International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Hazardous Effects of Industrial Waste Near Residential Area, Navi Mumbai: A Case Study

Dr. Swati Bande[1], Ms. Shamal Keni[2]

[1]Assistant Professor, Department of Zoology, Bharatiya Vidya Bhavan's Bhavan's College, Mumbai, India.
[2]Department of Zoology, Bharatiya Vidya Bhavan's Bhavan's College, Mumbai, India.

ABSTRACT

The increased population has led to an increase in the demand for goods which in turn has caused rapid industrialization. In turn the increase in industrial set-ups has led to the increased production of industrial wastes. These industrial wastes cause major environmental havoc by polluting the water, air and soil.

The following case study has been undertaken to bring forth the hazardous effects of improper industrial waste disposal around residential areas. For this, we have taken the TTC Industrial Area, Navi Mumbai as our prime location of study. This case study has been carried out by administering a questionnaire to the residents of the surrounding areas, taking under consideration the air quality index and testing the water sample acquired from the sewer located near the residential area of TTC Industrial Area, Navi Mumbai where industrial waste is directly disposed.

The objectives of this paper are to explore the impact of air and water pollution on human health. The study discusses the various parameters from the water sample of the sewer. We performed meta-analysis of environmental epidemiologic monitoring data for residents living near sewer. The respiratory and allergic symptoms and the prevalence of acute and chronic diseases, including cancer, were used as the outcome variables for health effects. After adjusting for age, sex, smoking status, occupational exposure, level of education, and body mass index, the residents near the industrial complexes were found to have more respiratory symptoms, such as cough. This study showed that residents living in the vicinity of industrial complexes have a high risk of acute and chronic diseases including respiratory and allergic conditions. These results can be used as basic objective data for developing health management measures for individuals residing near industrial complexes.

Keywords: Air pollution, water pollution, Health effect, Respiratory disease, Allergic disease, Industrial area, Prevalence, Symptom.

1. Introduction

Industrialization is also a major contributor to urban air pollution as the area having industries particularly show poor air quality. Factories release many toxic gases due to the burning of fossil fuels and the use of chemicals. Both urbanization and industrialization also pose harm to mankind, the top of which is air pollution. Urban air pollution refers to the air pollution in and around cities. Air pollution affects human health as well as the climate of an area. According to the World Health Organization (WHO) 4.2 million deaths every year occur as a result of exposure to ambient (outdoor) air pollution. Urban air pollution are anthropogenic activities, including transportation, domestic use of fossil fuels, industrialization, power

generation, combustion and agriculture and beauty products. The quality of urban air is indicated by the quantity of certain pollutants in the air, like Ozone (O_3), Particulate Matter (PM_{10}, $PM_{2.5}$), Sulphur Oxides (SO_x), Nitrogen Oxides (NO_x), Carbon monoxide (CO) and Volatile Organic Compounds (VOCs). One such problem is the deterioration of urban air quality in India and other developing countries. Maharashtra Industrial Development Corporation established an industrial estate at Thane Belapur Road, Navi Mumbai in 1963 which is often known as TTC MIDC Estate. There are about 2200 industrial units of various categories engaged in the manufacture of chemicals, dyes, dye-intermediates, Bulk drugs, pharmaceuticals, Textile auxiliaries, Pesticides, Petrochemicals, Textile processors, Engineering units etc. These industries contribute to heavy pollution in surrounding areas. Some of them are generating trade effluent and the total effluent quantity from all these units is 26 MLD. TTC industrial area is heavily polluted due to discharge of toxic pollutants and solid wastes from the industries and localities situated near lake as well as sewer, Navi Mumbai. Hence these reservoirs can serve as a model of studying the physicochemical properties of water and air pollution near this area. Air pollution contributes to illnesses like eye irritation, asthma, bronchitis, etc., which invariably reduce efficiency at work. Among the different types of air pollutants, suspended particulate matter (SPM), especially respirable suspended Particulate Matter (RSPM), is recognized as the most important in terms of health effects [1]. The better understanding of physio-chemical properties like salinity, temperature, pH, alkalinity, hardness, Chemical Oxygen Demand (COD), Biological oxygen demand (BOD), chloride, phosphate as well as nitrogen, ammonia, etc. in the sewer water seems to be particularly important issues of present day research on pollution assessment. The proposed study is an attempt to examine physio-chemical properties of sewer water and to estimate its health effects to the people of Navi Mumbai, near TTC industrial area, India. The main sources of air and water pollution are the industry associated with textiles, heavy engineering and tanneries. The city is also a major distribution centre for finished leather products, textiles and fertiliser. In the present study, the focus is more on water pollution due to rapid industrialization and its adverse health effects. The study results will help in understanding the current status of air and water pollution and its hazardous effect. This study gives us the effectiveness of pollution control measures already in existence, rationale planning of pollution control strategies and their prioritization.

