Monitoring, Sampling and Analysis for Ambient Air Quality, Surface Water Quality and Ground Water Quality in Critically/Severely/Other Polluted Industrial Areas of Maharashtra

MAHAD

Pre-Monsoon (April 2023 to June 2023)

MAHARASHTRA

LiFE
Lifestyle for Environment

Maharashtra Pollution Control Board

Kalptaru Point, Sion East, Mumbai – 400 022

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ABBREVIATIONS

APHA	American Public Health Association
ASTM	American Society for Testing and Materials
BIS	Bureau of Indian Standards
BLQ	Below the Limit of Quantification
CAAQMS	Continuous Ambient Air Quality Monitoring Station
CEMS	Continuous Emission Monitoring System
CEPI	Comprehensive Environmental Pollution Index
CETP	Common Effluent Treatment Plant
CPA	Critically Polluted Area
CPCB	Central Pollution Control Board
EPA	Environmental Protection Act, 1986
GDP	Gross Domestic Product
MIDC	Maharashtra Industrial Development Corporation
MPCB	Maharashtra Pollution Control Board
NAAQS	National Ambient Air Quality Standard
NWMP	National Water Quality Monitoring Program
OPA	Other Polluted Area
SPA	Severely Polluted Area
VOCs	Volatile Organic Compounds
WHO	World Health Organisation
ZLD	Zero Liquid Discharge

1. Executive Summary

Mahad was monitored for Ambient Air Quality, Ground and Surface Water quality. Based on the data collected by monitoring, a Comprehensive Environmental Pollution Index (CEPI) Score [as per latest directions 120 of Letter No. B-29012/ESS (CPA)/2015-16 dated 26th April 2016 of Central Pollution Control Board (CPCB)] was calculated. Maharashtra Pollution Control Board (MPCB) has carried out monitoring at CPCB location with the additional locations of sampling for ambient air, surface and ground water in consideration with the previous CEPI monitoring and covering the entire CEPI Impact Zone. The pre-monsoon monitoring was carried out during the period of April 2023 – June 2023 to assess the ambient air quality, surface water quality and ground water quality.

The Ambient Air Quality stations were identified considering the upwind and cross wind direction in the CEPI impact area. Ambient Air Quality was monitored at eight locations. The concentration of all the ambient air parameters was found well within the limits prescribed by NAAQS. Six locations each for surface water and groundwater were monitored for the study. Concentration of Total Dissolved Solids (TDS) was found above the standard limits in one of the surface water samples. Land index is represented by groundwater in the CEPI. Ground water parameters were found to be within the permissible limits when compared with IS 10500:2012 drinking water standards.

Based on the study conducted by CPCB during the period March 2018, the CEPI score of Mahad region as per the revised guidelines of CEPI (2016) was 47.12 (Air Index–41, Water Index-35.75 and Land Index–47.12). However, the present study reports the aggregate CEPI score of Mahad region of pre-monsoon season (June, 2023), the present CEPI score is 38.4 (Air Index–26.00, Water Index-33.0 and Land Index–30.8). The CEPI score is the combination of A, B, C and D factors. Here, C factor represents the health data and D factor represents the initiatives taken by MPCB in the past few years to mitigate the pollution. The regional office of MPCB has taken various initiatives like installation of CAAQMS, CETPs, etc. in the past few years to control and mitigate the air and water pollutants. This has contributed to the factor D, hence reducing the CEPI score of the region over the years.

The analysis of the aggregated CEPI score shows that the CEPI score of Mahad industrial cluster decreased approximately 19% from 47.12 of 2018 to 38.4 in June 2023.

2. Introduction

Industries play a pivotal role in a country's economic development, contributing to GDP growth, job creation, and technological advancement. However, in recent years, the environmental pollution caused by industries has emerged as a formidable challenge for authorities worldwide. The impact of these industrial activities on the environment is severe, affecting the quality of the water we drink, the air we breathe, and the soil that nurtures our plants. Industries releasing untreated wastewater have contaminated drinking water with hazardous substances, posing risks to human, animal, and aquatic life. Exposure to air pollutants has been linked to various respiratory and cardiovascular diseases, particularly in early human life, leading to infant mortality or chronic health issues in adulthood. According to the World Health Organization (WHO), environmental pollution is responsible for an estimated 9 million premature deaths worldwide each year. It also estimates that over 90% of the global population is exposed to air pollution levels that exceed WHO guidelines, causing serious health risks. Around 2 billion people worldwide use drinking water contaminated with faeces leading to infectious diseases such as cholera and dysentery.

Hence, addressing these pollution sources is crucial to achieving significant environmental and health benefits. Additionally, the widespread nature of industrial pollution requires extensive monitoring systems and resources to collect reliable data and assess the full extent of the environmental impacts. The complexities associated with monitoring and identifying pollution sources make it a daunting task for authorities to develop targeted strategies and enforce regulations effectively. Striking a balance between economic growth and environmental protection requires delicate negotiations and innovative policy approaches. Overcoming these challenges demands robust regulatory frameworks, international collaboration, advanced monitoring technologies, and a commitment to sustainable practices from industries and governments alike.

In view of this, Central Pollution Control Board (CPCB) has evolved the concept of the Comprehensive Environmental Pollution Index (CEPI) during 2009-10 as a tool for comprehensive environmental assessment of prominent industrial clusters and formulation of remedial Action Plans for the identified critically polluted areas. Later in 2016, the revised concept of CEPI was formulated by eliminating the subjective factors but retaining the factors which are monitorable CEPI bridges the perceptive gap between experts, public, and government departments by simplifying the complexity of environmental issues. It aims at categorizing critically polluted industrial areas based on scientific criteria, so as to ascertain various dimensions of pollution. This is a combined framework used to evaluate the impacts caused by industrial clusters on the nearby environment, as a numerical value.

The present CEPI study includes Mahad city in Raigad district situated in the North Konkan region of Maharashtra state, India. It is located 108.5 km from District's Headquarters Alibag. Savitri River is the main river which originates from Savitri Point in Mahabaleshwar and flows through Mahad. Mahad receives the highest rainfall in Raigad district because of the rain catcher forest of Raigad Fort Natural Reserve. Mahad accounts for lots of industrial units of various categories engaged in the manufacturing of chemicals, dyes, dye-intermediates, Bulk drugs, pharmaceuticals, Textile

auxiliaries, Pesticides, Petrochemicals, Textile processors, Engineering units etc. Besides the industries, there are other sources that are major contributors of pollution like emissions by transport and construction activities, etc.

The present report is based on the revised CEPI version 2016. The results of the application of the Comprehensive Environmental Pollution Index (CEPI) to selected industrial clusters or areas are presented in this report. The main objective of the study is to identify polluted industrial clusters or areas in order to take concerted action and to centrally monitor them at the national level to improve the current status of their environmental components such as air and water quality data, ecological damage, and visual environmental conditions. The index captures the various dimensions of the environment including air, water and land. Comprehensive Environmental Pollution Index (CEPI), which is a rational number to characterize the environmental quality at a given location following the algorithm of source, pathway and receptor have been developed.

3. Scope of Work

The major scope of work includes:

I. The scope of the present study is to perform three (3) rounds of "Monitoring, Sampling and Analysis for Ambient Air Quality, VOCs in Ambient Air, Surface Water Quality & Ground Water Quality in selected Pollution Industrial Areas (PIAs) of Mahad, Maharashtra" with a gap of one or two days. The analysis of the collected samples was carried out by the standard methods (CPCB, BIS, APHA, USEPA).

II. To Collect health-related data in the CEPI region.

III. To calculate the Comprehensive Environmental Pollution Index (CEPI) Score as per Revised CEPI-2016 issued by Central Pollution Control Board (CPCB).

The sampling details and frequency of sampling in Ambient Air, VOCs, Surface Water and Ground Water are given in Table 3.1 and Table 3.2 respectively.

Table 3.1 Sampling Details of MAHAD

Sampling Criteria	Total Sites	Monitoring Parameters
Ambient Air Quality	**08**	PM_{10}, $PM_{2.5}$, SO_2, NO_2, NH_3, O_3, C_6H_6, CO, BAP, Pb, Ni, As
Volatile Organic Compounds (VOCs)	**02**	Dichloromethane, Chloroform, Carbon Tetrachloride, Trichloroethylene, Bromodichloromethane, 1,3-Dichloropropane, 1,4-Dichlorobenzene, 1,3-Dichlorobenzene, 1,2-Dichlorobenzene, 1,2-Dibromo-3-Chloropropane, Naphthalene, Bromobenzene,1,2,4-Trimethylbenzene, 2-Chlorotoluene, Tert-Butylbenzene, SEC-Butylbenzene, P-Isopropyl toluene, M-Xylene, P-Xylene, Styrene, Cumene 1,2,3-Trichloropropane, N-Propyl benzene, Dibromochloromethane, 1,2-Dibromoethane, Chlorobenzene, 1,1,1,2-Tetrachloroethane, Ethylbenzene, 1,1-Dichloropropylene, 1,2-Dichloroethane, 1,2-Dichloropropane, Trans-1,3-Dichloropropene, CIS 1,3-Dichloropropene, 1,1,2-Trichloroethane, Tetrachloroethylene, 1,3,5-Trimethylbenzene, N-Butylbenzene, 1,2,3-Trichlorobenzene, Hexachlorobutadiene, 1,2,4-Trichlorobenzene, 2,2-Dichloropropane, Dibromo methane, Toluene, O-Xylene, Bromoform, 1,1,2,2-Tetrachloroethane, 4-Chlorotoluene, 1,1-Dichloroethylene, Trans-1,2-Dichloroethylene, 1,1-Dichloroethane, CIS-1,2-Dichloroethylene, Bromochloromethane, 1,1,1-Trichloroethane

Sampling Criteria	Total Sites	Monitoring Parameters
Water Quality Monitoring	**Surface water - 06**	**(i) Simple Parameters** Sanitary Survey, General Appearance, Colour, Smell, Transparency and Ecological **(ii) Regular Monitoring Parameters** pH, O & G, Suspended Solids, DO, COD, BOD, TDS, Electrical Conductivity, Total Dissolved Solids, Nitrite–Nitrogen, Nitrate-Nitrogen, (NO_2+NO_3) total nitrogen, Free Ammonia, Total Residual Chlorine, Cyanide, Fluoride, Chloride, Sulphate, Sulphides, Total Hardness, Dissolved Phosphates, SAR, Total Coliforms, Faecal Coliform **(iii) Special Parameters** Total Phosphorous, TKN, Total Ammonia (NH_4+NH_3)-Nitrogen, Phenols, Surface Active Agents, Anionic detergents, Organo-Chlorine Pesticides, PAH, PCB and PCT, Zinc, Nickel, Copper, Hexa-valent Chromium, Chromium (Total), Arsenic (Total), Lead, Cadmium, Mercury, Manganese, Iron, Vanadium, Selenium, Boron **(iv) Bio-assay (zebra Fish)** Test – For specified samples only.
	Ground water - 06	

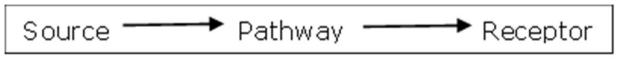
Table 3.2 Frequency of Sampling

	Parameter	Round of Sampling	Frequency in Each Round
A	**Ambient Air Quality Monitoring**		
1.	Particulate Matter (size less than 10 µm) or PM_{10}	03	3 Shifts of 8 hrs each
2.	Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	03	1 Shift of 24 hr
3.	Sulphur Dioxide (SO_2)	03	6 Shifts of 4 hrs each
4.	Nitrogen Dioxide (NO_2)	03	6 Shifts of 4 hrs each
5.	Ammonia (NH_3)	03	6 Shifts of 4 hrs each

	Parameter	Round of Sampling	Frequency in Each Round
6.	Ozone (O_3)	03	24 Shifts of 1 hr each
7.	Benzene (C_6H_6)	03	1 Shifts of 24 hrs
8.	Carbon Monoxide (CO)	03	24 Shifts of 1 hr each
9.	Benzo (a) Pyrene (BaP) – particulate phase only	03	3 Shifts of 8 hrs each
10.	Lead (Pb)	03	3 Shifts of 8 hrs each
11.	Arsenic (As)	03	3 Shifts of 8 hrs each
12.	Nickel (Ni)	03	3 Shifts of 8 hrs each
B	**Volatile Organic Compounds (VOCs)**		
	As mentioned in Table 3.1	03	3 Shifts of 24 hrs each
C	**Ground Water**		
	As mentioned in Table 3.1	03	01 sample at each round
D	**Surface Water**		
	As mentioned in Table 3.1	03	01 sample at each round

4. Methodology

The present report is based on the revised Comprehensive Environmental Pollution Index (CEPI) version 2016. The index captures the various dimensions of the environment including air, water and land. Comprehensive Environmental Pollution Index (CEPI) is a rational number, which is used to characterize the environmental quality at a given location. It is three-step process based on the algorithm of Source, Pathway and Receptor.



Ambient air stations, Surface water locations and Ground water locations were decided by the respective regional officers. The sampling was done in 3 rounds with an interval of one or two days at each location. Sampling has been done at the potentially polluted areas so as to arrive at the CEPI. This will further help the authorities to monitor the areas in order to improve the current status of their environmental components such as air and water quality data, ecological damage and visual environmental conditions.

AIR ENVIRONMENT

5. Air Environment

For studying the Air Environment of Mahad area, monitoring stations were identified considering the upwind and cross wind direction and all 12 parameters as per the notification of National Ambient Air Quality Standards (NAAQS) were carried out.

**Kindly note: Volatile Organic Compounds (VOCs) concentration is not detected in most of the Air samples collected; hence it is not shown in the graphs.*

In Mahad eight locations have been monitored of checking the Ambient Air Quality (AAQ) in triplicate from 22nd May 2023 to 26th May 2023. Concentration of all the parameters at all studied locations was observed well within the limits. VOCs were monitored at 2 locations namely Sequent Scientific Ltd. and Prasol Chemical Ltd.

