CHAPTER 1

Introduction to Environmental Pollution

1.1 INTRODUCTION

Amongst the developing countries, India is the foremost nation to take note of degradation of environment. In 1972, in the world environmental conference held at Stockholm, our government declared that it is their responsibility to control pollution in India. Even during recent global conference held at Kyoto in Japan, India accepted the responsibility of reducing global warming and depletion of ozone layer by banning the use of chloro-fluoro carbons in cryogenic engineering within a stipulated period. Even in the recent conference held in Rio-de-Janeiro, India declared solidarity by conforming to the standards as stipulated by United States Environmental Protection Agencies (US-EPA). Perhaps India was the foremost country in third worlds to implement rigorously pollution legislation both for air and water. We accepted the stipulated levels of the pollutants in act designated as 'maximum permissible level' to be implemented in successive stages in few years.

Within India, Maharashtra state was the front runner to enact Water Pollution and Control Act in 1962. This was followed by passing of Comprehensive Environmental Protection Bill for prevention of air pollution in 1983. Maharashtra, Gujarat, Madhya Pradesh were the first states in Indian union to have pollution control board with attached analytical laboratories. This was followed by the setting of series of laboratories in all remaining states of the nation. A legislation was passed. The grave tragedy of Bhopal in 1984 by accidentally releasing deadly poisonous gas such as methyl isocyanate took a toll of more than 4500 people who were innocent and helpless. With the growing civilisation and with rise in traffic, auto-exhaust emission also takes a toll of people. Therefore government enacted 'PUC' act to check every vehicle periodically and control, release of hazardous gases like NO-NO_x, CO, and hydrocarbons in air.

As a matter of fact, India did much more than any other developing country could do to control pollution. Even in controlling global warming and reduction of the Green House gases we were certainly ahead of developed countries like Canada, USA, Australia. General incentives were given by our government to design and develop indigenously pollution monitoring instruments within the country and make us self-sufficient. At moment, separate ministry looks after all problems related to pollution. In fact, all nations have their own ministry or department to implement effectively legislation related to control of pollution. We have passed act and prevented transportation of hazardous chemicals a big

offence on express highways. The abatement of noise pollution surrounding airports, hospitals was taken care by our legislation. Environmental Impact Assessment (EIA) was rigorously followed during setting of new industries and environmental modelling has been used to carry out future foresting of pollution and resorting to effective control measures of pollution.

Basically, our environment is composed of atmosphere, earth, water and space. In absence of pollution, it remains clean and enjoyable. The interaction of the atmosphere, lithosphere, hydrosphere and biosphere is continuing for years together. On account of the various activities of man, the composition and complex nature of environment gets changed. These activities include industrialization, construction, transportation. Such activities, although desirable for human development and welfare, lead to generation and release of objectionable materials into the environment thus turning it foul, and rendering our life miserable.

The natural environment is clean, but due to multiferious activities of man it gets polluted resulting in what is called as environmental pollution. Our main aim should be to keep our environment clean, by curbing industrial activities. However, in order to keep pace with the rapid industrialisation world over, a developing country like India cannot afford to arrest its industrial growth. We can select such industrial processes, which would cause minimum or zero pollution. Further, it is necessary to undertake pollution control measures, so as to enable us to keep our environment as clean as possible.

Our environment is complex. It gets fouled when industrial activities grow. To comprehend this complex nature of environment, we need knowledge of all disciplines of chemical, physical and biological science. To devise control measures, we need knowledge of engineering and technology. Environmental Science and Engineering is inter-disciplinary in nature. To understand atmosphere we need knowledge of physics and meteorology, while for knowing hydrosphere and air we need knowledge of chemistry, the complex behaviour of living organism can be really explained with a knowledge of the life sciences. The interaction in lithosphere can be best understood from principles of earth science, while the entire control mechanism can be devised only with intricate knowledge of engineering and technology. In the process of measurement we collect enormous data, which can be interpreted and understood only if we are conversant with statistical analysis and computer programming and environmental modelling. Some concerted effort must be made to keep our environment clean. It will lead to betterment of our lives and peaceful coexistence on the earth.