2.Materials And Methods

Area of Study

The study was carried out in TTC Industrial area, Navi Mumbai at an open sewer which passes from the residential areas located nearby. The effluents discharged by these industries are released into this open sewer. Suitable locations for sewage water sampling were identified and samples were collected after the industrial discharge over the span of 3 seasons via. Summer, monsoon and winter. In 2023, a survey was conducted to assess the impact of air and water pollution on the health of residential households in certain randomly chosen areas of TTC industrial area Navi Mumbai. The main survey commenced in May 2023 and was completed in January 2024. The primary data were collected by administering a questionnaire through a face-to-face interview with the head or any other working member of the household. The data for present study was from TTC industrial area and water sample was collected eighteen weeks over three seasons. The data for the present study was obtained through both household surveys and secondary sources. The survey questionnaire used for the household survey had four main sections with detailed subsections to facilitate the collection of relevant data on key variables. It covered various socio-economic and demographic features such as religion, family background, age and sex composition of household

members, level of education, marital status, occupation and the size of the accommodation / house as well as the current health status (symptoms of acute illnesses linked to air pollution exposure) and mitigating and averting activities adopted by all the members in a household for a recall period of two week. It contained information on individuals' past health stock (chronic diseases), their habits that affect health in general and the general awareness of households about the illnesses that occur due to air pollution. The secondary data, relating to the ambient air quality (RSPM) and weather conditions (temperature and humidity), was collected from the publications of the MPCB REPORT and CEPI Score (Comprehensive Environmental Pollution Index for Water Environment). Navi Mumbai experiences a tropical climate and the mean annual temperature is about 24.3^{o}c to 32.9^{o}c. April and May is the hottest and most dry part of the year. During this period the temperature rises to 38.0^{o}c. Humidity present in the atmosphere is usually 58 to 84%. In Navi Mumbai, the monsoon season usually commences in June and extends until September. Over this period, the city experiences an average rainfall of 1200 mm.

Requirements-

This was done for all the three seasons – summer, rainy and winter for a period of twenty four months. Polythene bottles were used to collect the water samples. The bottles were completely filled up with the water sample. The samples thus collected from different locations were mixed together to give a gross sample.

Quality Assurance

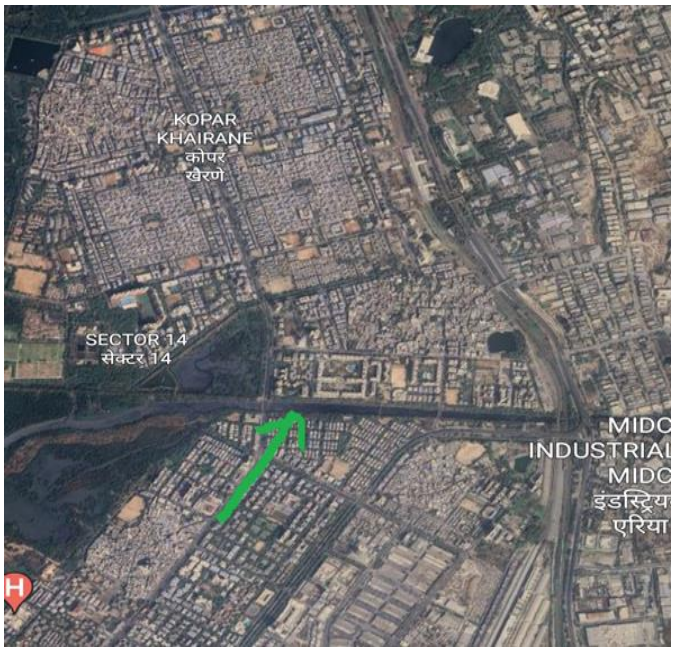
All calibrated instruments were used for analysis. Analytical grade chemicals and reagents were used for analysis. To correct the interference of reagent impurities and other environmental contaminants, during analyses if any, reagent blanks were used.