Table 5.1 Details of Sampling Location of Ambient Air Quality Monitoring

Sr. No.	Name of Monitoring Location	Latitude	Longitude	Date of Sampling		
				Round-1	Round-2	Round-3
1.	Nearby Piramal Healthcare Ltd.	N18°06'43.50"	E73°31'10.72"	22.05.2023	24.05.2023	26.05.2023
2.	Akzo noble India Ltd. (Nouryon Chemical) Mahad	N18°05'56.99"	E73°29'3.62"	22.05.2023	24.05.2023	26.05.2023
3.	Vinati Organics Ltd Mahad	N18°06'2.01"	E73°29'21.38"	22.05.2023	24.05.2023	26.05.2023
4.	Sandoz India Pvt. Ltd, Mahad	N18°05'55.13"	E73°27'49.53"	22.05.2023	24.05.2023	26.05.2023
5.	MIDC Office Mahad	N18°05'54.00"	E73°28'0.86"	22.05.2023	24.05.2023	26.05.2023
6.	Pidilite Industries Ltd	N18°06'26.38"	E73°28'21.46"	22.05.2023	24.05.2023	26.05.2023
7.	CETP, Mahad	N18°05'50.58"	E73°27'59.89"	22.05.2023	24.05.2023	26.05.2023
8.	Hikal Ltd	N18°05'43.45"	E73°27'53.50"	22.05.2023	24.05.2023	26.05.2023

Table 5.2 Details of Sampling Location of Volatile Organic Compounds (VOCs) Monitoring

Sr. No.	Name of Monitoring Location	Latitude	Longitude	Date of Sampling		
				Round-1	Round-2	Round-3
1.	Sequent Scientific Ltd	N18°40'00.9"	E73°17'34.3"	22.05.2023	24.05.2023	26.05.2023

Sr. No.	Name of Monitoring Location	Latitude	Longitude	Date of Sampling		
				Round-1	Round-2	Round-3
2.	Prasol Chemical Pvt Ltd.	N18°44'01.1"	E73°19'17.2"	22.05.2023	24.05.2023	26.05.2023

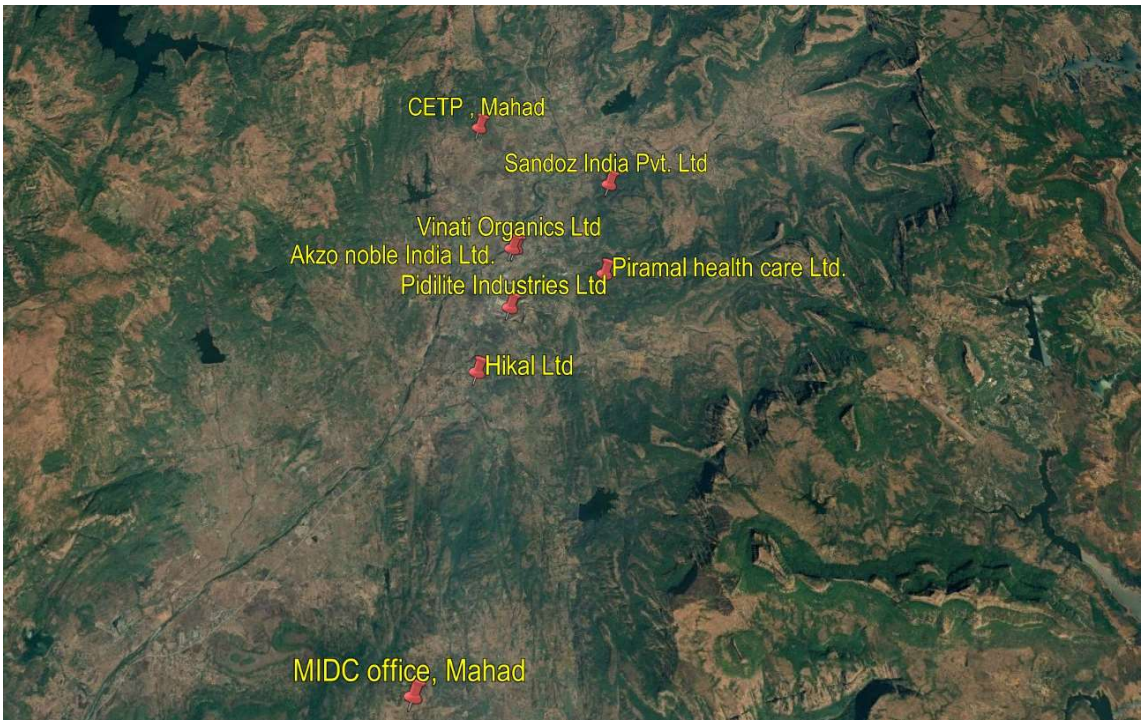


Fig: Geographical Locations of Ambient Air Sampling

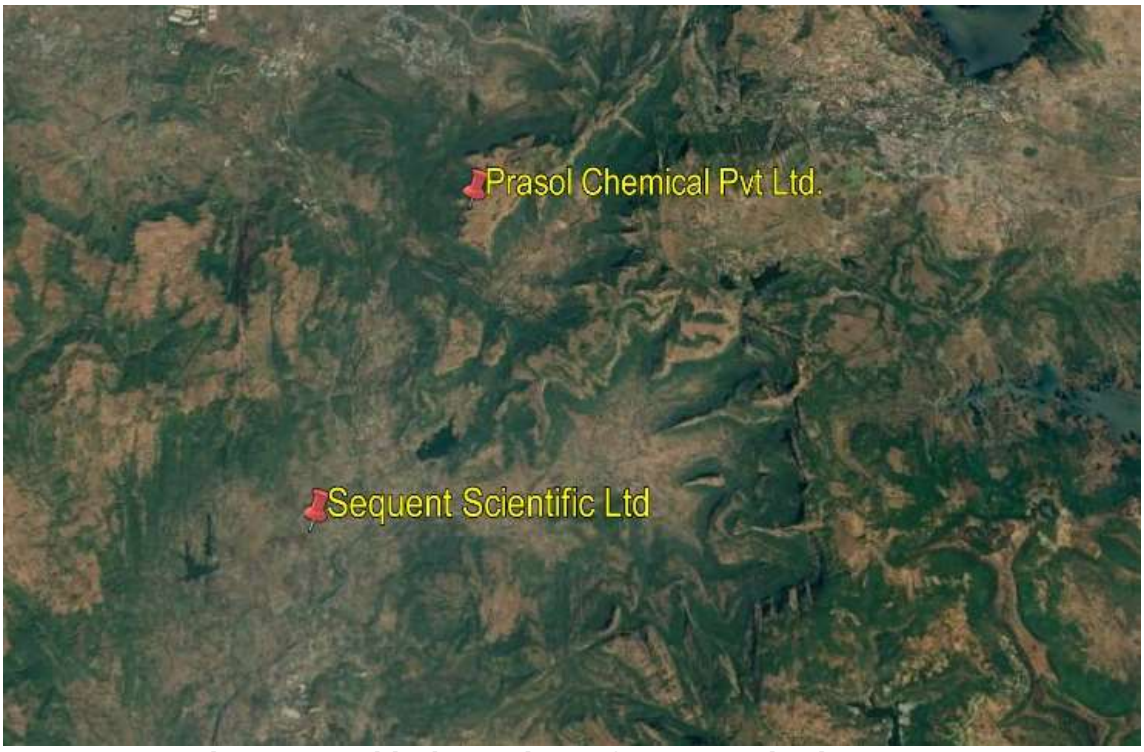


Fig: Geographical Locations of VOCs Monitoring

Table 5.3 Ambient Air Quality Monitoring Results

Parameters	Unit	Results			
		Piramal health care Ltd.	Akzo noble India Ltd. (Nouryon Chemical)	Vinati Organics Ltd.	Sandoz India Pvt. Ltd.
Sulphur Dioxide (SO_2)	$\mu g/m^3$	4.66	4.79	4.79	4.53
Nitrogen Dioxide (NO_2)	$\mu g/m^3$	12.95	17.76	17.76	20.50
Particulate Matter (size less than 10 µm) or PM_{10}	$\mu g/m^3$	53	76	76	59
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	$\mu g/m^3$	13	21	21	16
Ozone (O_3)	$\mu g/m^3$	32.20	24.30	24.30	36.70
Lead (Pb)	$\mu g/m^3$	0.04	0.02	0.02	0.03
Carbon Monoxide (CO) (1h)	mg/m^3	1.48	1.40	1.40	1.60
Carbon Monoxide (CO) (8h)	mg/m^3	1.71	1.65	1.65	1.90
Ammonia (NH_3)	$\mu g/m^3$	80.35	55.40	55.40	55.40
Benzene (C_6H_6)	$\mu g/m^3$	2.47	2.70	2.70	2.87
Benzo (a) Pyrene (BaP) – particulate phase only	ng/m^3	BLQ	BLQ	BLQ	BLQ
Arsenic (As)	ng/m^3	0.37	BLQ	BLQ	BLQ
Nickel (Ni)	ng/m^3	BLQ	BLQ	BLQ	BLQ

Parameters	Unit	Results			
		MIDC Office	Pidilite Industries Ltd.	CETP, Mahad	HIKAL Ltd.
Sulphur Dioxide (SO_2)	$\mu g/m^3$	BLQ	BLQ	4.53	4.47
Nitrogen Dioxide (NO_2)	$\mu g/m^3$	49.05	14.30	16.75	29.95
Particulate Matter (size less than 10 µm) or PM_{10}	$\mu g/m^3$	72	69	51	71
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	$\mu g/m^3$	21	18	12	20
Ozone (O_3)	$\mu g/m^3$	30.60	35.50	25.85	BLQ

Parameters	Unit	Results			
		MIDC Office	Pidilite Industries Ltd.	CETP, Mahad	HIKAL Ltd.
Lead (Pb)	µg/m^3	0.05	0.04	0.06	0.05
Carbon Monoxide (CO)-1h	mg/m^3	1.37	1.48	1.45	1.43
Carbon Monoxide (CO)-8 h	mg/m^3	1.52	1.71	1.75	1.70
Ammonia (NH_3)	µg/m^3	20.00	37.25	175.00	36.80
Benzene (C_6H_6)	µg/m^3	2.70	2.65	2.12	2.96
Benzo (a) Pyrene (BaP) – particulate phase only	ng/m^3	BLQ	BLQ	BLQ	BLQ
Arsenic (As)	ng/m^3	0.38	0.50	0.61	0.56
Nickel (Ni)	ng/m^3	BLQ	5.40	BLQ	3.10

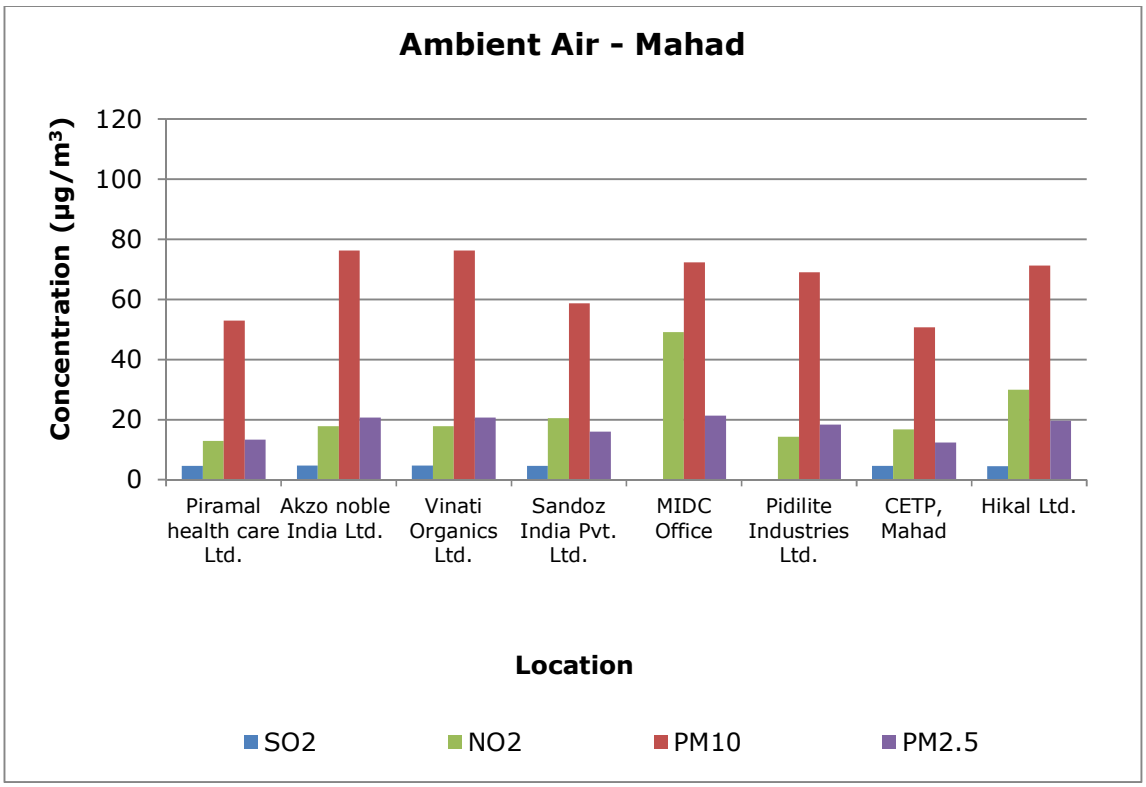
Table 5.4 Volatile Organic Compounds (VOCs) in Ambient Air Results