1.2 WHAT IS POLLUTION?

Our next task to keep the environment clean is to measure the damage caused to it by pollution. Without understanding the extent of damage caused to our environment due to pollution, it may not be possible for us to clean it. Such cleaning involves development of suitable control measures. Now these suitable control measures can be meticulously planned, provided we know what the level of pollution is? Hence, to understand the level of pollution, we should undertake the analysis or measurement of pollution. This analysis or measurement is termed as *Environmental Pollution Analysis*, which will throw light on exact degree of pollution. It will guide us to recover valuable products from waste and help us to take appropriate control measures to minimise pollution. With this objective in mind we should try to learn environment pollution analysis, so as to undertake the analysis, we must know the type of pollution.

Environmental pollution is classified into various groups. For instance, pollution of air is termed as the atmospheric pollution, the pollution of hydrosphere or water is termed as water pollution, while pollution due to disposal of waste water is termed as industrial effluents pollution. Similarly, indiscriminate dispersal of domestic sewage or sullage is called domestic effluent pollution. In addition to these major sources of pollution we have pollution of lithosphere or land, called soil pollution. For instance

pesticide residue contribute towards soil pollution. Urban areas are blessed with the menace of noise, which at times becomes intolerable. It is called noise pollution. Some kind of pollution lead to generation of smell or odour; and as such its measurement becomes important. In this chapter, let us have a glimpse of different kinds of pollution.

1.3 ATMOSPHERIC POLLUTION

Amongst the various types of pollution, air pollution is of greatest importance. It can be readily noticed as it causes immediate health problems. The hazardous gases that lead to pollution are oxides of carbon, nitrogen and sulphur (Table 1.1). Particulate matter also causes air pollution. Table 1.2 indicates level of suspended particulate matter in cities of India. The emission due to auto-exhaust causes serious pollution of air due to formation of oxides of nitrogen and benzopyrene. Table 1.3 indicates the level of BaP *i.e.* Benzopyrene in various towns of the world, and Table 1.4 shows BaP level at various places in Mumbai. BaP is generated by incomplete combustion of petrol. This is a serious air pollutant as it

Table 1.1 Growth of air pollution (1978–1986) in μg/m^3

S. No.	*Place/Town*	*SPM*	*SO_2*	*$NO–NO_x$*
(A) Levels of air pollution in Mumbai (1986)				
1.	Chembur	341	65	51
2.	Lalbaug	454	128	–
3.	Khar	349	11	77
4.	Babula Tank	318	56	56
5.	Parel	326	47	70
6.	Dadar	–	60	–
7.	Sewree	–	60	–
8.	Ghatkopar	407	75	–
9.	Sakinaka	–	49	–
(B) Levels of air pollution in India (1978) and abroad				
10.	Bombay (Mumbai)	238	172	50
11.	Calcutta (Kolkata)	500	58	51
12.	Delhi	700	90	35
13.	Kanpur	500	40	30
14.	London	150	87	29
15.	New York	–	135	42
16.	Tokyo	–	59	62

Table 1.2 Suspended particulate matter (SPM) in major cities in India (1978) μg/m^3

City	*Urban area*	*Suburban area*	*Residential area*
Bombay (Mumbai)	123	150	221
Calcutta (Kolkata)	352	324	246
Delhi	361	256	391
US (EPA) Standard	75	75	75

Table 1.3 Benzopyrene levels abroad

Country	*Town*	*Level μg/m³*
Germany	Hamburg	17–1863
Hungary	Budapest	32–1060
Iran	Tehran	0.61–63
Japan	Osaka	11.1
Poland	Warsaw	29–133
Spain	Madrid	0–9.4
Sweden	Stockholm	15–27
USA	Urban average	0.5–18.6

