosystem metrics like metabolism, nutrient concentration was compared of three ponds. In the result all parameters and vegetations are different to each other and have large qualitative variations, so that ecology and environment of the pond is also different and this study is useful to control the physico-chemical and biological condition of water.

Keywords: Physico-chemicals parameter, Ponds, ecosystem, BOD, COD, Chloride, Nitrate, Electric conductivity, DO, BOD, COD, and TDS

INTRODUCTION

Water is the good sources of life and it is required by all livings being. It affects all form of life (Ramesh and Soorya 2013). Pond is the small aera of fresh water and it is different from river in moving water. Pond bottom usually covered with mud and plant grow along the pond edge. It is also the reservoir of rainwater. Ponds can influence the ecological environment of the soil and human health (Mao et al., 2022). Kota Rajasthan boasts a complex and diverse wetland system including riverside habitats, lagoons and marshlands. This region rich in agriculture land as well agriculture practices, so play vital role to build environment. The wetlands and associated environments support many insect species. The majority of macro invertebrates have been identified as valuable bio-indicators for aquatic and wetland environments, but their utility in quick evaluations is constrained by the challenges associated with collecting, sorting, and distinguishing aquatic stages. Kota district is encircled by the districts of Bundi and Tonk in the north, Sawai Madhopur in the north west, Baran in the east, Jalawar and Mandsor in M.P. in the south, and Chittorgarh in the west. Kota has a hot, semi-arid climate with high temperatures and a mild winter. (Yadav et al., 2015).

Understanding an aquatic ecosystem's physicochemical properties is essential for comprehending its biological production. Although each element has a specific function, the composition and productivity of the flora and fauna are determined by the interaction of many different characteristics. (Bisht et al., 2013). The water chemistry like source, composition, reaction and transportation plays an important and direct role with human welfare. We hypothesized the temperature, pH, electric conductivity, dissolving oxygen, biology O2 demand, COD, total alkalinity, Cl and NO3 of three comparative pond waters.

MATERIALS AND METHOD

Study Location

In Kota, Rajasthan, three waterbodies were the subject of the study. This city is situated in the Chambel river basin in the state of Rajasthan. The Sultanpur, Ganeshganj, and Ayana ponds were among the water bodies sampled. Seasonal variations and a wide range of temperatures can be found in the Hadoti region. The average monthly temperature ranges from 27°C to 30°C and the average monthly relative humidity is below 70%.

Latitude, Longitude and Altitude of Ponds

Ganashganj pond latitude was N25˚30′1″, Longitude E76˚22′39″ and ALTITUDE was 227.1m(736.39 ft). Similarly, Ayana Pond Latitude, longitude and altitude was N25˚26′38″, E76˚26′18″ and 240.3m(780.48 ft). Sultanpur Pond Latitude Longitude and altitude was N25˚17′26″, E76˚10′16″ and 244.4m(792.48 ft).

Study Sites

Three ponds of Sultanpur, Ganeshganj, and Ayana ponds were suitable for study. The Sultanpur pond is characterized by the presence of grasses, shrubs and trees. The pond is a shallow, slow-moving body of water. Observed anthropogenic activities around the pond include bathing, vehicles navigating the shallow waters, and cattle grazing on the river banks. Ganeshganj pond site is located at Pipalda tehsil of Kota. Grasses, shrubs and trees are also present in pond. The pond is quite shaded, with lots of organic matter in suspension. Ayana Pond site is located at Ayana village Panchayatsimiti Itawa of Kota. It is characterised by the presence of herbs and trees. This pond has different vegetation and biodiversity. The pond is clear, shallow flowing slowly, and with a fine sand bed. Human activities observed at this site include the clearing of aquatic vegetation, washing and extraction of water for irrigation and other domestic purposes.

Collection of Water

This study was conducted in 2020-21 at the regional office state pollution control board Kota Rajasthan. Sample Water was collected from different places of Sultanpur, Ganeshganj and Anana ponds in clean and sterilized bottle for laboratories analysis. The samples were stored at 4˚c temperature to analysed the temperature, pH, electric conductivity, DO, BOD, COD, total alkalinity, Cl and NO3 with the help of APHA, (1998). Phosphate, sulphate, chloride and fluoride were used for analyse the water sample and double distilled water was used for preparation the solution. This method adapted was according to APHA (1998).

RESULT AND DISCUSSION

The quality of the pond depends on physical-chemical character of the water as well as the biological diversity of the ecosystem. The analysis of the biological diversity material and the physico-chemicals factors of the constitute an evolution of the water quality (Cairns and Dickson, 1971). The values of the examined physico-chemical characteristics of the water for the three water bodies (Sultanpur, Ganeshganj and Ayana Pond and) were presented in Table 1. However, most of the results obtained for the physico-chemical parameters were within the limits prescribed for tropical bodies (McCaffrey, 2018).

PH of Ponds

The pH of the Ganeshganj, Ayana and Sultanpur, Pond was 7.63, 6.96 and 7.72 respectively. The highest pH range was recorded in Sultanpur Pond comparison to Ayana and Ganashganj pond.

On the other hand (Singh, 2022) reported that the Ganeshganj pond pH was 7.39. It might be due to the pollution.

Temperature and Dissolving Oxygen (DO) of Ponds

Temperature is a major parameter which can affect the quantity of dissolved oxygen (DO) in freshwater bodies. This is one of the important factors and it is known to influence the amount of DO (Dissolving oxygen) available in water, also effect other properties of water. The highest temperature was recorded in Ganeshganj pond (21°C) which was followed by Ayana Pond (20°C) and Sultanpur pond (20°C). Dissolving oxygen is variable in all pond. Ayana pond has very less DO 2.02 mg/l in comparison to sultanpur 4.8 mg/l and Ganeshganj pond 5.34 mg/l. Water temperature can reduce the amount of DO in water. According to McCaffrey (2018), water at 0 °C can hold up to 14.6 mg/L oxygen, and at 30 °C it contains about 7.6 mg oxygen. This decreased ratio was also reported by Adu et al. al., 2019. In situ DO concentration variability is driven by factors such as water depth, proximity to water's edge, current velocity and temperature. Pond edges are usually richer in DO than deep water. Increased temperatures usually lead to lower dissolved oxygen levels, which also affects the metabolic rate of aquatic insects (Corbet 2004). According to Suhling *et al.*, (2015) and Kemabonta *et al.*, (2020) Plants are also affected by DO. The low levels of dissolved oxygen found at all sites indicate deteriorating water quality and may be due to the presence of nutrients in water bodies as a result of anthropogenic activity.

TDS and Total Hardness of Ponds

TDS and total hardness of pond effect on the vegetation and ecology of the pond. TDS of ganeshganj, Anaya and Sultanpur ponds were 360 mg/l, 310 mg/l and 458 mg/l. The total hardness of these three ponds were 116 mg/l, 180 mg/l and 160 mg/l. Electrical conductivity and TDS values showed significant differences in the Apommu River. This suggests that there is a close relationship between EC and TDS, as dissolved salts in water increase the electrical conductivity of this water. According to Ezekiel, Hart, and Abowei, 2011, the low EC range characteristic of tropical African waters.

Conductivity, BOD and COD of Ponds

Pond conductivity effect the pond environment. Sultanpur Pond conductivity was higher 660 µMHO/cm as compare to Ganeshganj pond conductivity 510µMHO/cm and Ayana Pond conductivity at 450 µMHO/cm at 25°c. BOD is very low (1.5 mg/l) of Sultanpur pond in compare to Ayana Pond (1.8 mg/l) and Ganeshganj pond (4.2 mg/l). According to Prommi and Payakka (2015), increased conductivity is an indicator of dissolved ions. Ganeshganj pond had highest COD (71.76 mg/l). Sultanpur pond COD value was (30.42 mg/l). Ayana pond had minimum COD value (29.64 mg/l).

Alkalinity, Chloride and Nitrate in Ponds

Chloride concentration is the important parameter for detection the contamination of sewage Ponds give variable results of alkalinity, chloride and nitrate. Sultanpur pond had high alkalinity 108 mg/l as compared to Ayana Pond (100 mg/l) and Ganeshganj pond (80 mg/l). Choride value was higher in Ganeshganj Pond (88mg/l) as compared to Sultanpur Pond (60 mg/l) and Ayana Pond (40 mg/l). Temperature, dissolved oxygen (DO), alkalinity, hardness, pH, electrical conductivity (EC), turbidity, total dissolved solids (TDS), and biological oxygen demand are some of the physicochemical parameters that are routinely measured within water bodies such as ponds (USDA, 1999).

CONCLUSION

Freshwater quality plays a vital role in distribution, abundance, and diversity of pond. This study revealed that the pond ecology is somewhat polluted based on the similar trend in species assemblages recorded at the selected study sites. The abundance of pollution tolerant species and few stenotopic species evidenced that the water maybe experiencing a level of human disturbance at the period the research was carried out. Efforts should therefore be taken to reduce pollution in order to preserve the diversity of these insects.