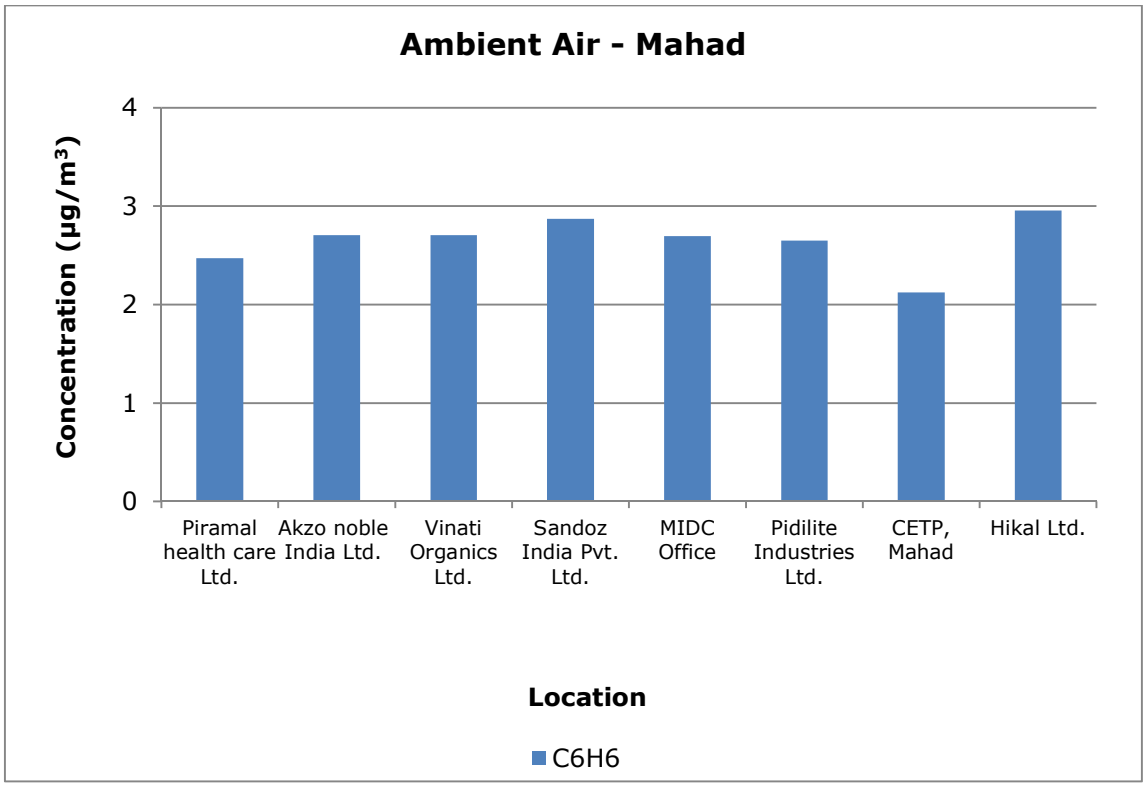
Parameters	Unit	Results	
		Sequent Scientific Ltd.	Prasol Chemical Pvt Ltd.
Dichloromethane	µg/m³	0.79	0.86
Chloroform	µg/m³	BLQ	3.73
Carbon Tetrachloride	µg/m³	BLQ	0.81
Trichloroethylene	µg/m³	0.88	0.54
Bromodichloromethane	µg/m³	BLQ	BLQ
1,3-Dichloropropane	µg/m³	BLQ	BLQ
1,4-Dichlorobenzene	µg/m³	BLQ	6.21
1,3-Dichlorobenzene	µg/m³	25.60	5.47
1,2-Dichlorobenzene	µg/m³	BLQ	BLQ
1,2-Dibromo-3-Chloropropane	µg/m³	BLQ	BLQ
Napthalene	µg/m³	BLQ	BLQ
Bromobenzene	µg/m³	BLQ	BLQ
1,2,4-Trimethylbenzene	µg/m³	3.67	7.69
2-Chlorotoluene	µg/m³	BLQ	BLQ
Tert-Butylbenzene	µg/m³	BLQ	BLQ
SEC-Butylbenzene	µg/m³	BLQ	BLQ

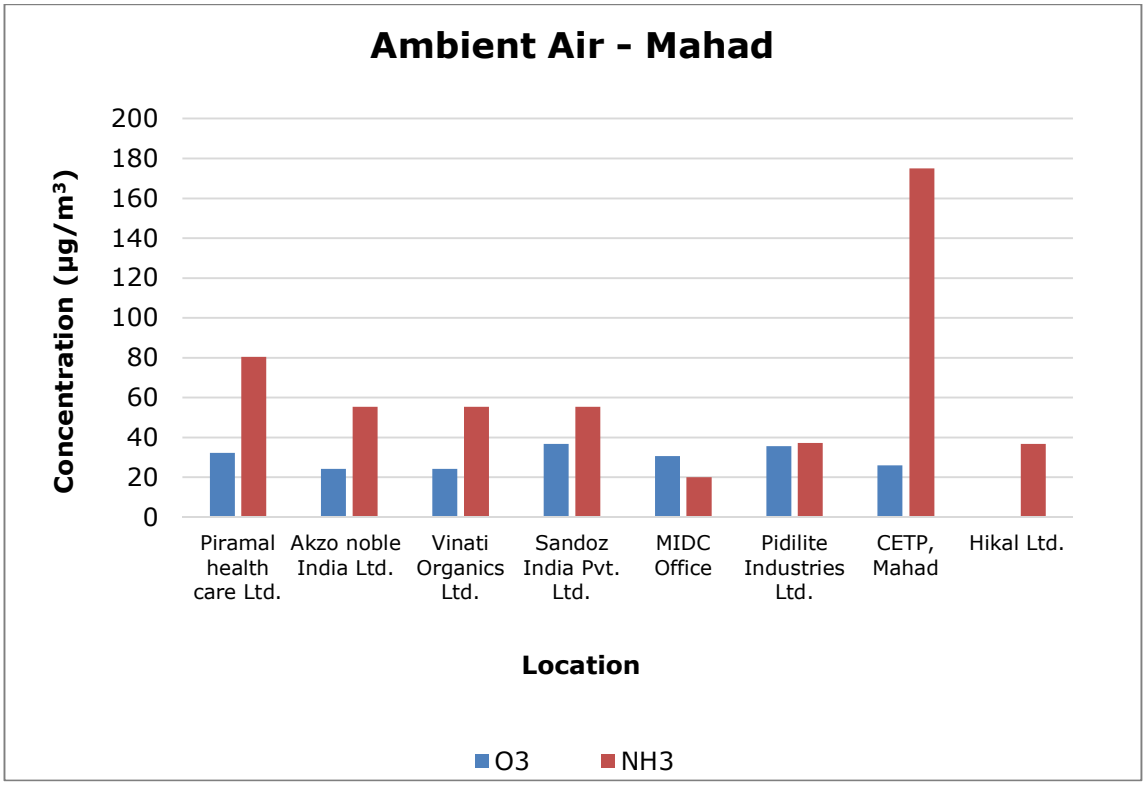
Parameters	Unit	Results	
		Sequent Scientific Ltd.	Prasol Chemical Pvt Ltd.
P-Isopropyltoluene	µg/m³	6.47	BLQ
M-Xylene	µg/m³	8.88	BLQ
P-Xylene	µg/m³	8.86	2.58
Styrene	µg/m³	BLQ	BLQ
Cumene	µg/m³	BLQ	BLQ
1,2,3-Trichloropropane	µg/m³	BLQ	BLQ
N-Propylbenzene	µg/m³	21.60	6.15
Dibromochloromethane	µg/m³	BLQ	BLQ
1,2-Dibromoethane	µg/m³	BLQ	BLQ
Chlorobenzene	µg/m³	BLQ	BLQ
1,1,1,2-Tetrachloroethane	µg/m³	BLQ	BLQ
Ethylbenzene	µg/m³	7.41	4.47
1,1-Dichloropropylene	µg/m³	BLQ	0.73
1,2-Dichloroethane	µg/m³	7.22	8.77
1,2-Dichloropropane	µg/m³	4.36	BLQ
Trans-1,3-Dichloropropene	µg/m³	BLQ	BLQ
CIS 1,3-Dichloropropene	µg/m³	BLQ	BLQ
1,1,2-Trichloroethane	µg/m³	BLQ	BLQ
Tetrachloroethylene	µg/m³	6.62	2.31
1,3,5-Trimethylbenzene	µg/m³	BLQ	BLQ
N-Butylbenzene	µg/m³	BLQ	BLQ
1,2,3-Trichlorobenzene	µg/m³	BLQ	BLQ
Hexachlorobutadiene	µg/m³	BLQ	BLQ
1,2,4-Trichlorobenzene	µg/m³	BLQ	BLQ
2,2-Dichloropropane	µg/m³	BLQ	BLQ
Dibromomethane	µg/m³	BLQ	BLQ
Toluene	µg/m³	6.32	8.69
O-Xylene	µg/m³	1.24	0.63
Bromoform	µg/m³	BLQ	2.91
1,1,2,2-Tetrachloroethane	µg/m³	BLQ	BLQ
4-Chlorotoluene	µg/m³	BLQ	BLQ
1,1-Dichloroethylene	µg/m³	BLQ	BLQ

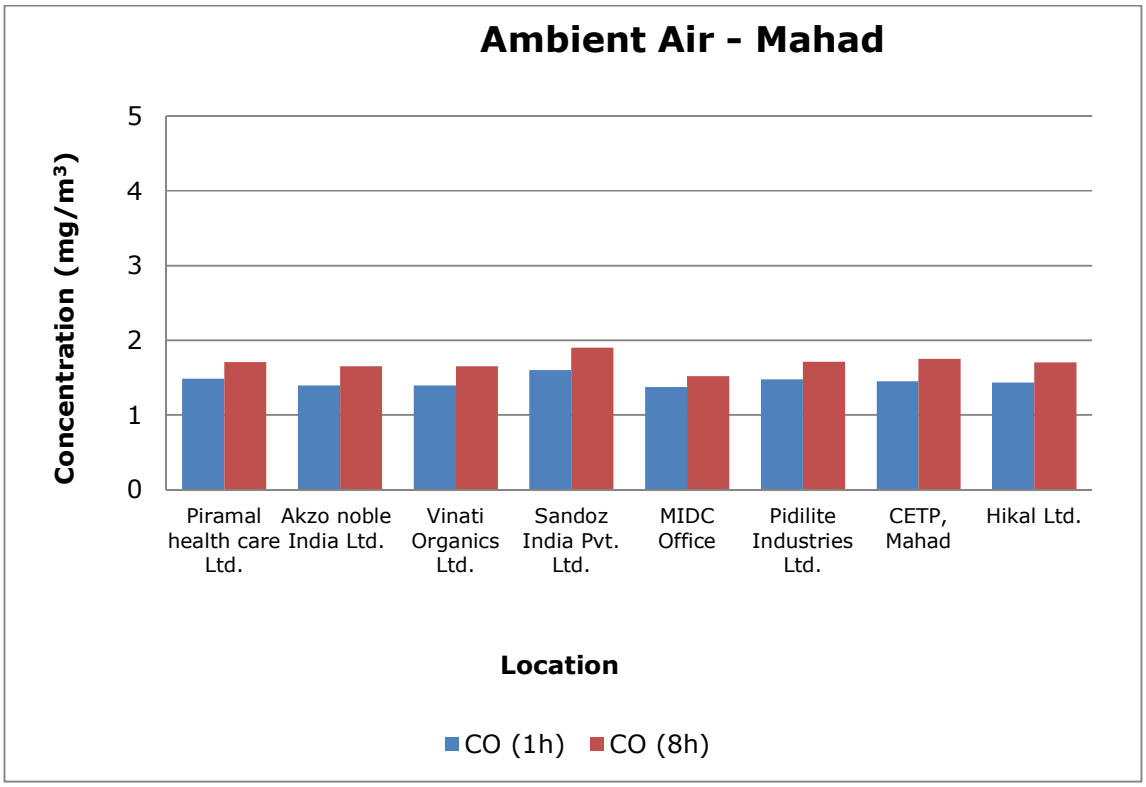
Parameters	Unit	Results	
		Sequent Scientific Ltd.	Prasol Chemical Pvt Ltd.
Trans-1,2-Dichloroethylene	µg/m³	BLQ	BLQ
1,1-Dichloroethane	µg/m³	BLQ	BLQ
CIS-1,2-Dichloroethylene	µg/m³	BLQ	BLQ
Bromochloromethane	µg/m³	BLQ	BLQ
1,1,1-Trichloroethane	µg/m³	BLQ	BLQ

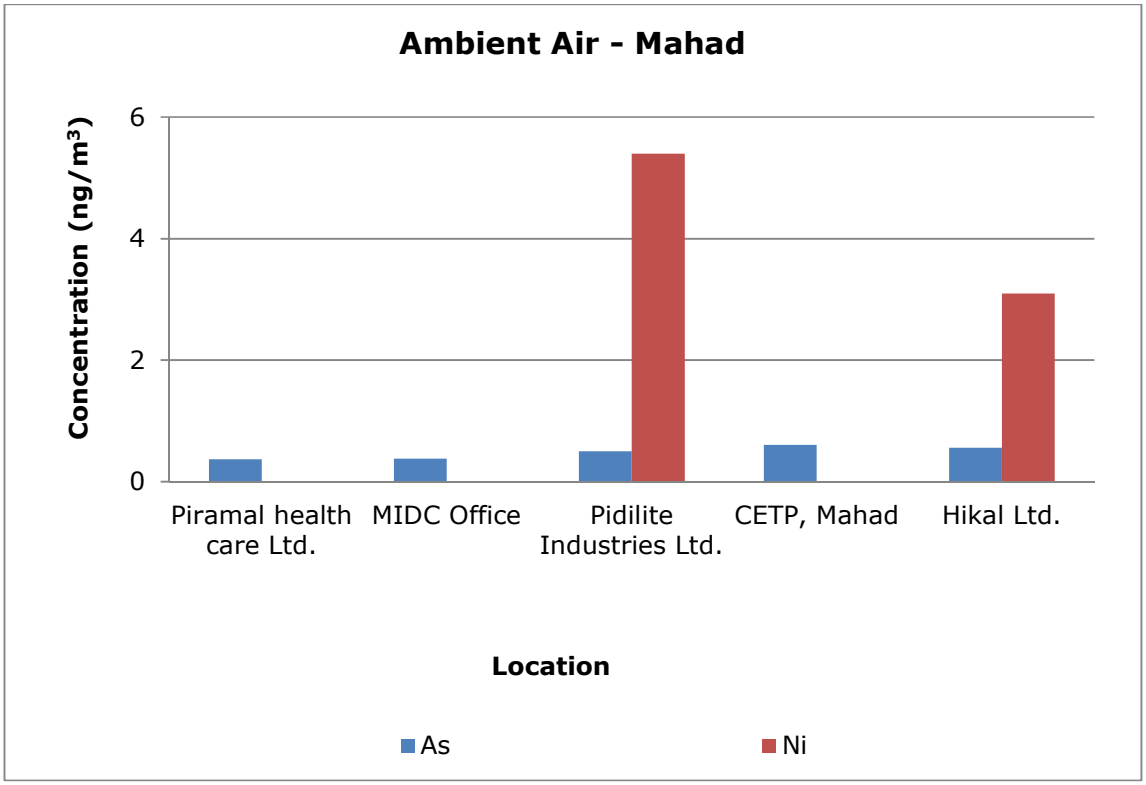
Graphs - Ambient Air Quality Monitoring of Mahad






Ambient Air - Mahad
Concentration (µg/m³)
200
180
160
140
120
100
80
60
40
20
0
Piramal health care Ltd.
Akzo noble India Ltd.
Vinati Organics Ltd.
Sandoz India Pvt. Ltd.
MIDC Office
Pidilite Industries Ltd.
CETP, Mahad
Hikal Ltd.
Location
O3
NH3


Ambient Air - Mahad
Concentration (mg/m³)
5
4
3
2
1
0
Piramal health care Ltd.
Akzo noble India Ltd.
Vinati Organics Ltd.
Sandoz India Pvt. Ltd.
MIDC Office
Pidilite Industries Ltd.
CETP, Mahad
Hikal Ltd.
Location
CO (1h)
CO (8h)


Ambient Air - Mahad
Concentration (ng/m³)
6
4
2
0
Piramal health care Ltd.
MIDC Office
Pidilite Industries Ltd.
CETP, Mahad
Hikal Ltd.
Location
As
Ni

WATER ENVIRONMENT

6. Water Environment

For studying the water environment of Mahad area, six samples of Effluent Treatment Plant (ETP) outlet were collected from different industries. The quality of waste water was determined by determining various parameters as per standards and corresponding results are discussed below:

Six surface water samples are collected from Mahad region.