Table 1.4 Benzopyrene levels in city of Mumbai

Place	*Range of concentration (μg/1000 m³)*	*Source of emission*
Lalbaug	165.0 to 861.0	Gas plant where coal is burnt
Dadar	7.1 to 16.2	The gas plant was shut down
Sion	15.0 to 36.0	Automobile exhaust
Koliwada	17.4 to 225.1	Kiln for firing pottery
Trombay	2.0 to 13.0	Petrochemical area
Bhandup	0.8 to 2.0	Residential area
Colaba	3.1 to 3.9	Coastal area

Table 1.5 Levels of noise pollution in general

Locality/Source	*Noise level, dB*
Garden	20
Bed rooms	25
Libraries	30
Living rooms	40
Conversation	60
Business office	67–70
Average street traffic	80–85
Heavy truck traffic	90
Pneumatic chipper	100
Pop music	110
Jet take off (at 100 m distance)	125
Jet engine (25 m distance)	130
Threshold of pain	140

has carcinogenic properties causing lung cancer. The figures refer to pollution noted two-three decades ago. The present level of pollution is 4-5 times the figures cited.

Noise is another source of pollution. Noise is measured in decibels *i.e.* dB. Table 1.5 list levels of noise in general while Table 1.6 gives noise in industrial town and Table 1.7 presents noise level in Mumbai in various locations, which is domestic noise. The human being can tolerate on an average 45-60 dB without much discomfort, however, beyond this limit it causes mental fatigue, irritation and other health hazards.

Table 1.6 Noise levels in two typical industrial towns in India

Visakhapatnam (Andhra Pradesh)		*Rourkela (Orissa)*	
Location	*Noise level (dB)*	*Location*	*Noise level (dB)*
Aseelemetta	81	Near Court	85.5
Gopalpatnam	82	Mangal Bhavan	86.1
B.H.P.V. Junction	75	Daily Market	83.2
Gyanapuram	78	Near Nala Road	76.3
Gurudwara Junction	77	Old Bus Stand	80.5
Dondaparthi	76	Madhusudan Market	84.8
Old Kotha Road	73	New Bus Stand	84.5
Ram Nagar	72	Near UCO Bank	76.6
Siddartha Nagar	76		
Thadichetlapalam	75		

Table 1.7 Noise level during festivals and normal times in Mumbai

S. No.	*Locality*	*Noise level (dB)*	
		In festival	*Normal times*
1.	Prabhadevi	101	70
2.	Pedder Road	108	75
3.	Opera House	98	70
4.	Tejpal Ground	90	68
5.	Goregaon (Dindoshi)	81	50
6.	Goregaon (Charkop)	88	55
7.	Colaba	57	40

1.4 SOURCE OF AIR POLLUTION

We have various sources for air pollution. These are burning of coal and coke, industrial emissions, commercial activities, thermal power generation unit and last but not the least is transportation. Table 1.8 lists various sources of atmospheric pollution (Fig. 1.1). Table 1.9 indicates as to how much air pollution is caused by burning sulphur containing fuels. Though wood causes zero pollution, its calorific value is poor, while fuel oil produces pollution due to SO_2 but it has high calorific value.

Transportation is a major source of pollution causing the highest pollution in metropolitan cities in India. Table 1.10 lists the population of two wheelers in various cities of Maharashtra, while Table 1.11

Table 1.8 Source of growing atmospheric pollution in developed countries

Source	*1973*	*1978*	*1983*	*1986*	*1990*
Domestic sources	34.2	43.5	47.12	53.58	55.00
Commercial point	4.92	6.15	6.34	6.95	7.00
Industrial estates	43.8	51.2	56.4	64.4	70.0
Power generation	12.2	12.2	48.94	46.95	40.0
Transportation	39.8	64.6	10.63	13.14	15.6
Others	40.0	64.6	10.64	13.15	15.0