Physico-Chemical Study

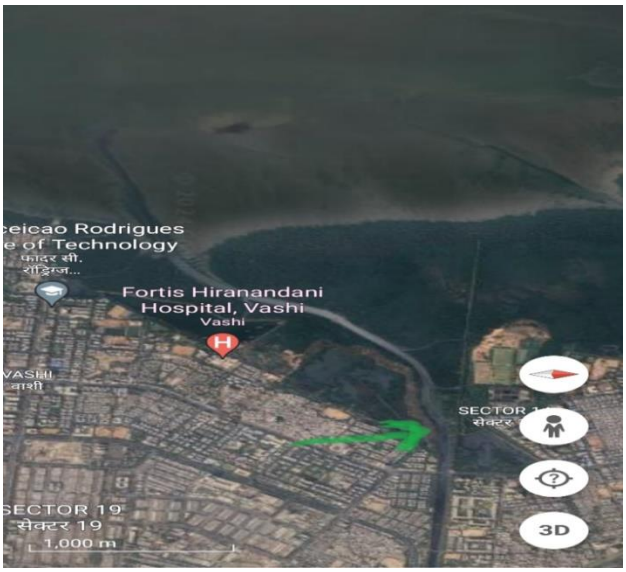
The water samples, collected at different locations from the sewer near the discharge of effluents from the industrial belt of TTC industrial area were analysed salinity, temperature, pH, alkalinity, hardness, Chemical Oxygen Demand (COD), Biological oxygen demand (BOD), chloride, phosphate as well as nitrogen, ammonia, etc.The techniques and methods followed for collection, preservation, analysis and interpretation are those given [7].

Fig.1 Figure showing Location of Sewer near residential area , Navi Mumbai

Fig. 2 Figure showing Location of Sewer near residential area , Navi Mumbai



.Fig. 3 Figure showing Sewer attached to sea , Navi Mumbai



3.Observation Table

Table 1 : Table showing values of pH, Nitrites and nitrates, Phosphate, COD, BOD

Sr.no	Pollutant	Average result	Normal Range
1	pH	8.9 units	6 units
2	Nitrites and nitrates	36.2 mg/L	0.1- 0.9 mg/L
3	Phosphate	7.8 mg/L	5.0 mg/L
4	COD	677 mg/L	250 mg/L

5	BOD	719.13 mg/L	30 mg/L

4. Result

The water sample has been analysed for its physicochemical properties, the average pH acquired is 8.9 which is leaning towards alkalinity. The value of pH has been observed to be 9.3 in the summer and has decreased slightly by 0.7 units during the monsoon season showing pH 8.6 and again increased in the winter by 0.3 units being pH 9. The acidity or alkalinity of water is measured in terms of pH. pH is an extremely important parameter since any change in pH of water affects the chemical reactions in aquatic environments. Highly acidic or highly alkaline pH may have a serious impact or even kill marine life. Water with pH value below 6 can be hazardous to aquatic life. Water with a pH value of about 10, though exceptional, may indicate the contamination by strong bases such as NaOH and Ca $(OH)_2$ [10].

The average phosphate value obtained is 7.8 mg/L. Higher concentrations of phosphate were observed in the summer and winter in comparison with the monsoon season. The maximum limit for dissolved phosphates (as phosphorus), is 5.0 mg/L [5]. The major sources of phosphorus air pollution are the industries engaged in production of phosphate fertilizers, phosphoric acid, phosphate pentoxide and phosphorus chemicals for industrial use. The application of organophosphorus pesticides may also result in environmental air pollution causing health hazards to people residing close to these industries. Repeated exposure to phosphorus may affect the liver and kidneys.

The average nitrates concentration found was 36.2m/L. Similar to phosphates, higher concentrations were observed in the summer and winter than the monsoon season. Nitrites and nitrates in wastewater normally range between 0.1 and 0.9 mg L^{-1}, but in this study, higher concentrations were found such as 7.89 NO_2^--mg L^{-1} and 17.5 NO_3^--mg L^{-1}, which can be justified by industrial and domestic discharges wastewater contaminated with nitrogen compounds is a problem for the wealth of water resources and ecosystems, due to its association with the problems of eutrophication and acidification of water bodies that lead to their deterioration.

Chlorides and amine groups were observed to be present in the water sample whereas sulphur and halogens were absent. Chloride is categorized as a pollutant for many reasons. Chloride is necessary for water habitats to thrive, yet high levels of chloride can have negative effects on an ecosystem [12].

The maximum limit for total residual chlorine is 1.0 mg/L [5] and the maximum limit for COD and BOD are 250 mg/L and 30 mg/L resp. In our study, the average COD and BOD acquired 677mg/l and 719.13 mg/l resp.