ACKNOWLEDGEMENT

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Table-1: Physicochemical parameters of three different sites of Kota, Rajasthan

S.No	Parameter	Ganeshganj Pond	Ayana Pond	Sultanpur Pond
1	pH	7.63	6.96	7.72
2	Temperature	21	20	20
3	TDS mg/L	360	310	458
4	Total Hardness mg/L	116	180	160
5	Conductivity µ MHO/cm (at 25˚C)	510	450	660
6	DO mg/L	5.34	2.02	4.8
7	BOD mg/L	4.2	1.8	1.5
8	COD mg/L	71.76	29.64	30.42
9	ALKALINITY mg/L	80	100	108
10	CHLORIDE mg/L	88	40	60
11	NITRATE mg/L	0.16	0.02	0.02
12	LATITUDE	N25˚30'1"	N25˚26'38"	N25˚17'26"
13	LONGTITUDE	E76˚22'39"	E76˚26'18"	E76˚10'16"
14	ALTITUDE	227.1m(736.39 ft)	240.3m(780.48 ft)	244.4m(792.48 ft)

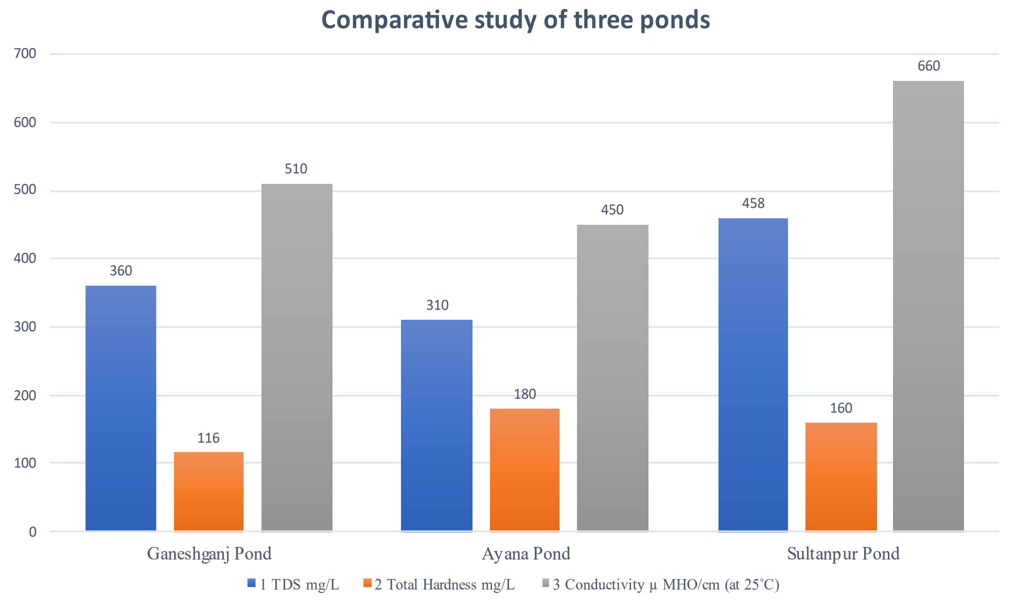
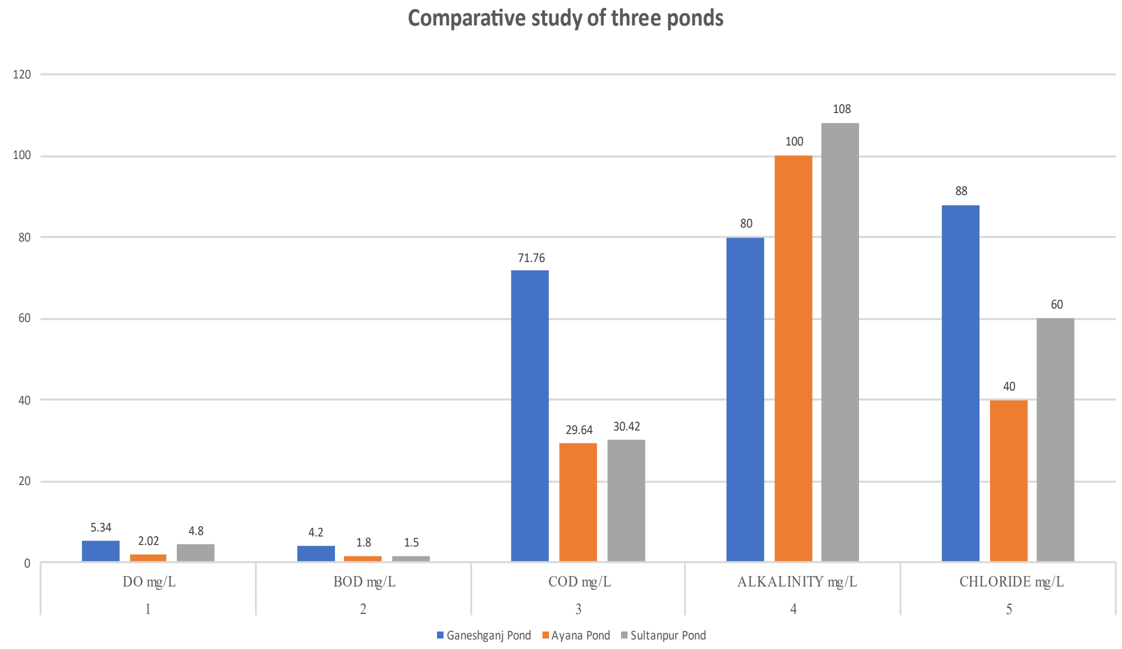


Figure-1



Comparative study of three ponds
120
100
80
60
40
20
0
5.34
2.02
4.8
4.2
1.8
1.5
71.76
29.64
30.42
80
100
108
88
40
60
DO mg/L
1
BOD mg/L
2
COD mg/L
3
ALKALINITY mg/L
4
CHLORIDE mg/L
5
Ganeshganj Pond
Ayana Pond
Sultanpur Pond

Figure-2

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Health Hazards of Various Micro-Pollutants, Stubble Smoke, Furnace Fumes and Dust Particles in Urban Areas

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Abstract:
Present review article describes hazardous effects of micro-pollutants mainly desert, rubber, silica, house hold and street, cement, ceramic, plastic, pollen, and tobacco dust. It also explains harmful effects of stubble smoke, smog, furnace fumes and organic volatiles. Most of these micro-pollutants are related to occupation mainly industries, housing construction and mining. These put both short- and long-term effects in workers and resident population. Micro size particulate matter, dust particles and automobile emissions and humidity put significant impact on weather, climate and atmospheric chemistry and form a thick haze. This brown colour thick haze forms a layer that acts as a noxious gas chamber and impose severe hazard to the environment and human health. Both alkali and heavy metal coated sand dust particles, and house hold particle induce inflammation in lung injury and aggravate allergen-induced nasal and pulmonary eosinophilia. In response to toxicity generated by dust particles body starts making innate immune defense and synthesize and secrete various cytokines, chemokines and antigen-specific immunoglobulin which are potentially identified by via toll-like receptor/myeloid differentiation factor signalling pathways. This article suggests safety, precautionary and remedial directions to cut down emissions and release of various micro-pollutants in the environment and its impact on human life. To combat this grave problem there is a need to adopt green technologies and eco-friendly methods to reduce level of gaseous emersions and dust formation.

Keywords: Micro-pollutants, dust, sand, fumes, and stubble smoke, occupational hazards, acute or chronic respiratory diseases, health hazards, Peroxyacyl nitrates (PAN), volatile organic compounds (VOCs), Chronic obstructive pulmonary disease (COPD), pulmonary arterial hypertension (PAH). Dcs = Dendritic cells, MQs = Macrophages, ILCs = Innate lymphoid cells, TCs = T cytotoxic cells, Th1 = T helper cell type 1, Th2 = T helper cell type 2, Th17 = T helper cell type 17, BALT=bronchus associated lymphoid tissue

INTRODUCTION

Micro-pollutants are chemical, physical and biological contaminants which found suspended in air or in water. Many of these micro-pollutants are generated due to increasing human activities or natural processes mainly related to climate or weather changes. Dusts are tiny solid particles scattered or suspended in the air. The particles are "inorganic" or "organic," depending on the source of the dust. Inorganic dusts can come from grinding metals or minerals such as rock or soil. Examples of inorganic dusts are silica, asbestos, and coal. Dust is generated during industrial, mining, housing construction, road transport and construction sites. Airborne dust (free silica) is produced from marble stone during mining, cutting, quarrying, grinding, polishing and finishing. Fly ash, cement, ceramic, plastic and asbestos and silica dust is released from industries, workshops, during manufacturing or making goods and materials. Working with marble and other stones such as dolomite generates fine dust, which enters inside lung through inhalation; it causes respiratory problems and irritation of the eyes and skin. Mainly particulate particles are released from automobiles, ceramic, steel and metallurgical plants. All these dust types, silica and emissions including automobiles are the main causative factors for many occupational chronic obstructive pulmonary disease (COPD), silicosis, asthma and pneumoconiosis (Castranova and Vallyathan 2000). All these particulate matter, dusts and gaseous air pollutants i.e., polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/F) adversely affected lung function induces asthma, cause respiratory infections and seasonal allergic rhinitis in exposed people. Industrial, house and industrial dust, mining dust, metal dust exposure, rubber dust is quite harmful to human being and aquatic life. Though, body tries to fight against the toxicity generated by dust particles and make innate immune responses. In response to its various cytokines, chemokines and antigen-specific immunoglobulin are generated. These are potentially identified by via toll-like receptor/myeloid differentiation factor signalling pathways.