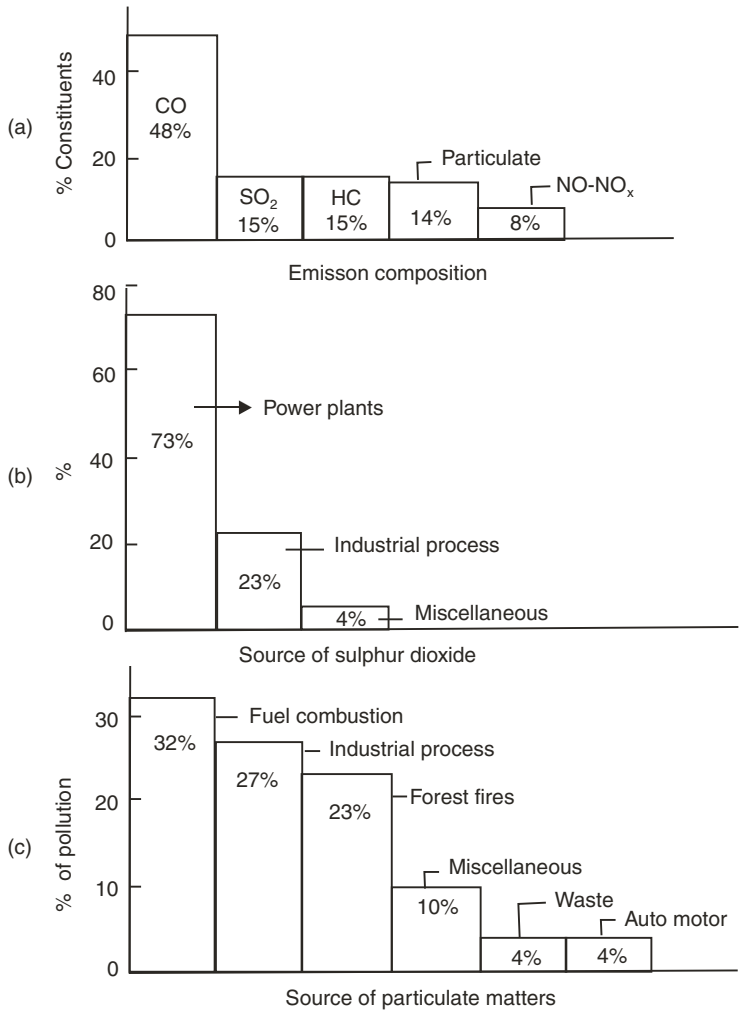

Fig. 1.1 Histograms for air pollutants

Table 1.9 Amounts of sulphur in fuels emitting SO_2 gas

Substance	*% S*	*Calorific value*
Wood	0	18
Peat	1	18
Lignite	1.3	23.2
Bituminous fuel	1.6	25.5
Semibituminous fuel	1.2	36.0
Anthracite	1.0	34.0
Coke	<1.0	29.0
Crude oil	0.5–3.0	–
Fuel oil	2–4	43.5
Coal tar fuel	0.5	37.8
Town gas	–	18.6
Natural gas	Trace	34.0
Producer gas	–	4.5

Table 1.10 Population of two wheelers in various cities of Maharashtra (1970)

City	*Number (approx.) (thousands)*
Bombay (Mumbai)	200.00
Thane	7.00
Pune	150.00
Nagpur	77.00
Nasik	14.00
Aurangabad	29.00
Kolhapur	21.00

Table 1.11 Population of light vehicles in India (all figures in thousands)

Year range	*Two wheeler of over 150 cc*	*Scooters*	*Mopeds*
1970-75	43,000	58.40	11.70
1975-80	70,000	101.70	36.20
1980-85	11,600	210.00	105.00
1985-90	175,000	400.00	425.00

lists overall production of light vehicles in India, which are responsible for vehicle emissions. The growth rate shows that as the activity of production increases, vehicle pollution also rises. The

photochemical smog which is obtained by combination of smoke and fog contributes several pollutants to air (Figs. 1.2 and 1.3) e.g. CO, CO_2, NO–NO_x, SO_2, Hydrocarbon (HC), etc., as listed in Table 1.12. A typical petrochemical plant in Gujarat has shown different levels of air borne (SPM) particulate in the atmosphere (Table 1.13). The thermal power plants in India are responsible for causing extensive air pollution. A typical thermal power plant in the capital of India throws daily 80 tons of flyash and several tons of SO_2 in the atmosphere. Amongst Indian cities, Delhi and Kanpur have the highest dust fallout, Mumbai emits highest SO_2 emissions, while Kolkata contributes its share by emitting largest proportion of NO–NO_x in the air.