- All six water samples collected are found acceptable in general appearance, colour, smell and transparency.
- General parameters like pH, electrical conductivity, suspended solids, BOD, and COD are also observed well within the limits in all the samples.
- Total dissolved solids were found to exceed the permissible limit in three water samples.
- In fish bioassay, 100% survival of fishes was achieved in the water sample of Savitri river near Visva hotel.
- All metals like Arsenic, Nickel, Copper, Iron, Hexavalent Chromium (Cr^{6+}) etc. are also observed either below detection limit or below their standard limits.
- Parameters like Total Residual Chlorine, Total Kjeldahl Nitrogen, Cyanide, Fluoride, Sulphide, Dissolved Phosphate, Total Ammonical Nitrogen and Phenolic compounds, also meet the criteria as prescribed by CPCB.
- Organo Chlorine Pesticides, Polynuclear aromatic hydrocarbons (PAH) and Polychlorinated Biphenyls (PCB) are also observed below the detectable limit in all the studied samples.

Table 6.1 Details of Sampling Location of Surface Water

Sr. No.	Name of Monitoring Location	Latitude	Longitude	Date of Sampling		
				Round-1	Round-2	Round-3
1.	Savitri river, Dadli bridge, Arvind nagar	N18°04'30.54"	E73°25'15.35"	23.05.2023	25.05.2023	27.05.2023
2.	Savitri river, savitri river near visva hotel	N18°05'12.17"	E73°26'40.04"	23.05.2023	25.05.2023	27.05.2023
3.	Savitri river, Nadgaon tarf Birwad	N18°06'50.10"	E73°28'39.17"	23.05.2023	25.05.2023	27.05.2023
4.	Savitri river, Kamble tarf	N18°04'32.86"	E73°28'26.38"	23.05.2023	25.05.2023	27.05.2023
5.	Kall river, Akale village, Near Bhorao	N18°10'30.05"	E73°29'54.37"	23.05.2023	25.05.2023	27.05.2023

Sr. No.	Name of Monitoring Location	Latitude	Longitude	Date of Sampling		
				Round-1	Round-2	Round-3
6.	Siddharth Colorchem Pvt. Ltd	N18°05'47.14"	E73°28'14.45"	23.05.2023	25.05.2023	27.05.2023

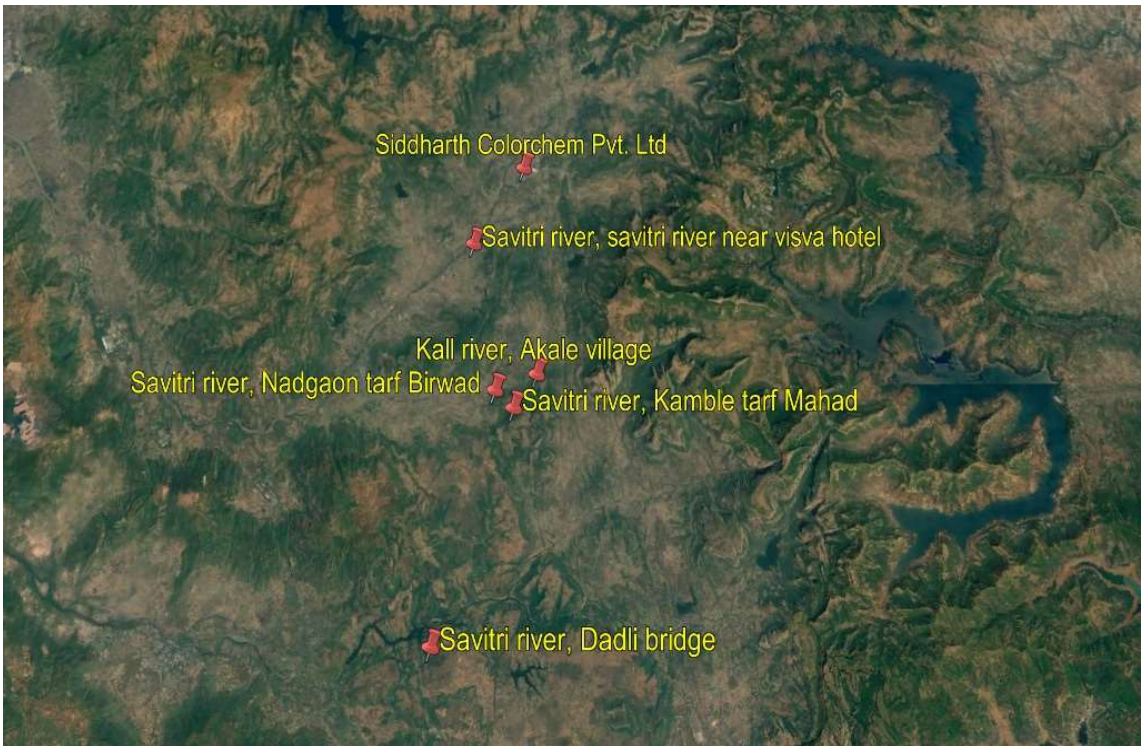


Fig: Geographical Locations of Surface Water Sampling

Table 6.2 Results of Surface Water

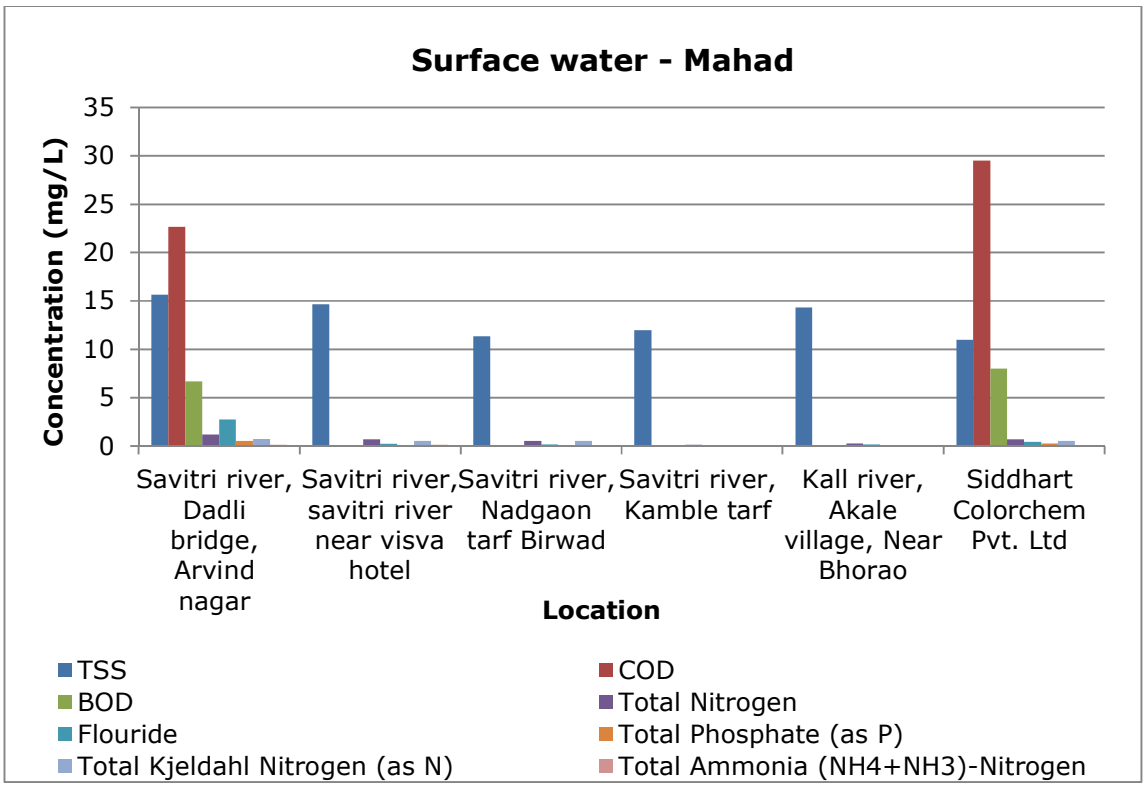
Parameters	Unit	Results					
		Savitri river, Dadli bridge	Savitri river near visva hotel	Savitri river, Nadgaon tarf Birwad	Savitri river, Kamble tarf Mahad	Kall river, Akale village, Near Bhorao	Siddhart Colorchem Pvt. Ltd.
Sanitary Survey	-	Reasonably clean neighbourhood	Reasonably clean neighbourhood	Reasonably clean neighbourhood	Reasonably clean neighbourhood	Reasonably clean neighbourhood	Reasonably clean neighbourhood
General Appearance	-	No floating Matter	No floating matter	No floating matter	No floating matter	No floating matter	No floating matter
Transparency	m	0.43	0.40	0.50	0.73	0.50	0.30
Temperature	°C	31	31	32	32	33	33

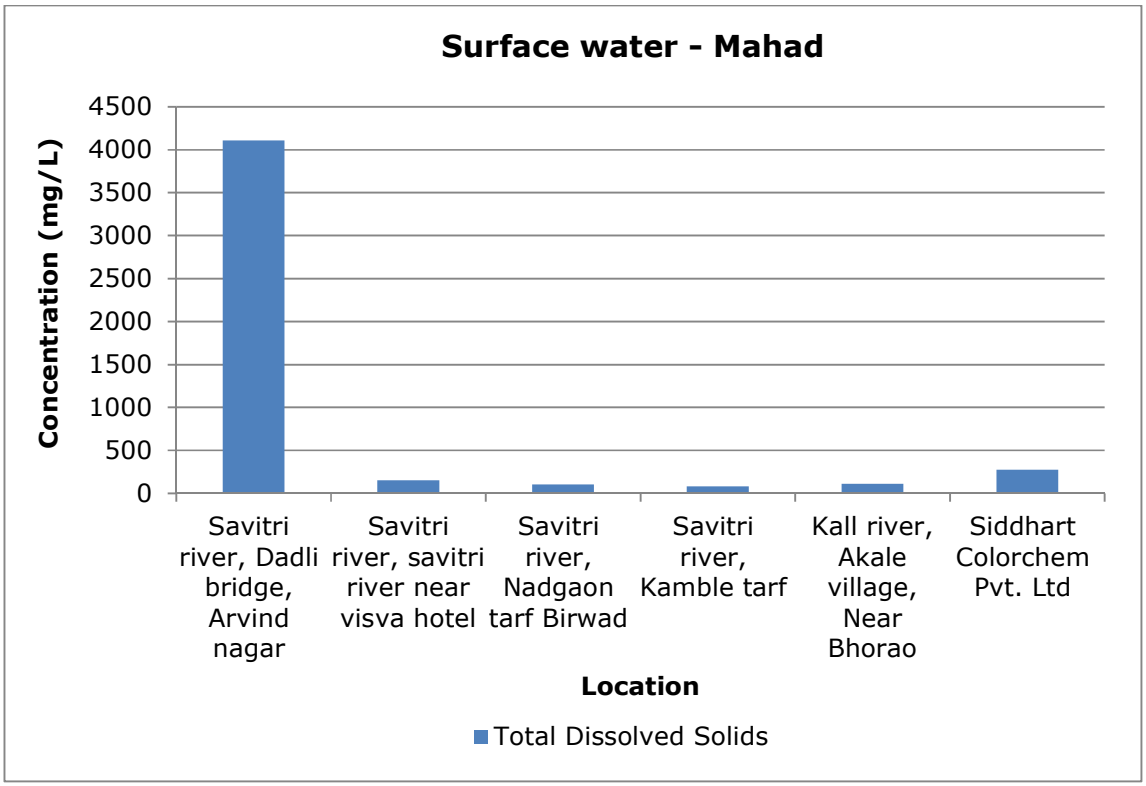
Parameters	Unit	Results					
		Savitri river, Dadli bridge	Savitri river near visva hotel	Savitri river, Nadgaon tarf Birwad	Savitri river, Kamble tarf Mahad	Kall river, Akale village, Near Bhorao	Siddhart Colorchem Pvt. Ltd.
Colour	Hazen	1	1	1	1	1	2
Smell	-	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
pH (at 25°C)	-	6.84	7.27	7.46	7.40	7.38	7.10
Oil & Grease	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Total Suspended Solids	mg/L	16	15	11	12	14	11
Total Dissolved Solids	mg/L	4107	152	104	81	110	277
Dissolved Oxygen (% Saturation)	%	67.33	84.33	88.33	87.33	89.67	70.00
Chemical Oxygen Demand	mg/L	23	BLQ	BLQ	BLQ	BLQ	30
Biochemical Oxygen Demand (3 days,27°C)	mg/L	7	BLQ	BLQ	BLQ	BLQ	8.00
Electrical Conductivity (at 25 °C)	µmho/cm	7340	270	185	145	196	492
Nitrite Nitrogen (as NO2)	mg/L	0.05	0.02	BLQ	BLQ	BLQ	BLQ
Nitrate Nitrogen (as NO3)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
$(NO_2 + NO_3)$-Nitrogen	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Free Ammonia (as NH_3-N)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Free Residual Chlorine	mg/L	0.23	0.24	0.25	BLQ	0.24	BLQ
Cyanide (as CN)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Fluoride (as F)	mg/L	2.77	0.23	0.17	0.10	0.17	0.43
Sulphide (as S2-)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Dissolved Phosphate (as P)	mg/L	0.44	BLQ	BLQ	BLQ	BLQ	0.16
Sodium Adsorption Ratio	-	10.57	1.28	0.53	0.46	0.70	1.37