This article explains effects of various dust particles on industry workers and local human population. It has highlighted lung diseases such as pneumoconiosis, chronic obstructive pulmonary disease (COPD), silicosis and asthma, heart attack and so many severe respiratory or allergies, irritation and airway inflammation faced by people in rural, semi-urban and urban sites. The worst condition is in workers exposed to metallurgical fumes, ceramic dust and welding workshops. These are working in highly suffocating environment and inhaling fumes which lower down respiratory oxygen levels and resulting in lung, bone, skin cancer and central nervous system problems.

More often, occupational hazards are equally dangerous because of the discharge of particulate matter dusts, fumes from furnaces, effluents and emissions from industries and automobiles. PAN (Peroxyacyl nitrates) is a secondary pollutant produced in the atmosphere it is formed after oxidation of volatile organic compounds combine with nitrogen dioxide. This is also generated in the thermal equilibrium between organic peroxy radicals by the gas-phase oxidation of a variety of volatile organic compounds (VOCs), or by aldehydes and other oxygenated VOCs oxidizing in the presence of NO_2 (Cape 2033, Gaffney et al, 2021; Jickells et al, 2013). PAN appears as a yellowish-brown haze in the atmosphere and is known as the photochemical smog. The important hydrocarbons for the production of photochemical smog are olefins. PAN in photochemical smog is a powerful respiratory and eye irritant, it reduces visibility and impose respiratory disorders.

Heavy metals are quite harmful for human beings. These cause neurotoxicity, generate free radical which promotes oxidative stress damaging lipids, proteins and DNA molecules. These free radicals propagate carcinogenesis of lung, liver, stomach, blood and kidney. Heavy metals cause noxious health effects. Heavy metal toxicity can lower energy levels and damage the functioning of the brain, lungs, kidney, liver, blood composition and other important organs. Workers exposed to hard-metal dust remain at risk of developing interstitial pulmonary fibrosis. Similarly, heavy metals in welding fumes are inhaled by workers which show lung inflammatory responses and cause hematological abnormalities (Thacker 2006). During welding heavy metals, carbon monoxide, carbon dioxide, and nitrogen oxides are generated which put adverse effect on workers. Similarly, benzene and its derivatives are ubiquitous chemicals and its presence in environment is responsible for acute leukaemia and other haematological cancers (Table 1). Most commonly house hold fires for making food, biomass, cow dung and coal burning release greenhouse gases in higher concentration and harmful for man and his environment. In addition, side-stream smoke from cigarettes contains formaldehyde, inhalable particulate matter and other pollutants; these are very harmful for human health. Partial smoking is responsible for lung cancer. From houses and human living solid waste, dusts, fowling water and fecal material is generated. All these are air contaminant and source of microbial infection. House and street dust contain many dusts mite, allergens hallucinogenic, mind-altering asthmatic and abnormal conditions (Hansel et al, 2013). Body generates innate immune response allergic inflammation (Wang 2013).

Table 1: Source of dusts, various categories micro-particles and its health/biological effects.

Dust type	Particle size	Chemical nature/composition	Biological/health effects	Reference
Stubble burning				
Stubble burning	PM 2.5 (0.1-2.5 µm)	5.5-kilogram nitrogen, 2.3 kg phosphorus, 25 kg potassium and more than 1 kg of sulphur — all soil nutrients, besides organic carbon	Asthma and airway inflammation	Abdurrahman MI. et al, 2020
Crop biomass burning	PM 2.5 (0.1-2.5 µm)	carbon monoxide (CO), methane (CH4), carbon dioxide (CO2), aromatic hydrocarbons, and volatile organic compounds (VOCs), resulting in smog	harmful greenhouse gases that contribute to pollution and climate change.	Bhuvaneshwari S et al, 2019
Straw dust, moldy hay, straw and grain	PM (2.5-10 µm)	30 – 45% cellulose, 20 – 25% hemicellulose, 15 – 20 % lignin, as well as a number of minor organic compounds. serine protease inhibitors, glutelin's and prolamins	*Sneezing, a stuffy or runny nose, or itchy and red eyes*. allergy moldy hay, straw and grain	Wunschel J, Poole JA.2016
Desert dust				
Yellow sand desert dust	PM10 mass was ***30.9***%, reaching up to 75.1% (PM10 > 50 µg/m^3	Iron-containing minerals such as clays, feldspars, and iron oxides,	irritate eyes, throat and skin respiratory and cardiovascular health problems	(Kinni P et al, 2021) (Engelstaedter S, *et al*. *2010;* De Longueville F et al, 2010.
Yellow sand desert dust	PM10 mass was ***30.9***%, reaching up to 75.1% (PM10 > 50 µg/m^3	Crystal dust alkali and heavy metal coated sand dust particles	toxic biogenic allergens	Hsu H-H, *et al* 2005, Griffin DW et al, 2001)
House and street dust				
House and street dust	PM (2.5-10 µm)	Street dust contains heavy metals, in an order of Zn > Cd > Cu > Cr > Pb > Ni	Dust allergies stuffy or runny nose	(Zgłobicki W et al, 2019).
House and street dust	PM (2.5-10 µm)	House dust contains polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans	which induce toxicity and human health risks	(NC D et al, 2012).

House and street dust	PM (2.5-10 µm)	metal(loid)s crystalline silica	Respiratory problems	(Rasmussen et al, 2022).
		Coal dust		
Coal dust	PM 2.5 (0.1-2.5 µm) PHLDB2 in air	carbon monoxide (CO) and fine coal particles	lung cancer	(Ge D et al, 2021).
		Silica dust		
Silica dust	PM (2.5-10 µm)	metal(loid)s crystalline silica Mg2xFe(2−2x) SiO4 and MgxFe(1−x) SiO3 (x = 0–1)	chronic silicosis, potential negative health effects	(Arnoldussen YJ et al, 2019
		Marble dust		
Marble dust	PM 2.5 µm) and PM_{10}	Calcite, serpentine and dolomite in form of crude mineral	Lung fibrosis, pneumoconiosis, pulmonary disorders and pulmonary disease, including silicosis and asthma	Chen W, Liu Y, Huang X, et al and Pollard KM 2016).
	PM (2.5-10 µm)	inorganic oxides of CaO, Si O2, Al2O3, Fe2 O3, MgO, SO3, K2O, Na2O	toxic to the human respiratory system	Rees D, Murray J: 2007
		Rubber dust		
Rubber dust	PM 2.5 µm) and PM_{10}	beta-naphthylamine, n-Nitrosamines	Its exposure in workers imposes bladder, stomach and lung cancers	(Hidajat M et al).
		Plastic dust		
Microplastics (MPs)	PM 2.5 µm	Polyethylene terephthalate (PET) and polycarbonate (PC)	cause adverse health effects and impose pneumothorax, alveolitis, chronic bronchitis and pneumonia	Vethaak and Leslie, 2016; Pimentel et al., 1975
		Metallic dust		
Metallic dust	PM 2.5 µm) and PM_{10}	Pb, Zn, Cu, Cr, and Ni	respiratory health of workers	Hamzah NA et al, 2016).
		Cement dust		
	PM 2.5 µm) and PM_{10}	Ceramic dust	cause pulmonary fibrosis (silicosis), lung function deficits, pulmonary inflammation, and lung cancer	Liao CM et al, 2015
		Tobacco dust		

Tobacco dust	PM 2.5 µm) and PM_{10}	spores of different moulds	allergic alveolitis	Huuskonen et al, 1984
		Automobile exhaust/dust		
Automobile exhaust/dust	Fine particle Particulate matter size 2.5 um	Pb containing particles/particulate matter	Settle deep inside lungs trigger plaque deposition,	

Stubble burning is a recent problem raised due to wrong agriculture practices opts by farmers in Northern states of India. Huge smoke that is generated from burning of "parali" that had choked the atmosphere around Delhi, it makes the environment more noxious for big urban life and people are feeling helpless. Besides this, fossil fuel derived smoke and smog aerosols are major problem in urban environments. Many countries have made clean Air Act to control pollution and climate change and resolve public health challenges. For collection of dusts air filters, vacuum machines, wet method and electric precipitators are required through a collection system before emission to the atmosphere. There is a need to safe storage, transport, and controlled disposal of dangerous waste. Present article explains various dust types, its source, biological effects and control. Plantation of more and more trees, forest covers, green patches, clean cultivation practices, use of bio-pesticides be made essential to minimize pollution levels and associated health risks.

SOURCE OF INFORMATION

For writing this comprehensive research review on Health hazards of various micro-pollutants, stubble smoke, furnace fumes and dust particles in urban areas various databases *were searched*. For collection of relevant information specific terms such as medical subject headings (MeSH) and key text words, such as "Health hazards of micro-pollutants", "biological effects", problems to human health" published till 2023 were used in MEDLINE. Most especially for retrieving all articles pertaining to the micro-pollutants, sources, and health hazards electronic bibliographic databases *was searched* and abstracts of published studies with relevant information on various dust particles, particulate matter and its impact on human health and environment were collected. Furthermore, additional references were included through searching the references cited by the studies done on the present topic. Relevant terms were used individually and in combination to ensure an extensive literature s*earch.* For updating the information about a subject and incorporation of recent knowledge, relevant research articles, books, conferences proceedings and public health organization survey reports were selected and collated based on the broader objective of the review. Most relevant information on this topic was acquired from various scientific databases, including SCOPUS, Science Direct Web of Science, and EMBASE, Pubmed central, PMC, Publon, Swissprot, and Google Scholar." From this common methodology, discoveries and findings were identified and summarized in this final review.