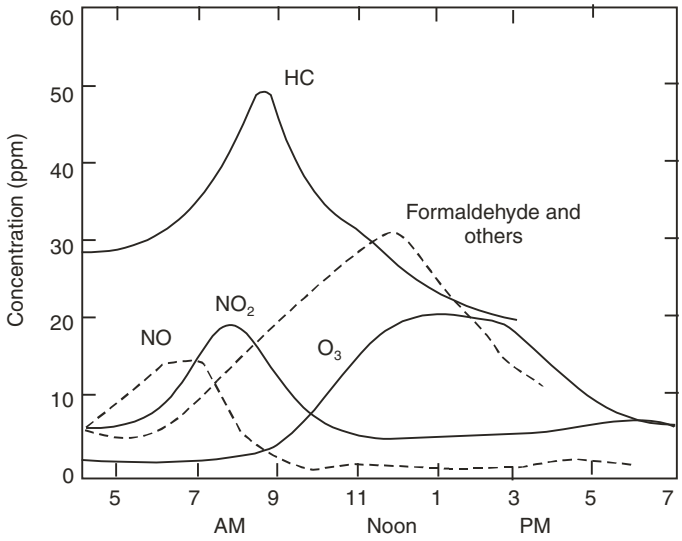

Fig. 1.2 Different pollutants in photochemical smog

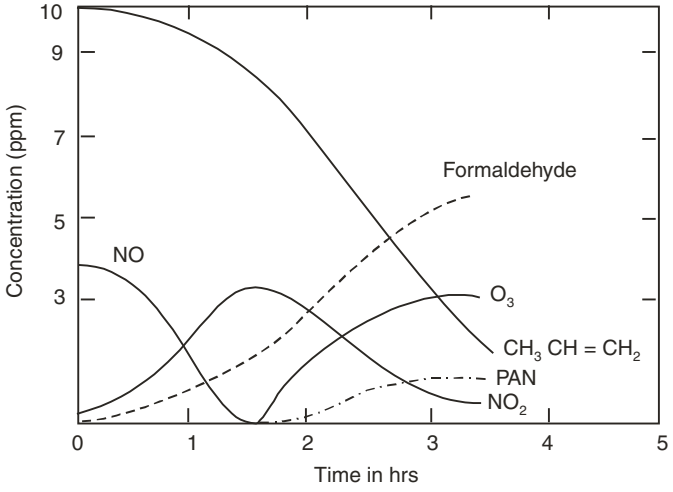

Fig. 1.3 PAN and other pollutants in smog

1.5 WATER POLLUTION

Water pollution has been studied in great details. The indiscriminate disposal of water after use in the form of waste causes water pollution. The tragic incident of Minnamata in Japan is well known. A paper factory using mercury compounds carelessly dumped its waste effluents into the sea, it formed $(CH_3)_2Hg$ and $(CH_3CH_2)_2Hg$, which in turn was consumed by the sea fish. The Japanese people who consumed such fish showed symptoms of mercury poisoning like gingivitis, vomiting, fever, diarrhoea, paralysis of extremities, etc. There were several instances of marine flora and fish dying in the sea, on account of deoxygenation of water, perhaps due to thermal pollution. Most of the rivers in India are polluted due to industrial activity. In Mumbai, Ulhas river is polluted due to disposal of effluents from rayon and dyestuff industries. Some rivers in India with polluting industries shown in parenthesis, are listed: Ganga (jute, sugar), Sone (paper pulp), Gomati (paper), Yamuna (insecticides), Chaliyar (rayon waste),