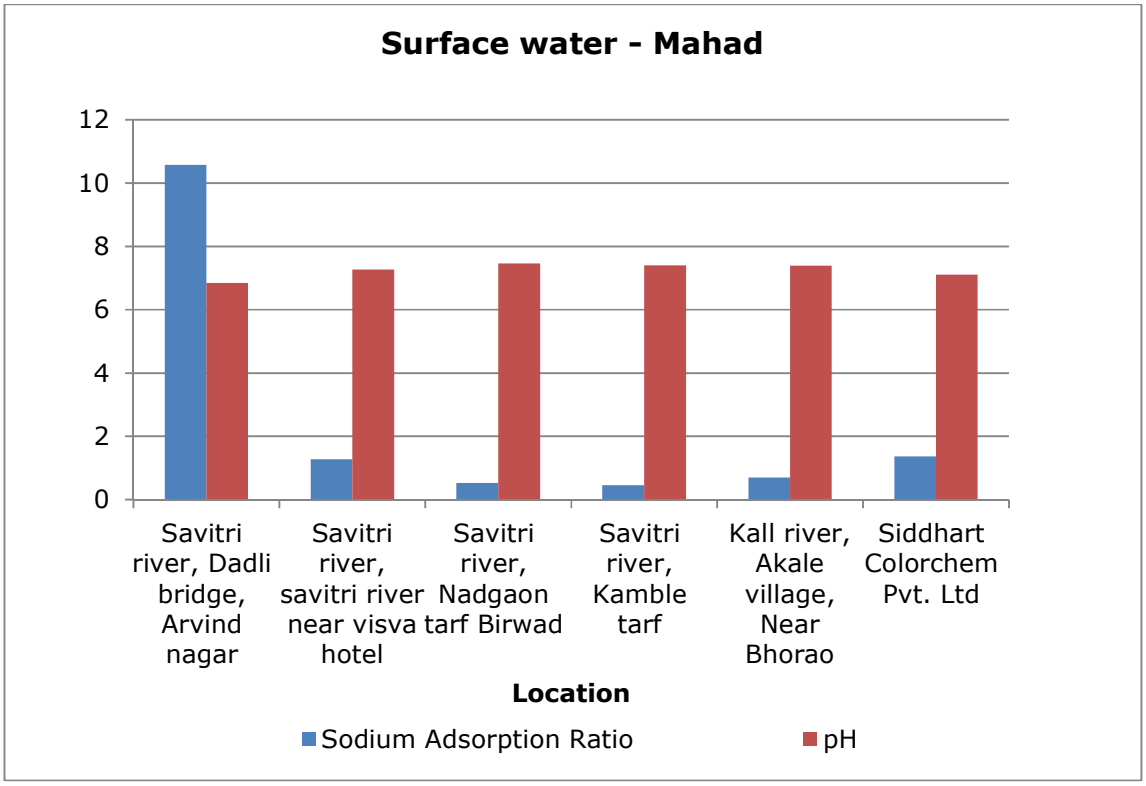
Parameters	Unit	Results					
		Savitri river, Dadli bridge	Savitri river near visva hotel	Savitri river, Nadgaon tarf Birwad	Savitri river, Kamble tarf Mahad	Kall river, Akale village, Near Bhorao	Siddhart Colorchem Pvt. Ltd.
Total Coliforms	MPN Index/ 100 ml	20	540	285	79	910	20
Faecal Coliforms	MPN Index/ 100 ml	18	350	240	23	49	14
Total Phosphate (as P)	mg/L	0.54	BLQ	BLQ	BLQ	BLQ	0.28
Total Kjeldahl Nitrogen (as N)	mg/L	0.75	0.56	0.56	BLQ	BLQ	0.56
Total Ammonia (NH_4+NH_3)-Nitrogen	mg/L	0.13	0.16	0.13	BLQ	BLQ	0.13
Total Nitrogen	mg/L	1.19	0.72	0.50	0.15	0.27	0.70
Phenols (as C_6H_5OH)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Anionic Detergents (as MBAS)	µg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Organo Chlorine Pesticides	µg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Polynuclear aromatic hydrocarbons (as PAH)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Polychlorinated Biphenyls (PCB)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Zinc (as Zn)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Nickel (as Ni)	mg/L	BLQ	BLQ	BLQ	BLQ	0.02	0.02
Copper (as Cu)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Hexavalent Chromium (as Cr^{6+})	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Total Chromium (as Cr)	mg/L	0.02	0.10	0.03	0.02	0.03	0.02
Total Arsenic (as As)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	0.01
Lead (as Pb)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Cadmium (as Cd)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

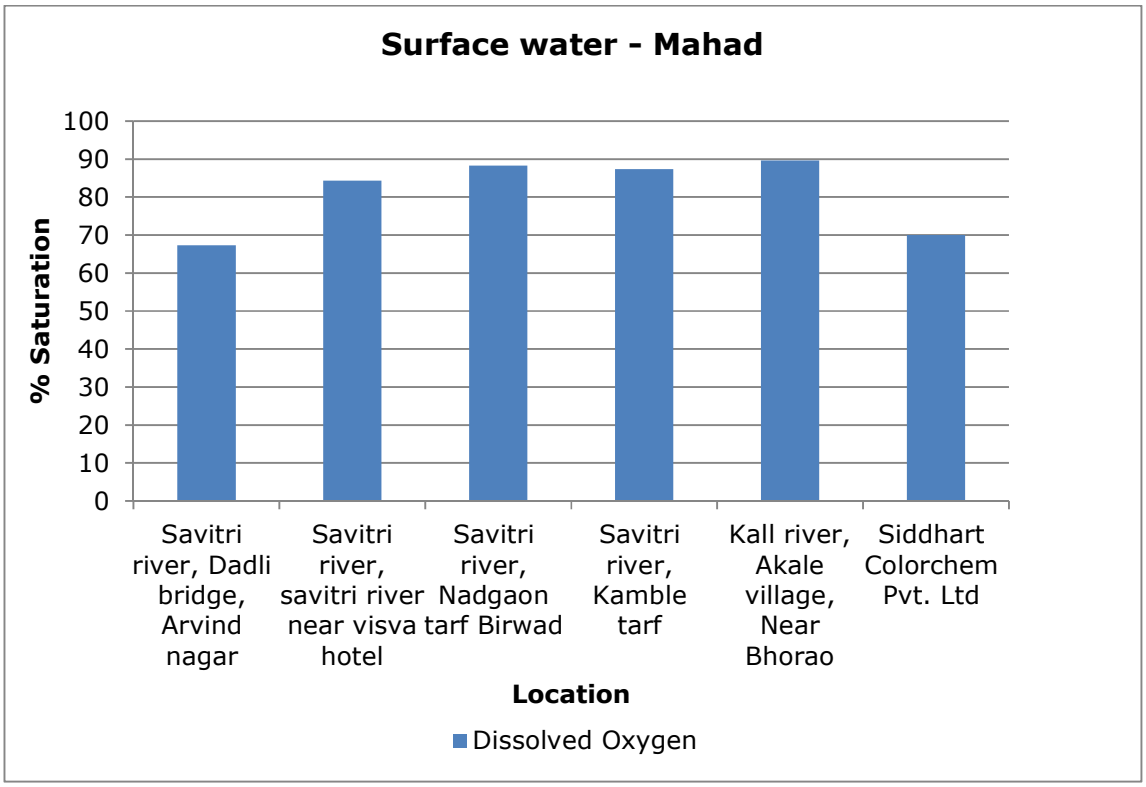
Parameters	Unit	Results					
		Savitri river, Dadli bridge	Savitri river near visva hotel	Savitri river, Nadgaon tarf Birwad	Savitri river, Kamble tarf Mahad	Kall river, Akale village, Near Bhorao	Siddhart Colorchem Pvt. Ltd.
Mercury (as Hg)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Manganese (as Mn)	mg/L	BLQ	0.02	0.03	BLQ	0.03	0.03
Iron (as Fe)	mg/L	0.42	0.33	0.34	0.20	0.31	0.29
Vanadium (as V)	mg/L	0.02	0.07	BLQ	0.03	0.05	0.03
Selenium (as Se)	mg/L	0.01	0.01	0.01	0.01	0.01	0.01
Boron (as B)	mg/L	0.22	0.18	0.18	BLQ	BLQ	0.30
Bioassay Test on fish	mg/L	67	100	100	67	100	100

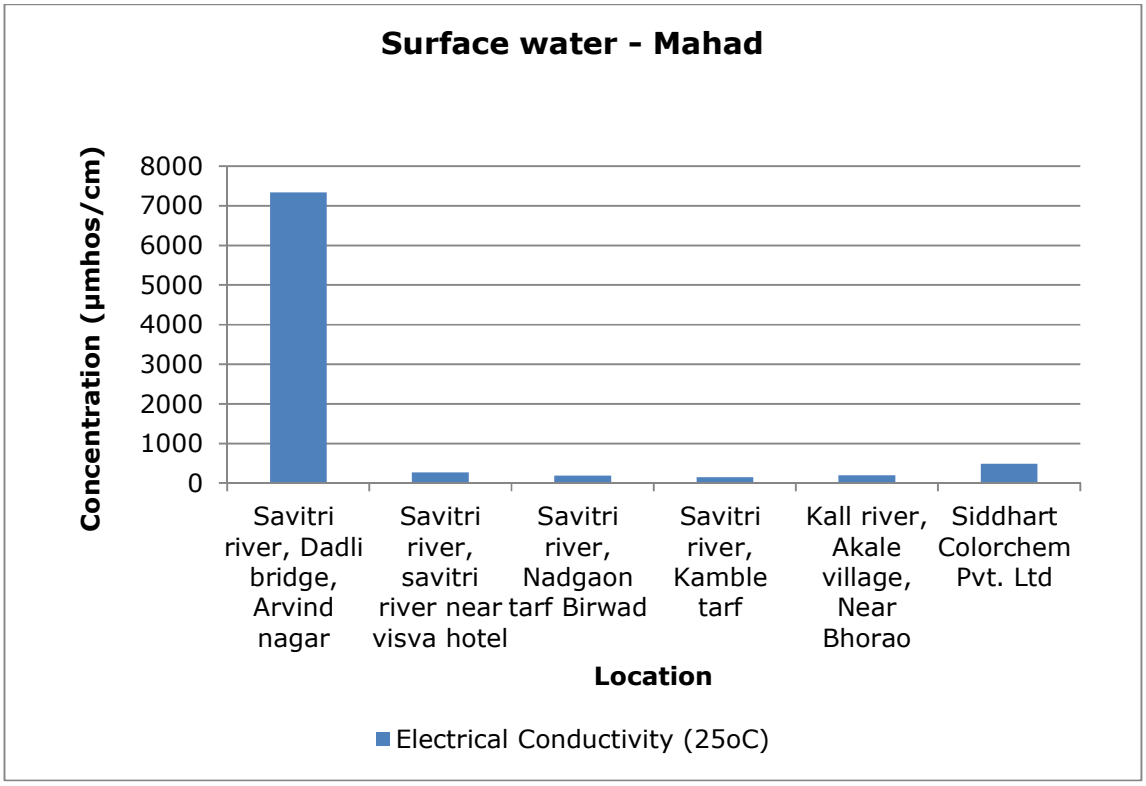
Graphs - Surface Water Quality of Mahad

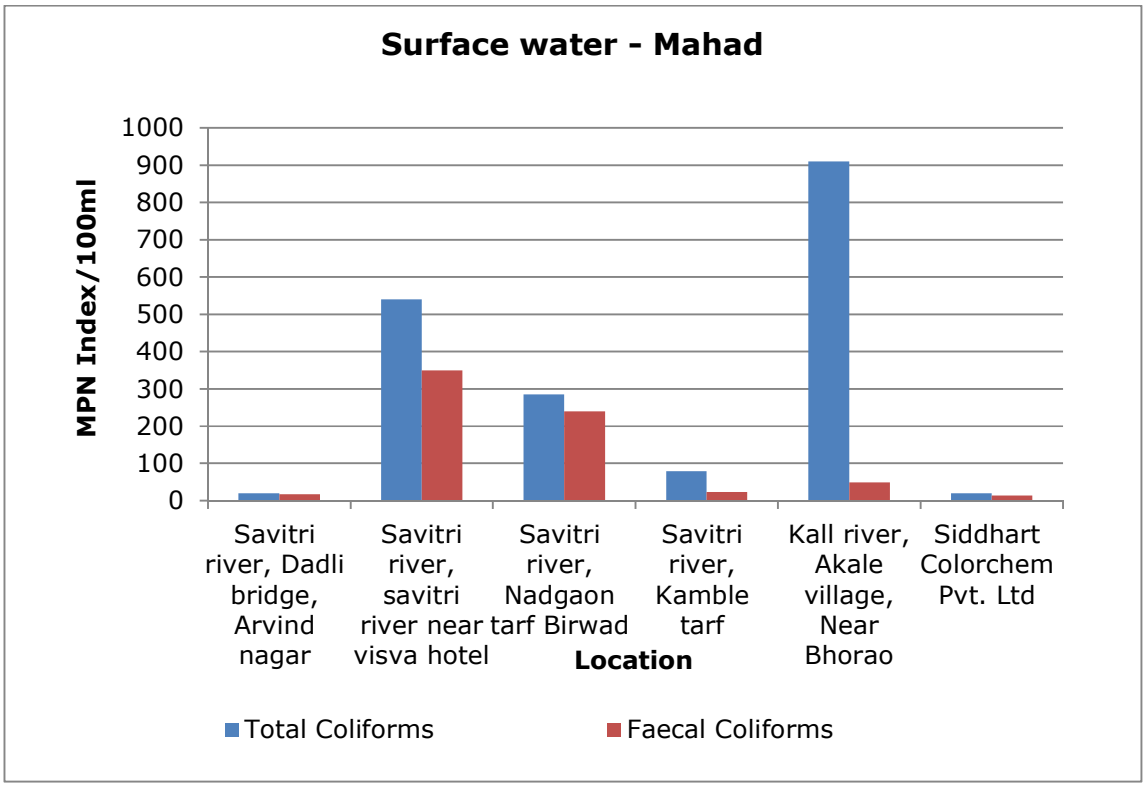


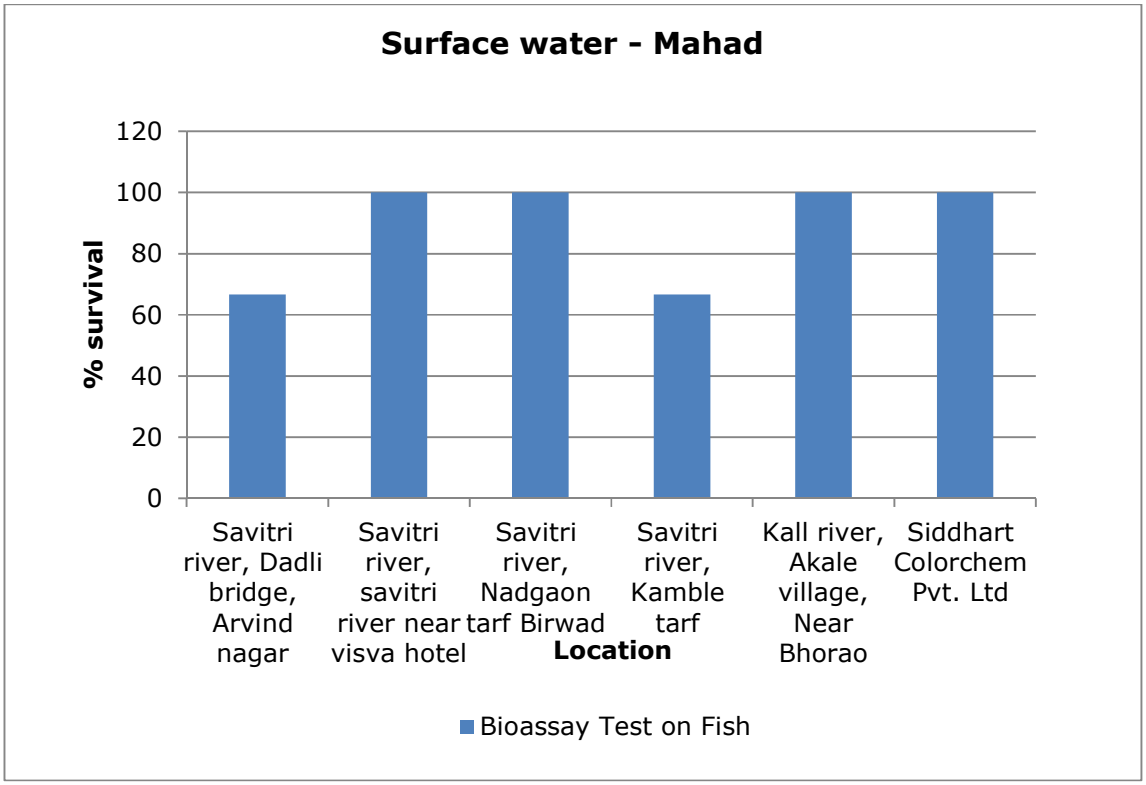



Surface water - Mahad
12
10
8
6
4
2
0
Savitri river, Dadli bridge, Arvind nagar
Savitri river, savitri river near visva hotel
Savitri river, Nadgaon tarf Birwad
Savitri river, Kamble tarf
Kall river, Akale village, Near Bhorao
Siddhart Colorchem Pvt. Ltd
Location
Sodium Adsorption Ratio
pH