SOURCES OF MICRO-POLLUTANTS

Stubble Farm Fires

Parali or stubble or crop biomass burning is a bad practice in used at large scale in Punjab, and Haryana and western Uttar Pradesh by farmers. This is a major cause of air pollution in Delhi and nearby high-density population zone. Every year 149.24 million tonnes of carbon dioxide (CO_2) are released due to crop residue burning over 9 million tonnes of carbon monoxide (CO), 0.25 million tonnes of oxides of sulphur (SOX), 1.28 million tonnes of particulate matter and 0.07 million tonnes of black carbon. These directly contribute to environmental pollution, and are also responsible for the haze in Delhi and melting of Himalayan glaciers. Along with vehicular emissions, thick smog formed over air space of affects the Air Quality Index (AQI) in the national capital and NCR. It is happening almost every year in Northern India smog formed from stubble (Parali) burning form thick coat in urban sites and it spread more frequently in other parts of country.

The main reason behind stubble burning is to gain more profit and quick finishing of crop residues from crop field by burning it abruptly for sowing next season crop in the same field. It is mostly seen finishing of kharif crop, and before showing of Rabi crop. The truth is, farmers get only one week time to vacate the land; hence they choose cheapest method to clear the farm fields after cutting the crop by combine machines. This illegal environmental polluting practice is very dangerous and affecting life of millions of people as they are facing heavy suffocation, asthma, heart attack and so many severe respiratory problems. Smog formed over Delhi chokes the big urban life and people are feeling helpless. This practice was not seen before year 2000 as farmers were engaged in clean cultivation and were handing crop residues by disposing of it by plaguing, green composting and use crop wastes for cattle feeding. Then the agriculture farming was not a burden but a dedication and honesty to the environment. This is somewhat evolved as more profit less input habit, laziness, and mechanized agriculture.

Stubble burring after 2010 has been started in a row or chain of events that is choking Delhi metro city every year. Stubble burning release *toxic pollutants* in the atmosphere containing harmful gases like Carbon Monoxide (CO), methane (CH_4), carcinogenic polycyclic. It produces toxic gases that not only make it difficult to breathe for nearby residents but also significantly contribute to global warming. Stubble burning emits pollutants like carbon monoxide (CO), methane (CH_4), carbon dioxide (CO_2), aromatic hydrocarbons, and volatile organic compounds (VOCs), resulting in smog. In rural areas farmers vacate farm fields by burning crop residues; they must be guided for its eco-friendly disposal to lower down level particle density in air and smog formation (Bhuvaneshwari et al, 2019). Farmers can also manage crop residues effectively by employing agricultural machines like Happy Seeder, Rotavator, Baler, Paddy Straw Chopper and Reaper Binder.

Biological Effects

According to a rough estimate 84.5 per cent people were suffering from health problem due to increased incidence of smog. Among which 76.8 per cent people reported eye irritation, 44.8 per cent reported irritation in nose, and 45.5 per cent reported irritation in throat (Figure 1 & 2). Cough or increase in cough was reported by 41.6 per cent people and 18.0 per cent reported wheezing. Stubble and agriculture biomass burning releases greenhouse gases and are highly harmful to human health & environment. (Abdurrahman et al, 2020). This occupational agriculture organic dust exposure imposes asthma and airway inflammation in adults (Wunschel and Poole 2016) (Table 1).

Pollen Dust

In winter season when temperature remains low white parthenium, deodar, eucalyptus and sagon pollens float in air in parks and road sides where there is this plantation is present. Pollen is a very fine powder produced by trees, flowers, grasses, and weeds to fertilize other plants of the same species. It's also one of the most common causes of allergies in rural, semi-urban and urban sites. Most of the morning walkers and passersby inhale pollens released in air which are highly allergic. In winter, when temperature goes down, most of the old age, children and passerby dwellers get infected with cold bacteria and suffer from severe cough, sneezing bouts, runny nose and itchy face. Normally, in people with pollen allergies, the immune system mistakenly identifies the harmless pollen as a dangerous intruder. In response to pollen toxicity, body starts synthesizing IgE antibodies and display allergic reaction. Severity of allergy depends upon pollen size and type, but all are known as an allergen. The allergic reaction leads to numerous irritating symptoms, such as sneezing, a stuffy nose, and watery eyes (Figure 1 & 2). Further, condition get aggravate as allergens and pollutants get mix, and generate both physical and psychological stress. Affected people will need early medication and anti-allergy allergy shots. Cigarette smoking aggravates the allergies during travelling in non-smokers. It is true that both pollen and non-pollen allergies have doubled as during post Covid period people were indoors and exposure to pollen was much lower during the pandemic (Table 1).

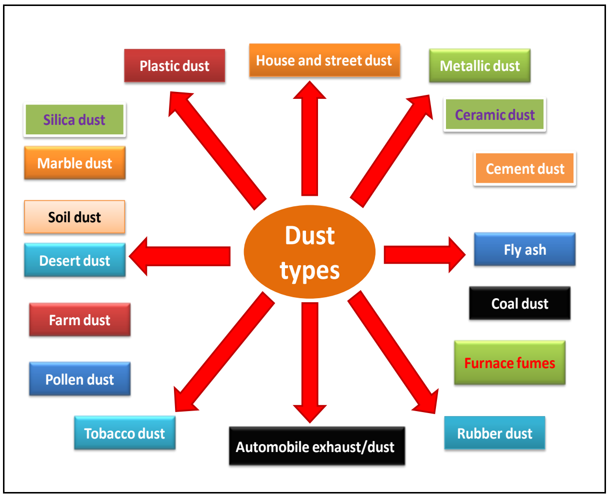

Figure 1: showing various dust particles as micro-pollutants

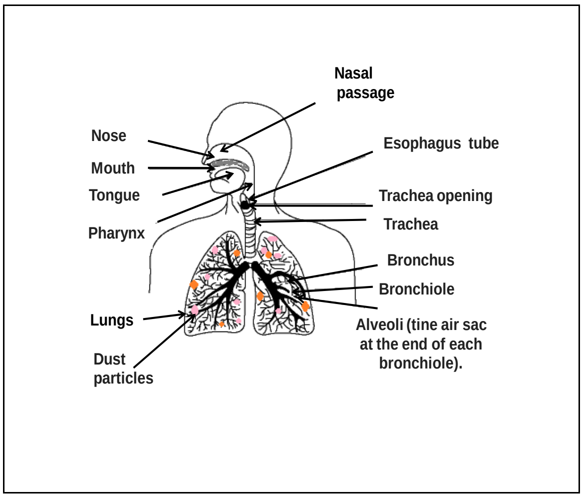

Figure 2 showing effect of micro-pollutants on respiratory ways and lungs

Marble Dust

Marble is a metamorphic limestone having calcite, serpentine and dolomite main constituents. Fine granules or particles of are formed which vary from 0 to 400 microns. Marble possesses important inorganic oxides of CaO, Si O_2, Al_2O_3, Fe2 O_3, MgO, SO_3, K_2O, Na_2O, LoI. Main constituent of marble is free silica, i.e., "free of elements" as it is not combined with other elements or silicon dioxide (SiO_2). Silica is a common ingredient of the Earth's crust and can be found in alpha quartz, beta quartz, moganite, granite, slate, sandstone, and keatite. Crystalline silica causes itching, red eyes and makes nose watery (Riccardo Mastrantonio et al, 2021). This is toxic to the human respiratory system (Rees and Murray 2007). Marble dust powder also contains calcium carbonate and is white in color. Dust clouds are generated in large quantities during excavation, mining and during quarrying operations. Marble dust is formed during, cutting, crushing, finishing and processing in industries. Both these processes generate around 38- 40% of marble waste is generated worldwide. This huge waste in form of rock fragments is used various purposes including landfills and roads and riverbeds. Working with these materials generates marble dust, which causes respiratory issues and irritation of the eyes and skin. Fine marble powder is one of the main (Corinaldesi et al., 2010) and storm and industrial dust are main source of environmental pollution throughout globe (Çelik, 1996; Akbulut and Gürer, 2003). Meanwhile, particles get deposited on airway surfaces were air flow changes direction. Silica particles having a size 0.2 to 2 micrometers get deposited on the walls of the air way and particles less than 0.2 micrometers enter the terminal respiratory epithelial surfaces and finally diffuse into alveolar gas (Singh et al, 2006; Koeppen et al, 2009) (Figure 1 & 2). Marble stone is widely used in construction of buildings, monuments and in the sculpturing of statues. It is commonly used in making tiles, countertops and indoor flooring. Its powdery dust is used in making paint, tooth paste and paper (Hae-Rim et al, 2018 and Esswein et al, 2013) (Table 1).