Table 1.12 Typical concentration of trace constituents in photochemical smog

Constituent	*Concentration, ppm*
Oxides of nitrogen	20
NH_3	2
H_2	50
H_2O	2×10^6
CO	4×10^3
CO_2	4×10^4
O_3	50
CH_4	250
Higher paraffins	25
C_2H_4	25
Higher olefins	25
C_2H_2	90
C_6H_6	10
Aldehydes	60
SO_2	20

Table 1.13 Analysis of lead and vanadium in petrochemical complex in Gujarat refinery campus

Period hr (interval)	*Mass of filter paper and sample gm*	*Mass of filter paper gm*	*Mass of sample gm*	*Total amount of Pb(II) μg/litre*	*Amount of V(V) mg/litre*
18	0.803	0.724	0.079	36.67	0.73
4	0.787	0.749	0.038	13.78	1.93
6	0.789	0.750	0.039	7.63	1.52
16	0.771	0.719	0.052	3.43	1.14

Kaveri (rayon, sugar), Godavari (paper, small-scale industries), Mahi (dyestuff), Mullamutha (antibiotics), Brahmaputra (black liquor), Juhari (fertiliser waste), Patalganga (organic chemicals) and Valdhun (disposal of dye intermediates). It is pardoxial to note that holier is the river, more it is polluted. It is bound to be polluted due to disposal of industrial effluents in the streams that feed the river. The Government of India had constituted the Ganga River Authority to keep the Ganges clean. We need such authority for all principal rivers in India. There exist similar organisations in most developed cities of the world, e.g. Thames River Authority in England.

1.6 INDUSTRIAL EFFLUENTS

The water after it is used once for industrial purpose cannot be reused for the same purpose without treatment. Such water which emerges out after use from industries is called as the industrial effluents. Such effluents have no definite composition, as anything which is not required is carelessly dumped into its stream. Such unwanted disposable material is contributed by chemical firms, food and beverage industry, textile and apparel industries, electronics and electrical material industries, or thermal power plants. The quality of such water is characterised by the study of its various physical, chemical and biological properties. The disposal of arsenic compounds by paper industry, or toxic chemicals by fertiliser plant had caused serious problem in western India. In many places, town authorities have not hesitated to let up sewage into streams or brooks or rivers, presuming that dilution would solve the pollution problem. Unfortunately, biological matter and bacteria such as coliforma, streptococcii, fecal coliforma, crenthronix, are not eliminated by mere dilution. Such water needs chemical treatment, like disinfection. This would also kill pathogenic bacteria.

1.7 POLLUTION DUE TO DOMESTIC EFFLUENTS

Very few cities in India have regular sewage treatment plants. Even major cities like Mumbai, Kolkata do not have plants to treat all sewage and sludge. Further most of our villages are fitted with antiquited treatment plants or septic tanks. The growth of slums in bigger metropolitan cities like Mumbai, Kolkata, Delhi are posing alarming problems of sewage disposal. In fact, the greatest problem that Ganga Water Authorities had faced during their initial working was the tackling of untreated and indiscriminately disposed off sewage. The untreated domestic sewage causes serious health problems. Even the cities in China with largest population are clean, because they have efficient sewage disposal network. The release of untreated sewage in sea causes serious problem with marine life, e.g. a huge amount of sardines in Mumbai sea were killed a decade ago (1958) due to release of sewage from a nearby industrial plant without proper treatment. The oil pollution deteriorates the aquatic marine environment, as several grades of oil are nondegradable. The oil slick caused due to Gulf War had caused enormous problem for India and neighbouring countries.

1.8 POLLUTION DUE TO PESTICIDES

Pesticide residue is the definite source of pollution of land and soil. A list of such pesticides in use is quite lengthy. The most important ones like DDT, malathion, para-malathion, aldrine, dialdrins, cause a serious problem of land pollution. The characterisation and determination is not simple. Some pesticides have deleterious effect on health. Several of them are carcinogenic and cause long term harmful effects upon health and hence need urgent analysis.