Surface water - Mahad
% Saturation
100
90
80
70
60
50
40
30
20
10
0
Savitri river, Dadli bridge, Arvind nagar
Savitri river, savitri river near visva hotel
Savitri river, Nadgaon tarf Birwad
Savitri river, Kamble tarf
Kall river, Akale village, Near Bhorao
Siddhart Colorchem Pvt. Ltd
Location
Dissolved Oxygen


Surface water - Mahad
Concentration (µmhos/cm)
8000
7000
6000
5000
4000
3000
2000
1000
0
Savitri river, Dadli bridge, Arvind nagar
Savitri river, savitri river near visva hotel
Savitri river, Nadgaon tarf Birwad
Savitri river, Kamble tarf
Kall river, Akale village, Near Bhorao
Siddhart Colorchem Pvt. Ltd
Location
Electrical Conductivity (25oC)


Surface water - Mahad
MPN Index/100ml
1000
900
800
700
600
500
400
300
200
100
0
Savitri river, Dadli bridge, Arvind nagar
Savitri river, savitri river near visva hotel
Savitri river, Nadgaon tarf Birwad
Savitri river, Kamble tarf
Kall river, Akale village, Near Bhorao
Siddhart Colorchem Pvt. Ltd
Location
Total Coliforms
Faecal Coliforms


Surface water - Mahad
120
100
80
60
40
20
0
% survival
Savitri river, Dadli bridge, Arvind nagar
Savitri river, savitri river near visva hotel
Savitri river, Nadgaon tarf Birwad
Savitri river, Kamble tarf
Kall river, Akale village, Near Bhorao
Siddhart Colorchem Pvt. Ltd
Location
Bioassay Test on Fish

LAND ENVIRONMENT

7. Land Environment

For studying the land Environment of Mahad area, ground water was collected from Bore well. Dug well, and Hand Pump. A total of 6 samples were collected from (i) Borewell at Mr. Anand Nayan farm house (ii) Well at Mr. Jadhav House Aasanpoi (iii) Hand Pump near Baudhabari Village (iv) Handpump near Navi Nagar Village Near Mahad Police Station (v) Hand Pump near Akole Village (vi) Well at Deshmukh Kamble Village.

Six groundwater samples were collected from the MIDC Mahad region.

- All the water samples collected are found acceptable in general appearance, colour, smell and transparency.
- Parameters like pH, suspended solids, TDS, BOD, and COD are also observed well within the limits in all the collected samples.
- All the six water samples achieved 100% survival in Fish Bioassay.
- All metals like Arsenic, Nickel, Copper, Iron, Hexavalent Chromium (Cr^{6+}) etc. are also observed either below detection limit or below their standard limits.
- Parameters like Total Residual Chlorine, Cyanide, Fluoride, Sulphide, Dissolved Phosphate, Total Ammonical Nitrogen and Phenolic compounds, also meet the criteria as prescribed by CPCB.
- Organo Chlorine Pesticides, Polynuclear aromatic hydrocarbons (PAH) and Polychlorinated Biphenyls (PCB) are below the detectable limit in all studied samples.

Table 7.1 Details of Sampling Location of Ground Water

Sr. No.	Name of Monitoring Location	Latitude	Longitude	Date of Sampling		
				Round-1	Round-2	Round-3
1.	Borewell at Mr. Anand Nayak farm house Aasanpoi	18°05'52.89"N	73°29'7.24"E	23.05.2023	25.05.2023	27.05.2023
2.	Well at Mr. Jadhav House Aasanpoi	18°05'55.43"N	73°29'11.39"E	23.05.2023	25.05.2023	27.05.2023
3.	Hand Pump near Baudhabari Village Aasanpoi	18° 5'47.40"N	73°29'13.90"E	23.05.2023	25.05.2023	27.05.2023
4.	Handpump near Navi Nagar Village Near Mahad Police Station	18° 5'56.85"N	73°27'47.04"E	23.05.2023	25.05.2023	27.05.2023
5.	Hand Pump near Akole Village	18° 6'1.91"N	73°27'45.27"E	23.05.2023	25.05.2023	27.05.2023

Sr. No.	Name of Monitoring Location	Latitude	Longitude	Date of Sampling		
				Round-1	Round-2	Round-3
6.	Well at Deshmukh Kamble Village	18° 4'52.09"N	73°28'14.24"E	23.05.2023	25.05.2023	27.05.2023

Fig: Geographical Locations of Ground Water Sampling

Table 7.2 Results of Ground Water

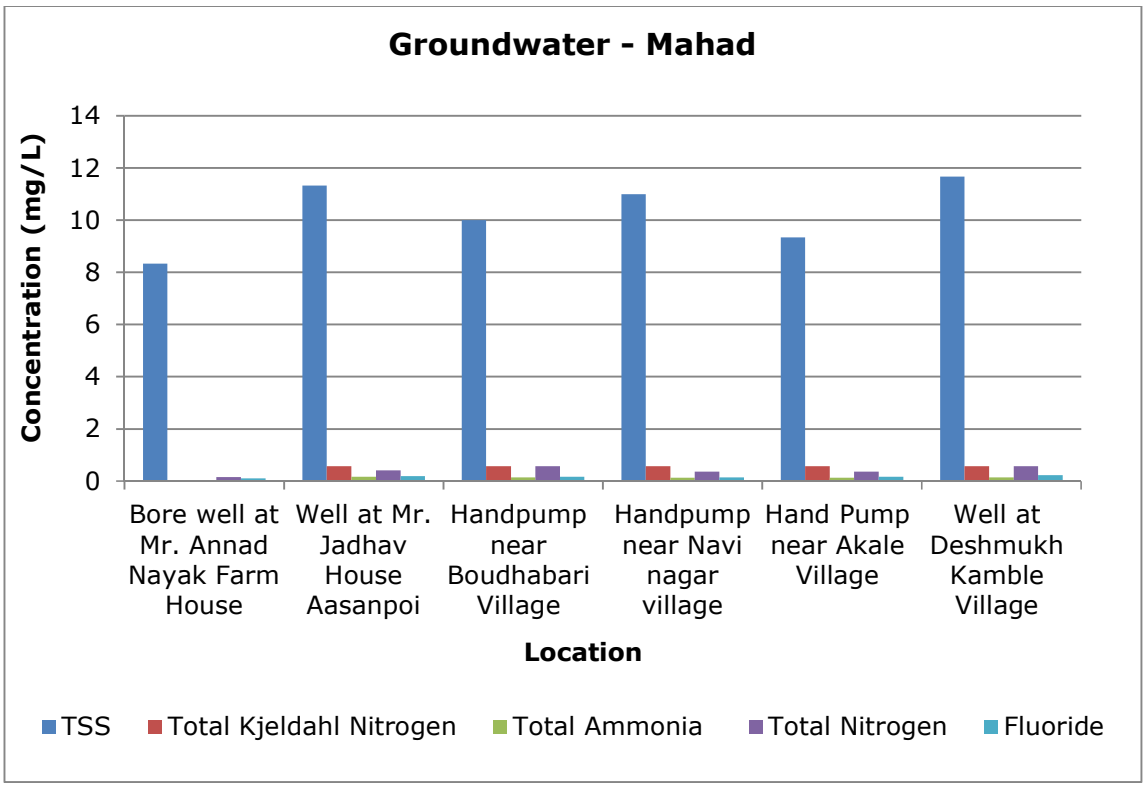
Parameters	Unit	Results					
		Bore well at Mr. Anand Nayak Farm House, Aasanpoi , Mahad	Well at Mr. Jadav House, Aasanpoi, THL, Mahad	Handpump near Boudhabari village Aasanpoi, THL Mahad	Handpump near Navi Nagar village, Near Mahad Police Station Mahad	Handpump near, Akale village THL, Mahad	Well at Deshmukh Kamble village well, THL Mahad
Sanitary Survey	-	Reasonably clean neighbourhood	Reasonably clean neighbourhood	Reasonably clean neighbourhood	Reasonably clean neighbourhood	Reasonably clean neighbourhood	Reasonably clean neighbourhood

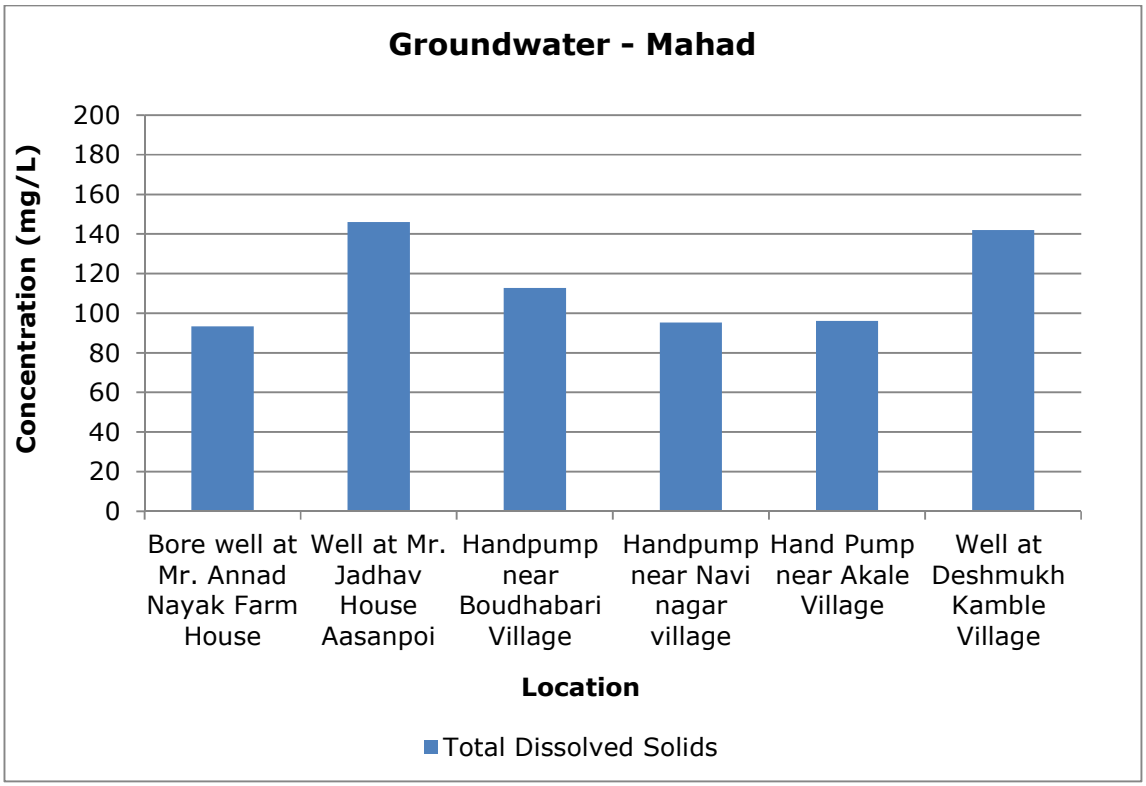
Parameters	Unit	Results					
		Bore well at Mr. Anand Nayak Farm House, Aasanpoi , Mahad	Well at Mr. Jadav House, Aasanpoi, THL, Mahad	Handpump near Boudhabari village Aasanpoi, THL Mahad	Handpump near Navi Nagar village, Near Mahad Police Station Mahad	Handpump near, Akale village THL, Mahad	Well at Deshmukh Kamble village well, THL Mahad
General Appearance	-	No Floating matter	No Floating matter	No floating matter	No floating matter	No floating matter	No floating matter
Transparency	m	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Temperature	°C	31	31	32	31	31	31
Colour	Hazen	1	1	1	1	1	1
Smell	-	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
pH (at 25°C)	-	7.34	7.48	7.97	7.70	7.79	7.42
Oil & Grease	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Total Suspended Solids	mg/L	8	11	10	11	9	12
Total Dissolved Solids	mg/L	93	146	113	95	96	142
Chemical Oxygen Demand	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Biochemical Oxygen Demand (3 days,27oC)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Electrical Conductivity (at 25°C)	µmho/cm	165	248	202	168	170	252
Nitrite Nitrogen (as NO2)	mg/L	BLQ	0.02	BLQ	BLQ	BLQ	BLQ
Nitrate Nitrogen (as NO3)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
$(NO_2 + NO_3)$-Nitrogen	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Free Ammonia (as NH_3-N)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Free Residual Chlorine	mg/L	0.24	0.25	0.23	0.50	BLQ	BLQ
Cyanide (as CN)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