Biological Effects

Workers who are engaged in stone cutting, grinding, finishing and processing get exposure of fine silica containing marble dust (Poinen-Rughooputh S, et al 2016). Inhalation of fine dust particles causes lung fibrosis, pneumoconiosis, chronic obstructive pulmonary disorders and pulmonary disease (COPD), silicosis and asthma (Chen, et al and Pollard 2016). Air lifted crystalline silica particles if inhaled for longer duration, these deposit over alveoli and absorb inside them, and cause several respiratory problems like mucosal irritation, inflammation and pulmonary fibrosis. It also results in mucosal hyper secretion in the large airways, mucosal gland hypertrophy of trachea and bronchi. Workers those who inhaled silica dust particles for more than one year face show increase in the number of goblet cells, and formation and collection of excessive mucus inside lungs. Later on, it results in the formation of a mucous plug in the lumen, and fibrosis of small air ways (Singh et al, 2006; Koeppen et al, 2009). It affects inhalation of air volume and affect forced vital capacity and forced expiratory volume (Camelo et al, 2014; Mohan 2010). Elemental silica enter inside the alveoli, increases the production of inflammatory mediators in the peripheral airway, and cause emphysema (Figure 1 & 2).

In workers mean RBC counts was significantly decreased 3.22± 0.016 in comparison to non-workers, while WBC counts was found increased (8.66± 0.22) (Upadhyay and Jaiswal 2007). In blood serum of marble stone workers cholinestrase, lactic dehydrogenase and alkaline phosphatase enzyme activities were found higher in comparison to control, which indicate that substantial occupational exposure of solid dust particles were generating negative effects and health hazards for the body physiology and biochemistry of craft workers (Upadhyay and Jaiswal 2007) (Table 1).

Cement Dust

Cement industries are multiple sources of particulate and gaseous pollutants. During production, packing, loading and transportation dust is released in air. Cement dust causes lung function impairment, chronic obstructive lung disease, restrictive lung disease, pneumoconiosis and carcinoma of the lungs, stomach and colon. After absorption in alveoli, cement dust enters into the systemic circulation and thereby reach the essentially all the organs of body and affects the different tissues including heart, liver, spleen, bone, muscles and hairs. Cement dust imparts potential toxic effects and generate health risks in cement mill workers (Meo 2004). A significant elevation in neutrophil counts is reported in cement production workers during the exposure period with elevated levels of IL-1beta concentration. Cement dust causes airway inflammation (Fell et al, 2010) (Figure 1 & 2). If median respirable aerosol level reaches beyond range 0.02-6.2 mg/m (3) number of leucocytes and TNF-α level increased and IL-10 decreased across the shift (Sikkeland et al, 2010) (Table 1).

Rice and Wheat Straw Dust

Gram-negative bacteria, thermophilic actinomycetes, and fungi generate aflatoxin, endotoxin, and stimulate production of human interleukin 1 beta (IL-1 beta). These microbes found in a range of 10(7) CFU/g and ranged from 10(7) to 10(9) CFU/g and cause contamination cause risk for respiratory illness (Shen YE, Sorenson WG, Lewis DM, Olenchock SA 1990). The wheat straws are hypoallergenic; it means they do not cause any allergic reaction to the people using them. Gluten allergy sufferers can usually use wheat straw fibre products. Wheat allergy is an allergy to wheat which typically presents itself as a food allergy, but can also be a contact allergy resulting from occupational exposure. Like all allergies, wheat allergy involves immunoglobulin E and mast cell response. Wheat allergy is rare; it happens only in 0.21% of adults (Morita et al, 2012) (Figure 1 & 2). Wheat allergy may be a misnomer since there are many allergenic components in wheat, for example serine protease inhibitors, glutelins and prolamins and different responses are often attributed to different proteins (Sotkovský et al, 2011) (Table 1).

House and Street Dust

House dust is a mixture of so many particulate allergens, dust particles create noxious irritable environment and trigger uncomfortable allergic rhinitis. Dust also contains house mites' i.e., tiny organisms which feed off house dust and the moisture in the air cause indoor allergy. House dust contains polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans which induce toxicity and very harmful to human health (NC et al, 2012). Dust from vacuum cleaners contain metal(loid)s that imposes alveolitis and systemic pulmonary diseases (Rasmussen et al, 2022). Street dust contains heavy metals i.e., Zn > Cd > Cu > Cr > Pb > Ni and metal (loid/s) which are easily inhaled, reach the alveoli, and damage respiratory function. These contaminants form moderate levels of pollution (Zgłobicki et al, 2019) and impose heavy health risks (Wu et al, 2017). In addition, on house dust bacterial toxins are coated on dust particles from Cyanobacteria, Bacteroidetes, and Fusobacteria. These induce allergy asthma and atopy or hay fever in children and adults (Lee et al, 2021) (Figure 1 & 2). Presence of endotoxins (bacterial lipopolysaccharide) and house mites in dust causes induce asthma (Schuijs et al, 2015) (Table 1).

Tobacco Dust

Tobacco dust is generated from a cigarette, beedi and chewing tobacco workshops/industry. Tobacco dust is rich in nitrogen (N) (2.35%), potassium (K) (1.95%) and phosphorous (P) (937 ug/g) which can provide essential nutrients to the soil and plant. It also contains total Nitrogen, Carbon/Nitrogen, Calcium, Phosphorous, Magnesium, Nicotine and moisture content and mold dust, basting spores and fine particles. A total of 57 subjects who had been exposed to mould dust in the tobacco industry were studied. Workers employed in tobacco industry heavily exposed both formed components of tobacco and its associating molds (Huuskonen MS et al, 1984). However, long term exposures of spores of different moulds (especially *Aspergillus fumigatus*) in the manufacture of tobacco products induce allergic alveolitis and showed slight radiographic pulmonary fibrosis. In response to allergens workers develop antibodies (Huuskonen MS et al, 1984). Tobacco leaf contains nicotine, solanesol, chlorogenic acid, etc. are included in tobacco leaf and aroma due to decanal, 1-hydroxy-2-propanone, and 2-methylbutanol. Many functional small molecules of volatile and semi-volatile compounds including aldehydes, ketones, alcohols, esters (lactones), and alkenes are called neutral aroma. And the tobacco flavor depends on concentration of neutral aroma components (Ma et al, 2015; Zeng et al, 2015, Nedeltcheva-Antonova et al, 2016; Farag et al, 2018) (Table 1).

Sand Dust and its Health Effects

There are so many causes of dust formation, including mechanical to natural one. Desert is full of alkaline dusts which form great storms with little change in pressure and wind blowing. Dust in desert is formed by natural reasons as the day and night temperature significantly varies and imposes significant health risks to rural populations. It is reality that desert is increasing day by day and formation is dust is also on an increase path. Deserts contain Yellow sandy dust from deserts is exposed with alkalies and heavy metals coated on them. In semi-arid zones and dry arid zones dust formed contains slight amounts of alkali but have calcium salts. Dust derived from alkaline soil bears sulphur and nitrogen oxides which are generated after combustion of fossil fuels in big furnaces in industrialized areas. From these sulphates (SO_4^{2-}) or nitrates are formed as soon as adsorbed at the surface of sandy dust particles (He et al., 2014, Karydis et al., 2016; Yu et al., 2020). Nature of soil decides from which dust particle is derived decide type of toxicity. Commonly, sand dust contains mainly of silicon, aluminium, calcium and iron (Figure 1 & 2). Dust suspended in mining areas contains heavy metals which are highly toxic (Han et al, 2017) (Table 1).

Sandy soil dust is enriched (>3 times) Br, Cu, Cl, Pb, Zn, Cr, Ca, Co, As and Sb in house dust, and Zn, Cr, Cu and Pb in street dust. The elements Hf, Th, Sc, Sm, Ce, La, Mn, Na, K, V, Al and Fe may be considered to be soil-based and contribute about 45–50% to house dust and 87% to street dust. Presence of these elements and their compounds put more serious biological effects and morbidity in human population. In general, atmospheric dust from multiple origins, suspend in air. But air lifted fly ash contains inorganic chemicals which are toxic. These chemicals also adhered on dust particle surface; react in open environment with gas particles. It reaches inside lungs through inhalation, and enhances toxicity of aerosols in urban environments (Fussell et al, 2021). Inhaled respired air reaches inside lungs and thereby enhance human particulate exposure (Sternberg T et al, 2017). Desert dust is a risk factor for inflammatory and allergic lung diseases (Querol, et al,). Significant amounts of suspended desert dust during storm periods may provide a platform to intermix with chemicals on its surfaces, thereby increasing the bio-reactivity of $PM_{2.5}$ during dust storm episodes. Furthermore, mineral dust surface reactions take place with the source of toxic organic chemicals in the atmosphere, enhancing toxicity of aerosols in urban environments. Therefore, it is highly important to develop control warning systems and dust impacts upon human health (Figure 1 & 2). Both clinical investigations and monitoring systems for health studies in relation to air quality management are highly essential. Natural sources in dry landscapes are exacerbated by human activities that increase the vulnerability to dust and dust-borne disease vectors (Table 1).

Desert Dusts

Desert dust flies with wind and atmospheric pressure, not only in areas close to the source points but also in peripheral areas which are situated far distantly thousands of kilometres (Prospero 2000; Ginoux et al, 2012). It results in heavy dust storms and put a significant impact on air quality.

Storms suck up large piles of desert sand mainly particulate matter with large loads of minerals (or crystals). Such events are also possible due to anthropogenic reasons, and sand deposited in the source areas or trapped by the high dust air mass during its atmospheric transport (Mori 2003; Rodríguez 2011). Sand carries large amounts of microorganisms and toxic biogenic allergens (Hsu H-H, *et al* 2005, Griffin et al, 2001). However, dust particles themselves are well known for their potential to cause respiratory and cardiovascular health problems (Figure 1 & 2). They can also irritate eyes, throat and skin. Human health effects of dust relate mainly to the size of dust particles (Table 1).