1.9 PROBLEM OF SOLID WASTE

The liquid waste was thoroughly investigated by environmentalists, but that is not the case with solid wastes. As a matter of fact with greater industrialisation, the production of colourful cartons, boxes and packings for food, beverages, drugs and edible oil, we have an alarming problem of solid waste disposal. The problem is further aggravated due to nondegradable nature of plastic and polymeric materials. A survey was made decades ago in the city of Mumbai on a typical solid waste composed of garbage, paper, glass, plastic, etc. It was found that animal waste (1500 tons) constitutes the largest share followed by mineral waste (1100 tons), agricultural waste (550 tons), with household waste of (250 tons) per year. In comparison, paper (30 tons) and plastic waste (4 tons) was very less. The methods for disposal of such solid waste are tedious. They are physical compositing incineration and land filling. All these methods available for their disposal are expensive. Table 1.14 gives percentage of solid waste in different towns in India as well as in typical cities of America, England, Japan and Switzerland. Such waste had all components of nature. From Table 1.14 it will be noted that the highest garbage was encountered in city of Pune, while paper and glass was disposed heavily in American cities, rags were extensive in Japanese solid waste, while Mumbai headed the list for having maximum of non-degradable plastic waste.

Table 1.14 Disposal of solid waste (%)

	Garbage	*Paper*	*Glass*	*Rags*	*Plastic*
USA	5.0	54.4	9.1	2.6	1.7
UK	13.0	50.0	6.0	3.0	–
Switzerland	14.5	33.5	8.5	3.0	2.0
Japan	36.9	24.8	3.3	7.1	2.2
India (average)	31.7	0.25	1.0	3.6	0.2
Nagpur	31.4	0.2	0.07	0.3	0.2
Pune	67.6	8.7	0.6	1.6	0.7
Kanpur	35.8	4.5	1.0	5.7	0.8
Kolkata	45.1	3.2	0.4	3.6	0.6
Mumbai	52.3	12.0	–	4.3	2.7

1.10 METAL POLLUTANTS

We have several elements in the periodic classification, of this few are metals. Fortunately, only 17 of these metals are toxic. Of these some are commonly utilised metals, while other are less frequently used and are termed as rare metals. The important toxic metals are: Be, Os, Pt, Hg, T1, V, Te, Co, U, Se, Cd, Pb, As, Sb, Cr, Ni, Zn, Mn. Their toxicity varies with threshold limiting value (TLV) = 2 $\mu g/m^3$ to 5000 $\mu g/m^3$. This is the maximum or permissable tolerable limit for a human. The different metals have different degrees of toxicity. Mercury causes tremor, renal disorder; lead causes plumbism, gastric and colic problems; cadmium is a cumulative poison, it causes anaemia and hepatic disorder; vanadium causes wheezing dyspnea; arsenic causes skin cancer and dermatitis; osmium causes halo around eyes and bronchitis, while tellurium consumption gives garlic odour to breath and sweat. Some of these metals are carcinogenic. They lead to cancer of lung, nose, liver pleura, thyroid. Sources of these metal pollutants are varying, some of these pollutants are encountered in water and air, effluents, solid waste

and sewage. A reliable method for their characterisation and quantitative determination is needed. They are emitted out from various sources, e.g. waste water from electroplating industry (Cr, Ni), air emission from fluorescent lamps (Cd, Be), paint pigment waste (Pb, Cr), auto-exhaust emissions (Pb, Te). It is imperative to understand their toxic effects upon health, before devising the method for their analysis and control.