A high level of COD means that the wastewater contains too much organic material, which can reduce the level of dissolved oxygen (DO) in the water course if the effluent is discharged, thereby harming the local environment. The higher the COD value, the more serious the pollution of organic matter by water. The most common application of COD is in quantifying the amount of oxidizable pollutants found in surface water or wastewater. COD is useful in terms of water quality by providing a metric to determine the effect an effluent will have on the receiving body, much like biochemical oxygen demand (BOD).

5. DISCUSSION

The results suggest that nitrites and nitrates levels impact on water bodies like problems of eutrophication and acidification. Similar findings were observed [5]. The results had a particular focus on increasing levels of nitrogen. For human beings, it can lead to physiological disorders such as nausea, diarrhoea,

gastroenteritis, muscle aches, and other various symptoms as dangerous as methemoglobinemia in babies. Similar findings were observed. [5]

Chlorides and amine groups were observed to be present in the water sample. Chloride is categorized as a pollutant for many reasons. Chloride is necessary for water habitats to thrive, yet high levels of chloride can have negative effects on an ecosystem. Chloride may impact freshwater organisms and plants by altering reproduction rates, increasing species mortality, and changing the characteristics of the entire local ecosystem. In addition, as chloride filters down to the water table, it can stress plant respiration and change the quality of our drinking water [7], Organic amines are regarded as highly toxic, refractory chemicals due to the great damage to the human body, and ecosystem.

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6. CONCLUSIONS

The increased population has led to an increase in the demand for goods which in turn has caused rapid industrialization. In turn the increase in industrial set-ups has led to the increased production of industrial wastes. These industrial wastes cause major environmental havoc by polluting the water, air and soil. TTC industrial area is heavily polluted due to discharge of toxic pollutants and solid wastes from the industries and localities situated sewer, Navi Mumbai. These industries contribute to heavy pollution in surrounding areas. Due to this some respiratory and allergic symptoms and the prevalence of acute and chronic diseases, including cancer, were used as the outcome variables for health effects. This study gives us the effectiveness of pollution control measures already in existence, rationale planning of pollution control strategies and their prioritization. Pollution control has become the primary concern of the environment today. The objective of this paper is to explore the impact of environmental pollution on the environment and society.

7. REFERENCES

1. Alberini A, M Cropper et al., “Valuing Health Effects of Air Pollution in Developing Countries: the Taiwan Experience,” *Journal of Environmental Economics and Management*,1997, (34): 107-26.
2. Action Plan for Industrial Cluster “Navi Mumbai”, Maharashtra Pollution Control Board, November, 2010. http://www.mpcb.gov.in
3. Indian Council of Medical Research (ICMR) Manual of Standards of Quality for Drinking Water Supplies,1975.
4. American Public Health Association (APHA), Standard Methods for Estimation of Water and Wastewater, 19th ed. American Water Works Association, Water Environment Federation, Washington,1995.
5. Camargo, J.A. and Alonso.A, Ecological and Toxicological Effects of Inorganic Nitrogen Pollution in Aquatic Ecosystems, *A Global Assessment. Environment International*,2006,(32), 831-849.
6. The Environment (Protection) Rules 1986 Available on Internet: cpcb.nic.in/GeneralStandards.pdf , 1986.
7. Rainwater FH, Thatcher LL ‘Methods for Collection and Analysis of Water Samples’. *US Geol. Surv. Water Supply Paper*. 1960; 1457: 301p.

8. Amol M. Jadhav, Pravin U. Singare.2015, Studies on Physico-Chemical Properties of Ulhas River Water along Dombivli City near Mumbai. *Journal of Modern Chemistry & Chemical Technology*.; 6(2)
9. P. U. Singare, S. E. L. Ferns, 2014, Monitoring the health of sediment ecosystem along the Mahim Creek of Mumbai - A Study of Physico-Chemical Properties, *International Letters of Natural Sciences* ISSN 2300-9675, 12(1) 70-76
10. Pravin U. Singare, M. V. A. Ansari, N. N. Dixit, 2014 Assessment of Physico-Chemical Properties of Sediments collected along the Mahul Creek near,Mumbai, India, I*nternational Letters of Natural Sciences*, 16:54-61.
11. Sara B.C and Goncaloglu K, W.(2008), Determination of water quality of lakes ,22(2), 44-50.
12. Langmuir D, Aqueous Environmental Chemistry. Prentice-Hall, Inc. New Jersey. 1997. *International Letters of Natural Sciences*, 11(1) (2014) 54-61.

11. Matta G., Kumar R., Kumar A., Kumar A., & Science E. (2015). Effect of industrial effluent on ground water quality with special reference to. 3(2), *Quality, W., & Guide, F. (n.d.). Biological Oxygen Demand*, 183–186, 27–32.