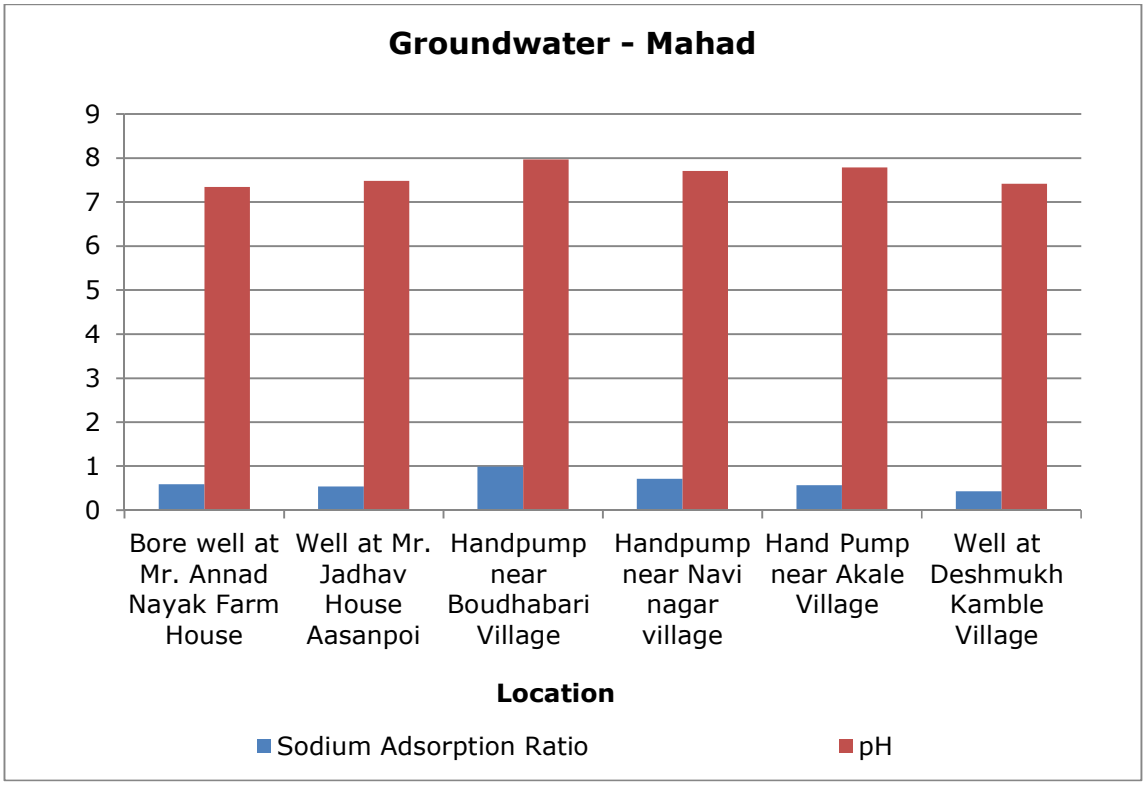
Parameters	Unit	Results					
		Bore well at Mr. Anand Nayak Farm House, Aasanpoi , Mahad	Well at Mr. Jadav House, Aasanpoi, THL, Mahad	Handpump near Boudhabari village Aasanpoi, THL Mahad	Handpump near Navi Nagar village, Near Mahad Police Station Mahad	Handpump near, Akale village THL, Mahad	Well at Deshmukh Kamble village well, THL Mahad
Fluoride (as F)	mg/L	0.10	0.20	0.17	0.13	0.17	0.23
Sulphide (as S^{2-})	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Dissolved Phosphate (as P)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Sodium Adsorption Ratio	-	0.59	0.54	0.99	0.71	0.56	0.43
Total Coliforms	MPN Index/ 100 ml	17	8	BLQ	BLQ	BLQ	77
Faecal Coliforms	MPN Index/ 100 ml	8	BLQ	BLQ	BLQ	BLQ	10
Total Phosphate (as P)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Total Kjeldahl Nitrogen	mg/L	BLQ	0.56	0.56	0.56	0.56	0.56
Total Ammonia (NH_4+NH_3)-Nitrogen	mg/L	BLQ	0.16	0.14	0.13	0.13	0.14
Total Nitrogen	mg/L	0.16	0.42	0.57	0.36	0.36	0.57
Phenols (as C_6H_5OH)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Anionic Detergents (as MBAS, Calculated as LAS, mol.wt. 288.38)	µg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Organo Chlorine Pesticides	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Polynuclear aromatic hydrocarbons (as PAH)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

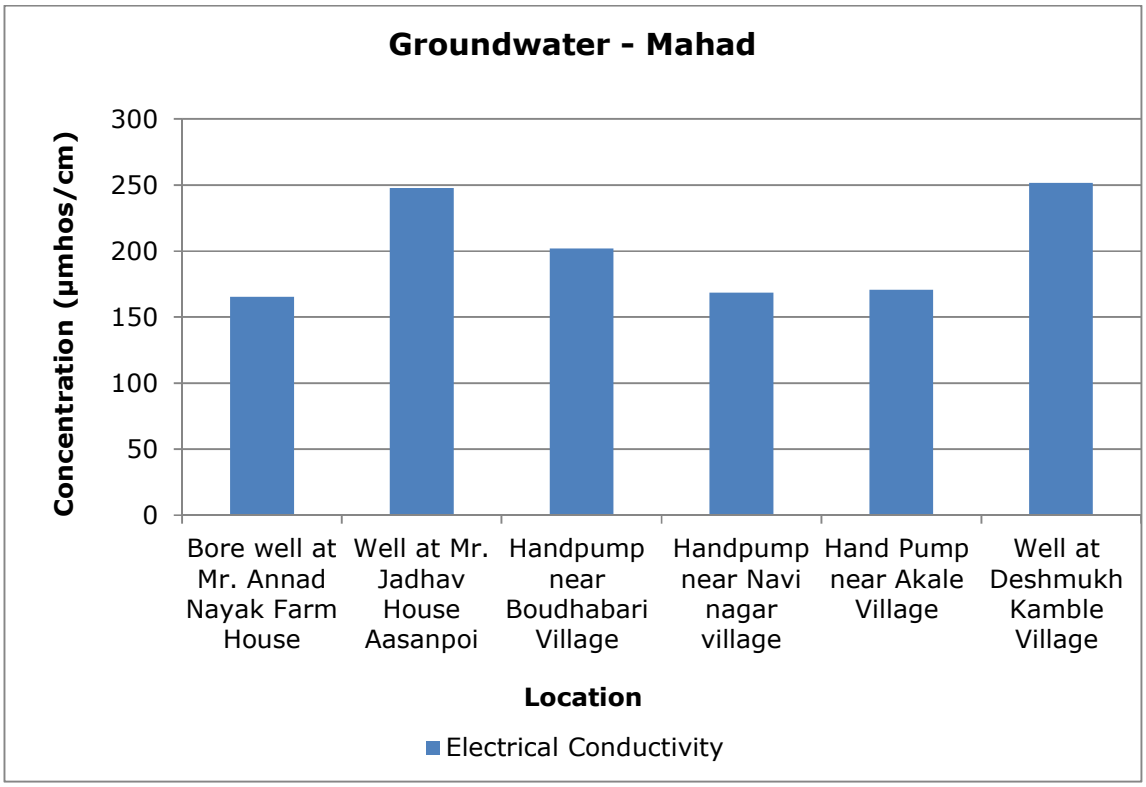
Parameters	Unit	Results					
		Bore well at Mr. Anand Nayak Farm House, Aasanpoi , Mahad	Well at Mr. Jadav House, Aasanpoi, THL, Mahad	Handpump near Boudhabari village Aasanpoi, THL Mahad	Handpump near Navi Nagar village, Near Mahad Police Station Mahad	Handpump near, Akale village THL, Mahad	Well at Deshmukh Kamble village well, THL Mahad
Polychlorinated Biphenyls (PCB)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Zinc (as Zn)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Nickel (as Ni)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Copper (as Cu)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Hexavalent Chromium (as Cr^{6+})	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Total Chromium (as Cr)	mg/L	0.03	0.03	0.03	0.02	0.06	0.03
Total Arsenic (as As)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Lead (as Pb)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Cadmium (as Cd)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Mercury (as Hg)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Manganese (as Mn)	mg/L	0.08	0.03	0.03	0.05	BLQ	0.06
Iron (as Fe)	mg/L	0.30	0.27	0.24	0.31	0.23	0.22
Vanadium (as V)	mg/L	BLQ	0.01	0.01	0.01	BLQ	0.11
Selenium (as Se)	mg/L	0.01	0.01	0.01	0.01	0.01	0.01
Boron (as B)	mg/L	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Bioassay Test on fish	% survival	100	100	100	100	100	100

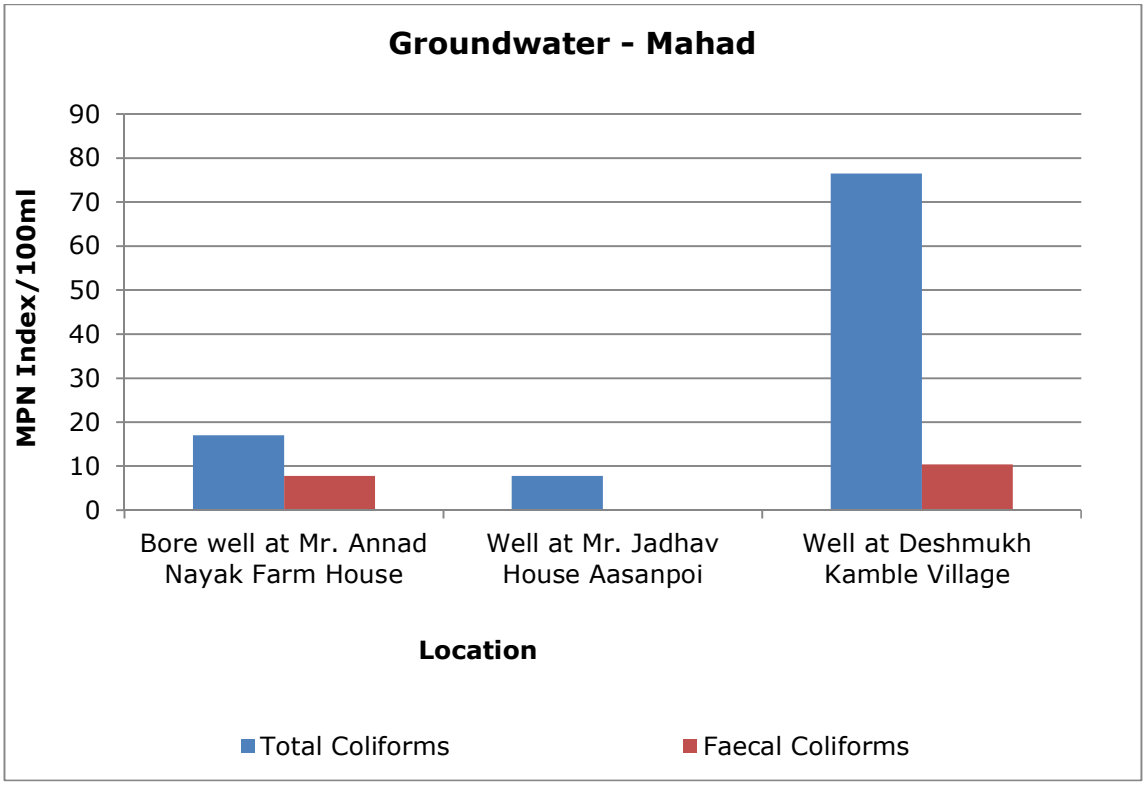
Graphs - Ground Water Quality of Mahad

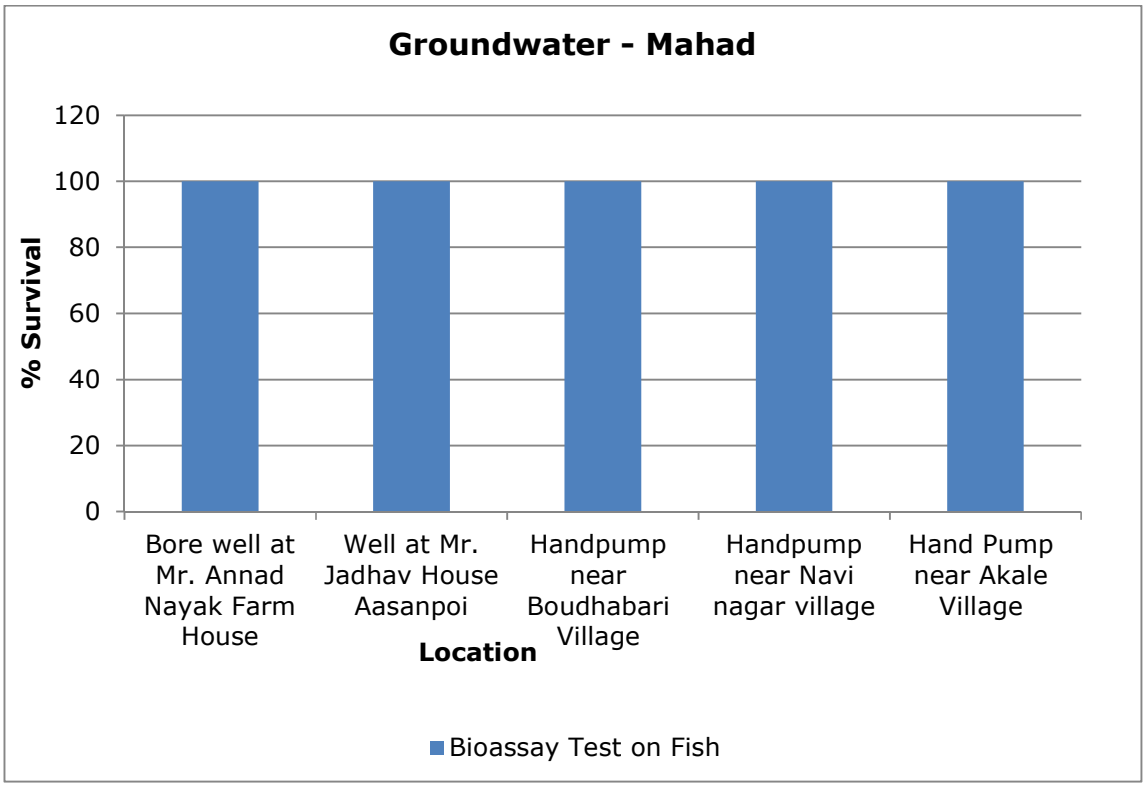





Groundwater - Mahad
9
8
7
6
5
4
3
2
1
0
Bore well at Mr. Annad Nayak Farm House
Well at Mr. Jadhav House Aasanpoi
Handpump near Boudhabari Village
Handpump near Navi nagar village
Hand Pump near Akale Village
Well at Deshmukh Kamble Village
Location
Sodium Adsorption Ratio
pH


Groundwater - Mahad
Concentration (µmhos/cm)
300
250
200
150
100
50
0
Bore well at Mr. Annad Nayak Farm House
Well at Mr. Jadhav House Aasanpoi
Handpump near Boudhabari Village
Handpump near Navi nagar village
Hand Pump near Akale Village
Well at Deshmukh Kamble Village
Location
Electrical Conductivity


Groundwater - Mahad
MPN Index/100ml
90
80
70
60
50
40
30
20
10
0
Bore well at Mr. Annad Nayak Farm House
Well at Mr. Jadhav House Aasanpoi
Well at Deshmukh Kamble Village
Location
Total Coliforms
Faecal Coliforms


Groundwater - Mahad
% Survival
120
100
80
60
40
20
0
Bore well at Mr. Annad Nayak Farm House
Well at Mr. Jadhav House Aasanpoi
Handpump near Boudhabari Village
Handpump near Navi nagar village
Hand Pump near Akale Village
Location
Bioassay Test on Fish

C: Receptor

Component C (Impact on Human Health) 10	
Main - 10	
% increase in cases	**Marks**
<5%	**0**
5-10%	**5**
>10%	**10**

- % increase is evaluated based on the total no. of cases recorded during two consecutive years.
- For Air Environment, the total no. of cases related to Asthma, Bronchitis, Cancer, Acute respiratory infections etc. are to be considered.
- For surface water/groundwater Environment, cases related to Gastroenteritis, Diarrhoea, renal (kidney) malfunction, cancer etc are to be considered.
- For the above evaluation, the previous 5 years records of 3-5 major hospitals of the area shall be considered.