1.11 ENVIRONMENTAL CARCINOGENS

Apart from metals, several of the organic compounds encountered in environment cause cancer. Their chemistry is complex and as such it is really difficult to ascertain the mechanism of interaction. 3-4 Benzopyrene (BaP) is one such deadly compound, which causes cancer of lung in industrial areas. BaP exist in auto-exhaust emissions, incompletely burned tobacco and cigarettes. In Table 1.3 various levels of BaP in different towns in the world are indicated; a similar list for Mumbai in Table 1.4 is also available. In a typical winter, the central Mumbai region showed highest level of BaP as 400 $\mu g/m^3$ due to location of coal gas manufacturing unit in the Lalbaug one time a labour area of Mumbai. The south Mumbai had 3.5 $\mu g/m^3$ while north Mumbai had 1.4 $\mu g/m^3$. The eastern suburbs of Mumbai had varying limit of 15-36 $\mu g/m^3$ due to location of several brick and kiln factories. A consumption of 1000 cigarettes emits 2-122 $\mu g/m^3$ BaP, which is sufficient to kill a large human population. A survey of the workers in England working in gas plant, gas retorts with coal or producer gas, crane operators, printers, chimney sweepers, asphalt workers, street cleaners showed that they were largely affected by cancer of lung. A large number of organic compounds like benzidine, β-napthylamine, 4-aminodiphenyl, 4-dimethylaminobenzene, 4-nitrodiphenyl are all confirmed as carcinogenic compounds.

1.12 CONTROL OF POLLUTION

The environmental pollution is the most burning problem, requiring immediate attention by the society. A survey of basic needs of man in America revealed the order of preference that people wanted consideration of issues such as environment, odour, bus fare, parks, employment, noise, medical care, schools, roads, garden and home. However, they gave top priority to the stoppage of degradation of their environment in preference to other important issues. In England there was greater awareness since 1952. With the enforcement of clean air act (1968), air was cleaned, while in the USA, Environmental Protection Agency (USEPA) was established. In India since 1962 Maharashtra was the first state to enact Water Pollution Act, followed by preparation of the draft proposal for Air Pollution Control in 1980. Fortunately the Central Government is aware of the problems. It enacted comprehensive environmental protection bill in 1986 to include legislation on abatement of noise pollution. Mumbai city was the first to introduce a bill for transportation of hazardous chemicals (1988). In spite of this we have tragedy of spilling of chemicals on roads. We have now boards for abatement and control of air and water pollution in every state of India, including union territories. However, these control measures shall not be effective, unless environmental education is imparted compulsarily from primary school to college and university level. We have the Department of Environment and Forest of the Central Government under the Ministry of Environment. Agencies to control environmental pollution will be effective only if we properly monitor pollution and implement laws governing pollution strictly.

1.13 ENVIRONMENTAL POLLUTION ANALYSIS

What is the need for monitoring environmental pollution and analyse the data thus collected? This is a vexing question. One cannot think of control measures unless one knows what is the extent of pollution?

A lot of awareness can be created about pollution, a great awareness is already there in urban society in large cities on pollution, but we cannot effectively control pollution in the absence of authentic data about air pollution, water pollution, water treatment, industrial effluents, sewage management, land and pesticides pollution or abatement of noise pollution. Such measures can be effective only if we have reliable data on exact levels of pollution. Such reliable data can be obtained by monitoring of environmental pollution at site. The knowledge of levels of pollution will enable us to use and adopt effective, reliable and economic measures for their control. To control pollution, which is growing in alarming proportion, the most effective way is to analyse environmental pollution and then adopt a strategy for its control. Therefore, in this book it is envisaged to consider ways and means to analyse environmental pollution. The modern methods for analysing environment pollution shall be first considered. This will be followed by overall consideration of industrial toxicology and hygiene due to inorganic and organic pollutants. It will be followed by discussion on atmospheric pollution and its measurement, potable water treatment and analysis of water as well as the analysis of industrial waste effluent. Finally, the methods for characterisation and analysis of sewage and sludge, pesticide residue and noise pollution shall be considered. A detailed account is presented in few chapters for the analysis of air pollutants as well as water polluting materials with all minor details on experimental procedure in the separate chapters.

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