Biological Effects

Dust storms are natural events, and are common in parts of the world with dry land areas. The most common symptoms experienced during a dust storm are irritation to the eyes and upper airways, trigger allergic reactions and asthma attacks. It causes serious breathing problems, and increase the risk of cardiovascular or heart disease, and reduce the life span. Prolonged exposure to airborne dust can lead to chronic breathing and lung problems, and possibly heart disease (Figure 1 & 2). Desert dust and sand storms play a significant role in different aspects of weather, climate and atmospheric chemistry and represent a severe hazard to the environment and human health (Kinni et al, 2021) (Engelstaedter, *et al*. *2010;* De Longueville et al, 2010) (Table 1).

Both alkali and heavy metal coated sand dust particles, dust storm particles and house hold particle induce inflammation in lung injury and aggravate allergen-induced nasal and pulmonary eosinophilia. Long term effect of pollutants affects lungs which are generate cytokines, chemokines and antigen-specific immunoglobulin potentially via toll-like receptor/myeloid differentiation factor signaling pathways. With this, particulate air pollutant also induces asthma, cause respiratory infections and seasonal allergic rhinitis in exposed people (Fussell et al, 2021). Toxic dust imposes negative effect on cardio-respiratory health. These smaller particles and toxic substances in found desert dust enter in systemic circulation, thereby transported to all tissues and impose endothelial dysfunction (Münzel et al, 2018). These also increase the heart beat rate and mean blood pressure and decreased cardiac contractility (Chang et al, 2017). There is need to inhibit immunoglobulin mediated suppression of inflammation (Keil, et al, 2018), amplify pro-inflammatory cytokines and oxidative stress in respiratory epithelial cells (Ghio et al, 2014). These exacerbate pulmonary eosinophilia (He et al, 2016) and tissue injury (Wang et al, 2016) (Table 1).

Coal Dust

Coal dust is the main pollutant in coal mining areas (Xia et al, 2022. In addition, burning of coal generate huge amounts of CO_2 that is directly added to the atmosphere. Both smoke and coal particles intermix and suspend for longer period in atmosphere above human habitation and industrial areas. In addition, micro pollutants aired from surface transportation, rock ore mining, and wet aerosols increase the seriousness. Besides, various factors, such as wind, coal type, and the mining, processing technology used, and transportation modes, affect coal dust pollutants release and persistence in atmosphere (Xia et al, 2022). In these areas not only, human population get disturbed but plants in crop fields, orchards, and road side get heavy deposition of fine coal dust over leaf surface. These light dust particles and coal dust air lifted and transported with winds and reach to distant places. It also deposits over physical structures and plants, thus distributed with higher ventilation air velocities (Patts et al, 2017) (Figure 1 & 2).

Further, larger the coal dust content needs higher the oxygen (O_2) consumption rate and generate more carbon monoxide (CO) and fine coal particles which mix with humidity present in air very easily (Liu et al, 2022). This fine coal dust inhaled by people becomes an important triggering factor in disease development (Ge et al, 2021). It is inhaled by local residents and making them asthmatic with severe risks of lung cancer at global level. Coal dust particles cause pneumococosis in mining workers (Mu et al, 2022). These particles (CDP) also impose various toxic effects on lung epithelial cells, macrophages and induce pulmonary fibrosis ((Mu et al, 2022). Presence of PHLDB2 in air is the main cause of development of cancer (Ge et al, 2021). PHLDB2 might be a molecular maker for disease diagnosis or treatment (Ge et al, 2021). Most of the industrial emissions contain polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/F). All these increase risk of non-Hodgkin lymphoma (NHL) (- Deziel) (NC et al, 2017). Both industrial and mining dusts contain heavy metals (HMs) (Schonfeld et al, 2017) which cause severe respiratory and airway problems (Feletto, Eleonora et al) (Table 1).

Silica Dust

Silica, or silicon dioxide (SiO_2), is a group IV metal oxide, which naturally occurs in both crystalline and amorphous forms (i.e., polymorphic; NTP, 2005). Fine particles of silica are released from the silica-containing materials during its high-energy operations or processing such as sawing, cutting, drilling, sanding, chipping, crushing, or grinding. Fine particles of the crystalline silica contain Mg2xFe(2−2x) SiO4 and MgxFe(1−x) SiO3 (x = 0–1). These are released into the air becoming dust during stone processing. There are many forms of silica particles i.e. crystalline silica, microcrystalline silica consists of minute quartz crystals bonded together with amorphous silica. Amorphous silica consists of kieselgur (diatomite), from the skeletons of diatoms, and vitreous silica, this is produced during heating and then rapid cooling of crystalline silica. However, occupational exposure to respirable synthetic amorphous silica (SAS) dusts causes severe inflammation, and put adverse health effects (Yong et al, 2022). More often, inhalation of crystalline silica dust causes silicosis that is a form of occupational lung disease (Yong M et al, 2022). Symptoms which are seen in chronic silicosis are dyspnea, persistent cough, fatigue, tachypnoea, loss or appetite and weight loss, chest pain, and cracks in nails. This is also characterized by shortness of breath, cough, fever, and cyanosis (bluish skin). In silicosis inflammation and scarring is noted in the form of nodular lesions in the upper lobes of the lungs (Figure 1 & 2). It is marked by inflammation and scarring in the form of nodular lesions in the upper lobes of the lungs. It is a type of pneumoconiosis. It may often be misdiagnosed as pulmonary edema (fluid in the lungs), pneumonia, or tuberculosis. Moreover, amorphous silica exposure induces a small non-significant reduction in cell viability compared to crystalline silica which led to increased levels of toxicity. Silica dust affects human glial cells (astrocytes) in vitro cell cultures. By controlling and keeping the particle exposure levels low at the work place, help to minimize negative health effects (Arnoldussen YJ et al, 2019). Furthermore, particle exposure, in a dose-and time-dependent manner, affected the ability of the cells to communicate through gap junction channels (Arnoldussen YJ et al, 2019) (Table 1 & 2).

Table 2. Volatile organic compounds, solvents and Furnace fumes and its health/biological effects

Type of pollutant	Particle size	Source	Physical and chemical properties	Biological/health effects	References
Formaldehyde	particle *size ≤ 0.1µm,*	Plywood, furniture, decoration material and combustion products	Colourless irritant gas absorbed by the respiratory system	Throat discomfort, cancers of nasal, throat, oral, skin and alimentary canal	Ni P et al,

Benzene	40 picometres (pm).	Motor vehicle exhaust, paint, liquid detergents, wood satin, plastic pipes	Colourless transparent, oily liquid, volatile combustible	Inhibition of human hematopoietic function, anemia, Infection, brain, liver, kidney	Smith MT 2010
Total volatile organic compounds (TVOCs)	< 10 micrometres (PM10) and < 2.5 micrometres (PM2.	Quick drying paint, cleaning compounds coatings, adhesives, building and decoration materials, Volatile organic compounds (VOCs) are commonly found in consumer products, including furniture, sealants and paints.	Compounds with boiling range between 50-260 C	Irritation and discomfort of mucous membranes, and eyes, Chronic pulmonary diseases, including the onset and persistence of asthma and chronic obstructive pulmonary diseases	Alford KL, Kumar N 2021
Carbon monoxide	cracked heat exchanger less than 2.5 microns in diameter (PM2.	Carbon monoxide, often due to a cracked heat exchanger. carbon monoxide fumes can leak into your home and create a big problem	Odorless, tasteless, invisible, and poisonous, Inhalation of carbon monoxide can lead to injury or even death. That's why keeping furnace exhaust out of your home is important	Headaches, dizziness, Nausea, confusion, shortness of breath, blurred vision, loss of consciousness, sickness or death	Townsend C L, Maynard RL 2002
Oil, gasoline, diesel	between approximately 40 nm and 1 µm with a maximum concentration of particles in the size range of 0.1 - 0.2 µm	(NOx), (CO), (CO_2), (CH_4) (N_2O), Volatile organic compounds (VOCs), (SO_2) Particulate matter (PM)	Many of the by-products are pollutants. Contains harmful gases and by-products.	short-term (e.g., cardiovascular diseases or asthma) and long-term health effects, most notably cancer	Sydbom A et al, 2001
Welding fumes	particles range between 0.05 and 20 µm	oxides of zinc, Fe, Mn, and Si and Cr Zinc oxide fume is known as metal fume fever (MFF)	Dryness and irritation to the throat and larger airways in the lungs. coughing or tightness in the chest, acute irritant-induced asthma	Risk of some rare cancers, metal *fume* fever, acute pneumonia, stomach ulcers, kidney damage and nervous system damage	Abdullahi IL, Sani A. 2020

Ceramic Dust

Ceramic waste powder (CWP) contains silica as main component. Inhalation of silica (SiO_2) in occupational exposures can cause pulmonary fibrosis (silicosis), lung function deficits, pulmonary inflammation, and lung cancer. For granulation workers, long-term exposure to airborne silica dust for 30-45 years was likely to pose severe adverse health risks of inflammation and fibrosis. In ceramics manufacturing units long-term exposed workers develop occupational diseases (Liao CM et al, 2015) mainly develop potential hazard for silicosis in dusty workplaces (Kolton et al, 1981) (Table 1 & 2).