Annexure – I Health Related Data enclosed.

9. CEPI Score

Comprehensive Environmental Pollution Index (CEPI) is intended to act as an early warning tool that helps in the categorization of industrial clusters/ areas in terms of priority of needing attention. The CEPI score has been calculated based on CPCB Letter No. B-29012/ESS (CPA)/2015-16 dated 26th April 2016. The scoring system involves an algorithm that considers the basic selection criteria. It is proposed to develop the CEPI based on Sources of pollution, real-time observed values of the pollutants in the ambient air, surface water and groundwater in & around the industrial cluster, and health-related statistics.

Table 8.1 CEPI score of the Pre-monsoon Season 2023

	A1	A2	A	B	C	D	CEPI
Air Index	2.75	4	11	0	10	5	**26.00**
Water Index	1.75	4	7	11	10	5	**33.00**
Land Index	1.5	4	6	9.75	10	5	**30.80**
						Aggregated CEPI	**38.4**

Table 8.2 Comparison of CEPI Scores

	Air Index	Water Index	Land Index	CEPI
CEPI Score June 2023	26.00	33.00	30.80	**38.40**
CEPI Score March 2023	29.00	35.25	33.00	**41.45**
CEPI Score June 2021	21.50	20.00	41.00	**43.54**
CEPI Score March 2021	21.50	39.00	37.25	**43.89**
CEPI score March 2020	41.80	20.30	23.30	**44.60**
CEPI score June 2019	30.50	51.50	50.00	**58.90**
CEPI score march 2019	34.75	45.00	45.00	**53.60**
CEPI score June 2018	26.00	39.25	45.00	**50.61**
CEPI score March 2018	32.50	38.50	45.00	**51.88**

CPCB CEPI score March 2018	41.00	35.75	29.00	**47.12**

CEPI Score Calculation:

Ambient Air Analysis Report

Pollutant	Group	A1	A2	A (A1 X A2)
PM_{10}	B	2	Large	
$PM_{2.5}$	B	0.5		
NO_2	A	0.25		
		2.75	**4**	**11**

Pollutant	Avg (1)	Std (2)	EF (3) [(3)=(1)/(2)]	No. of samples Exceeding (4)	Total no. of samples (5)	SNLF Value (6) [(6)=(4)/(5) x(3)]	SNLF score (B)	
PM_{10}	65.96	100	0.66	0	8	0.00	L	0
$PM_{2.5}$	17.79	60	0.30	0	8	0.00	L	0
NO_2	22.38	80	0.28	0	8	0.00	L	0
B score = (B1+B2+B3)							**B**	**0**

C	**10**	**>10%**
D	**5**	**A-IA-A**

Air CEPI	**(A+B+C+D)**	**26.0**

Water Quality Analysis Report

Pollutant	Group	A1	A2	A (A1 X A2)
TDS	A	1	Large	
(NH_4+NH_3)-N	A	0.25		
BOD	B	0.5		
		1.75	**4**	**7**

Pollutant	Avg (1)	Std (2)	EF (3) [(3)=(1)/(2)]	No. of samples Exceeding (4)	Total no. of samples (5)	SNLF Value (6) [(6)=(4)/(5) x(3)]	SNLF score (B)	
TDS	805.22	2000	0.40	1	6	0.07	M	9
(NH_4+NH_3)-N	0.15	1.5	0.10	0	6	0.00	L	0

BOD	7.33	8	0.92	0	6	0.00	L	2
B score = (B1+B2+B3)							**B**	**11**

C	**10**	**>10%**
D	**5**	**A-IA-A**

Water CEPI	**(A+B+C+D)**	**33.0**

Ground Water Quality Analysis Report

Pollutant	Group	A1	A2	A (A1 X A2)
Fe	A	1	Large	
TDS	A	0.25		
Fluoride	A	0.25		
		1.5	**4**	**6**

Pollutant	Avg (1)	Std (2)	EF (3) [(3)=(1)/(2)]	No. of samples Exceeding (4)	Total no. of samples (5)	SNLF Value (6) [(6)=(4)/(5) x(3)]	SNLF score (B)	
Fe	0.26	0.3	0.87	1	6	0.14	M	9.75
TDS	114.22	2000	0.06	0	6	0.00	L	0
Fluoride	0.17	1.5	0.11	0	6	0.00	L	0
B score = (B1+B2+B3)							**B**	**9.75**

C	**10**	**>10%**
D	**5**	**A-IA-A**

Land CEPI	**(A+B+C+D)**	**30.8**

Water CEPI Score (im) **33.0**

Land CEPI Score (i2) **30.8**

Air CEPI Score (i3) **26.0**

Aggregated CEPI Score =

CEPI Score = **38.4**

10. Conclusion

Ambient Air Quality

- In the present study, 08 AAQ stations were identified in the CEPI impact area to cover both upwind and cross-wind directions, and an AAQ survey was conducted.
- All air quality parameters are observed well within the limits as per NAAQS.
- Concentration of PM_{10} is observed in the range of 51µg/m^3 to 76µg/m^3 and $PM_{2.5}$ in the range of 12 to 21µg/m^3 at the studied locations, which are less than the limits laid down in NAAQS 2009. However, in the CPCB CEPI report (2018), out of 24 samples, 10 of PM_{10} and 7 of $PM_{2.5}$ are found to exceed the standard limits of NAAQS.
- In the CEPI score calculated for Air Environment by CPCB in March 2018, the concentration of PM_{10} exceeded at all the studied locations and which contributed to a higher air index (41.00). However, in the present report, the concentration of both PM_{10} and $PM_{2.5}$ are found below permissible levels resulting in less exceedance factor, this time air index is calculated as 26, which is quite lower than the CPCB report.

Surface Water Quality

- To understand the quality of treated effluent, samples were collected from six industries
- Higher concentration of Total dissolved solids was observed in the three surface water samples collected, which may be due to domestic wastewater, sewage, or other localized activities.
- In the Mahad region, industries are reusing either the treated trade effluent as sewage in their process or gardening.
- In the CEPI score calculated for Water Environment by CPCB in March 2018, concentration values of total hardness were higher and exceeded at 3 of the studied locations.

Ground Water Quality

- Six groundwater samples were collected from different Dug well, and Bore well in the region.
- Higher concentration of Iron was observed in one of the groundwater samples collected, this may be due to agricultural processes.
- In the CEPI score calculated for Land Environment by CPCB in March 2018 also there is no critical pollutant exceeding in any water sample collected.

CEPI Score

- The CEPI Score pre-monsoon season is 38.4.

- During the calculation of the CEPI score, the water Index is calculated as highest at 33.0, followed by the Land Index at 30.8 and Air index as 26. The parameters of surface water and groundwater in the Mahad region is well within the limits. Hence, aggregated CEPI score is calculated as 38.4.
- In CEPI score of CPCB 2018, the Air index was higher as compared to the present (June, 2023) indices.
- As per the CPCB CEPI calculation revised in 2016, Health statistics represented by Receptor C in CEPI Calculation, also play an important role.
- For analysing the health data collected from hospitals in the vicinity of the studied area, a more than 10% increase in air and waterborne disease cases is observed in the consecutive years of 2020-2021 and 2021-2022. Hence score for receptor C is considered 10 for all air, water & land Environment. However, in the CEPI score calculated by CPCB (2018), the receptor C (the health data) score was zero for all three environmental components i.e. air, water, and land. An increase in health data is observed, which may be due to the decreased immunity in the masses after the pandemic of COVID-19 globally.
- Collective efforts of the regional office of MPCB, NMMC, administration, and environmental organizations are resulting in control of pollution level in this region.
- Efforts taken to reduce the pollution level is represents factor D in CEPI Calculation, which also affects the overall CEPI score.
- The present study is the compilation of pre-monsoon season, which results in the dilution of environmental samples resulting in lower pollution load, hence also affecting the total score.
- In conclusion, this year in 2023, the CEPI score calculated in the Mahad region is 38.4, which is approximately 19% lower than the CEPI score (47.12) observed in 2018.

11. Efforts Taken by MPCB to Control and Reduce Environmental Pollution Index

- Waste collection and segregation centres:
  a) **Domestic Solid Waste**: MMC has provided on site waste collection and segregation facility for residential area.
  b) **Industrial Non-Hazardous waste**: Recyclable waste is sent to authorized segregation facility for residential area.
  c) **Hazardous waste**: industrial hazardous waste sent to common hazardous treatment and disposal facility by industries.
- One Common Effluent Treatment plant (CETP) of 7.5 MLD capacity is installed for the treatment of wastewater.
- Continuous Emission Monitoring System (CEMS) are installed for Air and Water in 30 Large and Medium scale RED category industries.
- Arrangement of scientific collection and treatment of sewage generated by each industry:-65 no of Industries.
- Installation of CAAQMS station: 01 no.
- Establishment of Monitoring stations under National Water Quality Monitoring Programme (NWMP): 05 no.
- Steps are taken for industrial area/other units to recycle 100%% treated effluent to achieve zero liquid discharge (ZLD):18 nos.
- Steps taken to reduce dust emission:- Industry have changed their F.O. to low Sulphur fuel and Green Fuel like LPG, PNG, and Electricity.
- Tree plantation in last one year (2021-2022): 14056
- Various awareness programs are conducted regularly in coordination with TBIA, TTCWMA, CETP & other industries.

Continuous Ambient Air Quality Monitoring Station (CAAQMS)

Ambient Air Quality Monitoring (AAQM) Van

12. Photographs

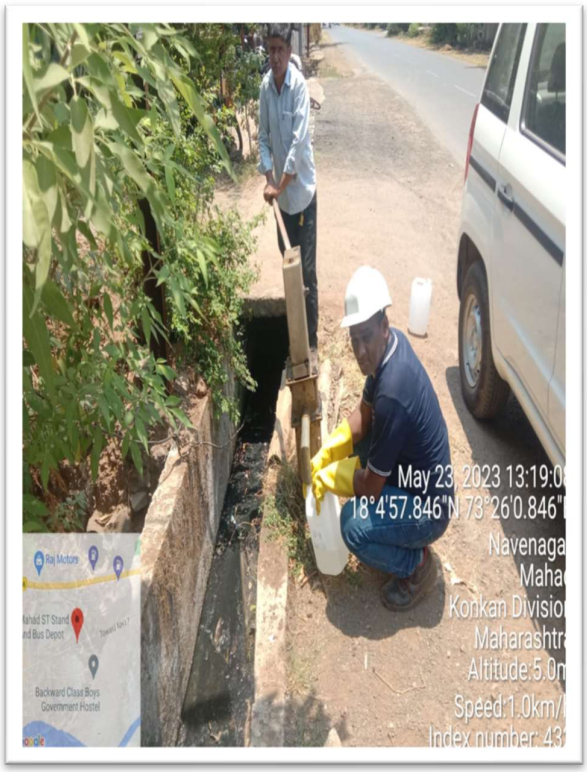
Ambient Air Sampling at Akzo Noble India Ltd.

Ambient Air Sampling at Vinati Organics Ltd.

Ambient Air Sampling at Kamble Tarf, Birwadi

Ambient Air Sampling at Sandoz India Ltd.

Surface water sampling at Kamble Tarf Mahad	**Surface water sampling at Nadgaon Tarf Birwadi**
Surface water sampling at Savitri River, Dadli Bridge	**Surface water sampling at Savitri River near Vishwa Hotel**

Groundwater sampling at Asanpoi	**Groundwater sampling at Bhoudhabari Village**
	
Groundwater sampling at Akale village	**Groundwater sampling at Navi nagar**

HEALTH STATISTICS

Required for Comprehensive Environmental Pollution Index (CEPI) Study by Maharashtra Pollution Control Board (MPCB)

Name of the Polluted Industrial Area (PIA)	MAHAD
Name of the major health center/ organization	MMA hospital MIDC
Name and designation of the Contact person	Dr Ramesh Naik, Medical superintendent, 9503856761, 7350004775
Address	MIDC Mahad, Nadgaon, Tarf Birwadi, Maharashtra 402309

S No.	Diseases	No. of Patients Reported	
		2022 (Jan-Dec)	2021 (Jan-Dec)
AIRBORNE DISEASES			
1.	Asthma	15	10
2.	Acute Respiratory Infection	750	500
3.	Bronchitis	--	--
4.	Cancer	--	--
WATERBORNE DISEASES			
1.	Gastroenteritis	--	--
2.	Diarrhea	60	40
3.	Renal diseases	--	--
4.	Cancer	--	--

Date: 20/10/2023

Signature

MMA HOSPITAL MIDC MAHAD

HEALTH STATISTICS

Required for Comprehensive Environment Pollution Index (CEPI) study by Maharashtra Pollution Control Board (MPCB)

Name of the polluted Industrial Area (PIA)	MAHAD
Name of the major health center/ organization	RURAL HOSPITAL (P.H.C. Birwadi)
Name and designation of the contact person	DR E.C. Biradar (9604221024) medical officer
Address P.H.C. Birwadi Tq Mahad Dist Raigad	MG Rd, Mahad, Maharashtra 402301

S No.	Diseases	No. of Patients Reported	
		2022 (Jan-Dec)	2021 (Jan-Dec)
AIRBORNE DISEASES			
1.	Asthma	9	12
2.	Acute Respiratory Infection	140	180
3.	Bronchitis	7	10
4.	Cancer	1	1
WATERBORNE DISEASES			
1.	Gastroenteritis	18	22
2.	Diarrhea	28	16
3.	Renal Diseases	01	0
4.	Cancer	0	0

Date:

सदर पेशेंट हे प्रा आ केंद्र बिरवाडी अंतर्गत येणाऱ्या O.P.D. Basis वर देण्यात आले आहेत

Signature:

Medical Officer
Primary Health Center Birwadi,
Tal.: Mahad, Dist.-Raigad.