Rubber Dust

Among all types of dusts rubber dust is quite harmful. It contains $PM_{2.5}$ particles are more dangerous. Gaseous emission from rubber industry contains n-Nitrosamines. These are formed during curing/vulcanizing and preprocessing. Rubber industry also uses antioxidant beta-naphthylamine, which was banned in the 1950s. Its exposure in workers imposes bladder, stomach and lung cancers (Hidajat et al). Tire dust contains two main classes of chemicals organic and inorganic. Organic chemicals are especially toxic to aquatic creatures (such as fish and frogs), and depending on the levels, can cause mutations, or even death. In test tube laboratory experiments, they damage human DNA. Latex (a component of rubber dust) has been implicated in latex allergies and asthma. Rubber dust contains heavy metals such as lead and zinc. Rubber dust is also released from loaded trucks and goods vehicles during their movement on roads. Exposure to inhalable dust causes chronic respiratory problems. Rubber dust particles affect the respiratory system by directly entering into the respiratory tract while breathing. Rubber fumes severely affect lung function and generate acute pulmonary effects (Gopathy Sridevi et al, 2014). Lung function is affected by the rubber dust particles and the severity of the effect is time duration-dependent (Meijer, et al, 1998) (Table 1 & 2).

Plastic Dust

Plastic dust is quite harmful to human life as it has so many contaminants. Uptake of plastics by humans may cause adverse health effects (Vethaak and Leslie, 2016). More specifically, fiber shape microplastics (MPs) found in dust contain polyester (including PET), polyethylene terephthalate (PET) and polycarbonate (PC). These are very risky for circulation of blood and impose neoplastic related risks in humans. Long-term exposure to the dust containing synthetic fibers would induce airway and lung diseases, such as asthma, pneumothorax, alveolitis, chronic bronchitis and pneumonia (Pimentel et al., 1975) (Figure 1 & 2).

Asbestos Dust

Asbestos is a mineral that occurs in natural deposits around the world. Raw asbestos is often friable, or loose and crumbling. This means the asbestos fibers can become airborne dust. Because of this, the process of mining may release asbestos dust. All types and forms of asbestos may cause lung cancer, mesothelioma, cancer of the larynx and ovary and asbestosis (fibrosis of the lungs) (Figure 1 & 2). Asbestos is made up of microscopic bundles of fibers that may become air borne when distributed. These fibers get into the air and may be inhaled into the lungs, where they may cause health problems. These asbestos fibers are inhaled; they may get trapped in the lung tissue. The body tries to dissolve the fibers by producing an acid. This acid, due to chemical resistance of the fiber, but may scar surrounding tissue. It also generates chronic inflammation and fibrosis in the lungs and pleural linings of humans. Eventually, this scarring may become so severe that the lungs cannot function. It results in mesothelioma a type of cancer of pleura; it is evoked due to asbestos exposure. In addition to lung cancer and mesothelioma, asbestos exposure can also cause cancer of the larynx pharynx, stomach, ovary, and colorectum. Both pleura, bilateral and symmetric fibrotic plaques usually reflect environmental or occupational exposure to asbestos fibers, it results in asbestosis (Travis et al. 2002) (Table 1 & 2).

Metallic Dust and Fumes from Metallurgical Furnaces

Metallic dust is a heterogeneous substance with respiratory sensitizing properties. It is formed during manufacturing of goods, items and grinding. Its long-term exposure adversely affect lung function, thus may cause acute or chronic respiratory diseases. There was an exposure-response relationship of cumulative metal dust exposure with the deterioration of lung function values (Hamzah et al, 2016). Improvement of control measures as well as proper and efficient use or personal protection equipment while at work could help to protect the respiratory health of workers (Hamzah et al, 2016) (Figure 1 & 2). Heavy fumes are generated during extraction of metals from ores, calcining and sintering of ores, melting, refining and alloying of metals, heating of metals, and heat treatment of metals etc. Gases in furnace fumes typically contains about 20–30% carbon monoxide (CO) and about 2–6% hydrogen (H_2) as combustible components, and a significant amount of inert gases with about 45–60% nitrogen (N_2), and 20–25% carbon dioxide (CO_2) (Table 1 & 2).

The metal production and processing industry does pose significant threat to the environment by causing air pollution from fumes and dust. The process of manufacturing various ferrous and non-ferrous metals and alloys and metal forming processes as well as metal casting causes pollution and dust in the air. The foundry industry and its allied industries also suffer setback due to air loaded with dust that causes damage to the surrounding and to the people working in such environments. Smelting units like crucible furnaces and casting in crucible, even the shakeout stations cause dust in the air.

HEALTH RISKS

Workers exposed to hard-metal dust remain at risk of developing interstitial pulmonary fibrosis. Heavy metals cause neurotoxicity, generate free radical which promotes oxidative stress damaging lipids, proteins and DNA molecules. These free radicals propagate carcinogenesis of lung, liver, stomach, blood and kidney. Heavy metals cause noxious health effects (Figure 1 & 2). Heavy metal toxicity can lower energy levels and damage the functioning of the brain, lungs, kidney, liver, blood composition and other important organs. Uncontrolled dust can pose a risk to employee health, cause cross-contamination, reduce air quality, and even create fire and explosion hazards. Long term exposure to hard-metal dust in industry workers keep them at risk of developing interstitial pulmonary fibrosis, lung cancer and pneumoconiosis (Table 3).

Dust that reaches the air sacs and stays inside lower part of the airways where there are no cilia is attacked by special cells called macrophages. These are extremely important for the defense of the lungs. The way the respiratory system responds to inhaled particles depends, to a great extent, on where the particle settles. For example, irritant dust that settles in the nose may lead to rhinitis, an inflammation of the mucous membrane. If the particle attacks the larger air passages, inflammation of the trachea (tracheitis) or the bronchi (bronchitis) may be seen. Macrophages keep the air sacs clean. Dust particles and dust-containing macrophages collect in the lung tissues, causing injury to the lungs. Though cilia try to propel dust particles and macrophages virtually eat upon dust particles. Besides macrophages, the BALT (bronchus associated lymphoid tissue) generates immunoglobulins in response to invasion of dust particles. These antibodies attach to particles and neutralize them. Dust particles that cause fibrosis or allergic reactions in the lungs. Metal or chemical dusts cause acute toxic effects, and generate cancer.

Organic dusts originate from plants or animals. An example of organic dust is dust that arises from handling grain. These dusts can contain a great number of substances. Aside from the vegetable or animal component, organic dusts may also contain fungi or microbes and the toxic substances given off by microbes. For example, histoplasmosis, psittacosis and Q fever are diseases that people can get if they breathe in organic that are infected with a certain microorganism.

The amount of dust and the kinds of particles decide lung injury. For example, after the macrophages swallow silica particles, they die and give off toxic substances form scar and impair lung function. The particles which cause fibrosis or scarring are called fibrogenic. It is also known as silicosis. The changes which occur in the lungs vary with the different types of dust. For example, the injury caused by exposure to silica is marked by islands of scar tissue surrounded by normal lung tissue. Because the injured areas are separated from each other by normal tissue, the lungs do not completely lose their elasticity. In contrast, the scar tissue produced following exposure to asbestos, beryllium and cobalt completely covers the surfaces of the deep airways. The lungs become stiff and lose their elasticity.

Several factors influence the effects of inhaled particles. Among these are some properties of the particles themselves. Particle size is usually the critical factor that determines where in the respiratory tract that particle may be deposited. Chemical composition is important because some substances, when in particle form, can destroy the cilia that the lungs use for the removal of particles. Cumulative effects of smoking are seen in loss of tidal volume and lung capacity. Similarly, combined effects are developed from exposures to various dusts, gases, fumes and vapours inhaled for longer duration. Generally, inhalation of dust particles causes pneumoconiosis or dusty lungs.

Short-Term Effects

Short-term effects of inhaling air dusters include headaches, nausea, dizziness, fatigue, muscle weakness, stomach pain, mood swings, irrational or violent behavior, anger, slurred speech, and clumsiness, tingling in the hands and feet, hallucination, hearing loss and delayed reflexes. Currently it cannot be confirmed that dust exposure causes asthma to develop, however breathing in high concentrations of dust over many years is thought to reduce lung function in the long term and contribute to disorders like chronic bronchitis and heart and lung disorders.

Long-Term Effects

Recognize the long-term effects of huffing by unexplained weight loss, muscle weakness, depression, indifference, muscle spasms, ineptitude and an ill-temper. Permanent damage to vital organs including the heart, liver, kidneys and lungs occurs, as does damage to areas of the brain that control learning, motor skills, vision and hearing. A serious and sudden consequence of inhaling air dusters is Sudden Sniffing Death Syndrome. It can happen whether it's a user's first time huffing or not. It occurs most often when inhaling aerosol products like air dusters. Sudden Sniffing Death Syndrome results in rapid and irregular heartbeats that lead to cardiac arrest and death. Another fatal consequence of inhaling air dusters is suffocation. When the fumes enter the lungs and central nervous system, oxygen levels are depressed so that the user is unable to breathe and suffocates.

IMMUNE RESPONSES TO DUST PARTICLES

Though, lungs possess epithelial cells which function as physical barrier, these cells play important roles in the generation immune response against dust. Epithelial cells form respiratory lining inside lungs display Toll-like receptors (TLRs), C-type lectin receptors (CTRs) and protease-activated receptors (PARs). These receptors respond and send signal in response to dust particles and release inflammatory cytokines such as IL-6 and IL-8. These cells also release inflammatory mediators such as IL-25, IL-33 and TSLP (Hammad and Lambrecht 2008). Dust particles can be sensed by airways epithelial cells, activate macrophages, dendritic cells and innate immune cells. These initiate immune responses by deploying specific immune cells such as T helper cells subsets (Th1, Th2, Th17), T cytotoxic cells and B cells. Dust particles can be sensed by airways epithelial cells, activate macrophages, dendritic cells and innate immune cells and then initiate responses in various populations of specific immune cells such as T helper cells subsets (Th1, Th2, Th17), T cytotoxic cells and B cells. Initiation of inflammatory immune responses, activation of immune cells and releases of many cytokines, chemokines and other inflammatory molecules, have variable pathologic effects on lung in different respiratory diseases. Th2 immune cells are most important cells in progress for allergic asthma and eosinophilic inflammation. IL-4 and IL-13 are two major cytokines of Th2 cells, assisting in the production of IgE. Interleukin 13 is being involved in mucus production, airway remodeling and fibrosis (Hansel et al, 2013). In addition to Th2 cells, Th17 cells have important roles in pathogenesis of asthma and allergic airway disease. In addition to Th2 cells, Th17 cells have important roles in pathogenesis of asthma and allergic airway disease. Th17 cells are a T cell effector subset that produces high levels of IL-17 and IL-22 cytokines (Aujla SJ, Alcorn JF. 2011). Innate lymphoid cells 2 (ILC2), another group of innate lymphocyte-like cells, are also involved in inflammation and remodeling in asthma. ILC2 cells contribute to airway hyperreactivity and could be important in the initiation of the acute allergic responses (Spits et al, 2013; Hams and Fallon 2012). COPD the innate immune response and cell mediated immune response is generated by T cytotoxic.

Silica (SiO_2), which is mainly derived from feldspar and quartz, is the major mineralogical component of Asian sand dusts. Long-term exposure to crystalline silica causes silicosis is a chronic occupational pulmonary disease, which is characterized by inflammation and fibrosis of the lung (Castranova, Vallyathan 2008; Hamilton et al, 2008). After inhalation, silica particles are quickly engulfed by alveolar macrophages and in response these cells release inflammatory mediators [73,74] Yucesoy et al, 2001 Yucesoy et al, 2002); Excessive exposure to silica also has been associated with tuberculosis, chronic bronchitis, COPD, and lung cancer (Rimal et al, 2005).

Desert Dust, Microbes and Respiratory Disease

Different species of pathogenic and non-pathogenic bacteria are constituents of desert dust. However, currently the virulence characteristics of these microorganisms are not well understood and need to be further investigated (Mehta et al, 2000). However, it is clear that the presence of potentially pathogenic microorganisms in respirable particles (≤ 2.5 μm) could contribute to various health effects, especially in the respiratory system. Gwang Pyo. et al. have suggested that different microorganisms are transported in East Asia during Yellow Sand events which is known to be linked to increased incidence of infection which leads to significant adverse health effects (Lee et al, 2009; Choi et al, 1997). It is believed that dust storms can serve as carriers for the pathogens, promoting infections upon inhalation. For example, Neisseria meningitides residing in the mucosa can gain access to underlying tissue and blood following exposure to particles from dust storms (Kang et al, 20002). Other pathogens have also been detected in dust storm particles.

Few microbial products found deposited over the surface of sand dust particles. More specifically, lipopolysaccharide (LPS) is a glycolipid of gram-negative bacteria cell wall and glucan, a major constituent of fungi are microbial products found coated over sand particles. These are responsible generation of neutrophilic pulmonary inflammation (Takano et al, 2002; Young et al, 2001). Both LPS and β-glucan are identified by pattern recognition receptors (PRRs. Signaling via the PRRs results in the release of different pro-inflammatory cytokines and chemokines. These are combined with the induced maturation of the antigen-presenting capacity of dendritic cells, these activate innate lymphoid cells, T helper cells (Th1, Th2, Th17), T cytotoxic cells and B cells. In response to inhaled dust-storm particles and its associating microbes the immune activation is done in the lungs (Holgate 2012; Habibzay et al, 2012).

Immune responses to different particles in desert dust. Various components of dust that penetrate into the airways have effects on the epithelium. In addition to the physical barrier role of airway epithelial cells, these cells also play important roles for the immune response. Interacting with airway epithelial cells, macrophages, dendritic cells and innate lymphoid cells are activated and contribute to the inflammatory immune response. Furthermore, cross-talk between epithelial cells and dendritic cells (DCs) can mature the antigen presenting capabilities. DCs can present antigen to different subsets of T helper cells. As result of the cellular interactions, other immune cells such as B cells and T cytotoxic cells can also be activated in response to dust particles in the airways.

SAFETY MEASURES AND PRECAUTIONS

So many methods are available in form of duct and air filtration system to reduce dust or polluted air from the working zone. These instruments absorb the house hold dust and keep it out. For reducing industrial dust density rotary air sucking system with strong air filters is required. A speedy motor operated air flow system is used to control both temperature and humidity, it helps to remove toxic air from the workplace and naturally reduce intensity of occupational and environment health hazards. Toxic wastes dispersed in air/atmosphere can be collected by using latest technology to reduce the density of particulate matter deposited to the soil, water and vegetation depending on their density. From a metal industry, micro-pollutants (cadmium (Cd), nickel (Ni), iron (Fe) and cobalt (Co) can be collected by electric precipitators. For fibrous dust Cleantech Metal Dust Collection equipment and Wet Dust Collector reduce the hazardous dust indoor of any industry and milling area or a habitation center. This system is capable of controlling exposures to the workers. To avoid respiratory or other problems caused by exposure to dust, controls must be implemented. However, exhausting air containing dust can be collected in through a collection system before emission to the atmosphere. First try to separate hazardous substances substituted with non-hazardous substances. To avoid respiratory or other problems caused by exposure to dust, controls must be implemented Personal protective equipment should not be a substitute for proper dust control and should be used only where dust control methods are not yet effective or are inadequate. Workers themselves, through education, must understand the need to avoid the risks of dust. Meanwhile, enclosure of dust-producing processes under negative air pressure

USE OF PROTECTIVE DEVICES

Use of personal protective equipment may be vital, but it should nevertheless be the last resort of protection. Before entry into the lungs air is filtered inside the nose and particulate matter is sticked over hairs and mucous mass. Thus, particles suspended in the air enter the nose, but not all of them reach the lungs. Some of the smaller particles succeed in passing through the nose to reach the windpipe and the dividing air tubes that lead to the lungs. These tubes are called bronchi and bronchioles. All of these airways are lined by cells. The mucus they produce catches most of the dust particles. Tiny hairs called cilia, covering the walls of the air tubes, move the mucus upward and out into the throat, where it is either coughed up and spat out, or swallowed. The air reaches the tiny air sacs (alveoli) in the inner part of the lungs with any dust particles that avoided the defenses in the nose and airways. The air sacs are very important because through them, the body receives oxygen and releases carbon dioxide.

CONCLUSION

Micro-pollutants found in air in multiple forms, size and shape these are potential biological or chemical contaminants that make their way into ground and surface. Unfortunately control of desert dusts is more difficult than control of air pollution. Fresh and clean air support our life, not only us, but all living beings feel cherish to live. If any addition of harmful gas, particulate matter, smoke or smog or dust or fumes enters into it deplete and alter its quality. These chemicals also adhered on dust particles surface, react in open environment with gas particles, reach inside lungs through inhalation, and enhance toxicity of aerosols in urban environments for prevention and treatment of respiratory diseases that are caused by desert dusts, researchers need well-designed epidemiological studies, combined with analysis of the precise composition of sand dusts, and the precise mechanisms of the immune responses. Recognizing the exact cellular and molecular immune mechanisms would be very useful to find new approaches for treatment of desert dust associated pulmonary diseases.

Different dust particulate matter cause allergies, skin and acute pulmonary chronic respiratory problems with serious decrease in lung function that is exposure and time dependent. Its long-term exposure causes permanent damage to vital organs including the heart, liver, kidneys and lungs occurs, as does damage to areas of the brain that control learning, motor skills, vision and hearing. Toxic fumes from furnaces, plastic and coal burning cause rapid and irregular heartbeats that lead to cardiac arrest and death. Another fatal consequence of inhaling air dusters is suffocation. When the fumes enter the lungs and central nervous system, oxygen levels are depressed so that the user is unable to breathe and suffocates.

Many countries have made clean Air Act to control pollution and climate change and resolve public health challenges. Plantation of more and more trees, forest covers, green patches, clean cultivation practices, use of bio-pesticides be made essential to minimize pollution levels and associated health risks. A third critical challenge is that climate change is expected to exacerbate air pollution in many locations, making it harder to ensure that people have safe air to breathe, Clinicians have an important role to play in helping patients understand how climate change and air quality play a role in their health. In addition, as trusted information sources, clinicians can be effective in raising awareness about the health consequences of air pollution and climate change. To improve the air quality at regional, national and international level there is a need to control industrial emissions, and complete ban be made on stubble, biomass and plastic burning, furnace fumes, fossil fuel burning.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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