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Noise Pollution in Palghar

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ABSTRACT

The current work was carried out during Ganesh festival which is a very popular festival in Maharashtra. Idols of lord Ganesh are brought to homes and also in public places .The idols the occasion is celebrated with huge pomp and splendour. On a normal working day and the final day of the festival, noise levels were measured at four different locations in Palghar Tehsil, a far western suburb of Mumbai city, using a sound level metre. Noise pollution indices as well as Noise Climate were computed. On both days, noise levels exceeded the central pollution control board's norms, with a noticeable increase in noise levels on the final day at all sites. On the Vaitarna site, the category of safe zone on festive and non-festive days was indicated. At 4 pm, 5 pm, and 6 pm time slots on festive days, Saphale site displayed a low to moderate risk zone category, while the rest of the time slots on festive days displayed a high risk zone category. On a festive day, the Boisar site indicated a high risk. On non-festive days, the Saphale, Palghar, and Boisar sites indicated safe zones, safe to low risk zones, and safe to moderate zones, respectively. Noise levels are not monitored by any agency in this area.

Keywords: Noise pollution; festival; L_{eq}; Noise climate.

1. INTRODUCTION

Palghar, a town in Thane district, is 87 kilometres from Mumbai. The town is rapidly expanding and is classified as semi-urban because it has designated areas for agriculture and industry. Tarapur, which is part of the Maharashtra Industrial Corporation (Palghar), has little environmental monitoring. At regular intervals, the CPCB monitors the air and water in and around certain locations in Palghar. Attempts have been made to regulate noise levels; however, despite being a rapidly growing region, noise pollution in this area has not been studied. Noise is an unwanted sound that may cause some psychological and physical stress to human beings exposed to it. It is also considered as an environmental stressor and nuisance. Noise pollution has become an inevitable part of modern civilization. It is a fact that sound intensity above 80dB level is harmful to individual belonging to all ages [1-5]. An attempt has been made to investigate noise pollution during Ganesh Utsav, a well-known festival celebrated throughout Maharashtra. The festival lasts 11 days, culminating in Anant Chaturdashi. The Ganesh idol immersion procession lasts several hours and includes loud speakers, musical instruments such as drums, banjos, and cymbals, and firecrackers. This generates a significant amount of noise pollution. A Five-day noise monitoring study was conducted in Thane by MPCB [6] during Ganesh Festival. The result showed that the maximum noise level was 91.4 dBA and minimum noise level was 46.4 dBA. Considerable amount of increase in noise levels have been recorded on festival days in various parts of the country [7].

Noise imparts several effects on mental and physical health and results in disturbances in the daily activities. It affects living as well as non-living things [8]. Noise might affect sleep, conversation, causes hearing loss; in addition to these effects it also affects human judgment and performance [9]. Generally high exposure to noise level can cause annoyance, irritation, damage to auditory system, number of health related effects like physiological, psychological disorders, difficulties in daily activities and performances, hypertension and heart diseases [10]. Along with other types of pollution,

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noise has become a hazard to quality of life [11]. Various studies have revealed that noise levels in some of the Indian cities are higher than the standards prescribed by CPCB, Central Pollution Control Board and MoEF, Ministry of Environment and Forest, Govt. of India [12-17]. Several studies have been carried out in India on noise levels, noise climate, *Leq,* and L_{max} [18-20].

The CPCB has notified air quality standards for noise which has been included as an air pollutant. Realizing the need to control and regulate noise levels, the Ministry of Environment and Forests, Government of India, have notified Standards and Guidelines for Noise Levels under Environment (Protection) Rules, 1986, known as Noise Pollution (Regulation & Control) Rules, 2000 as shown in Table 1. The objective of the study is to assess the noise pollution levels, noise climate, *Leq,* and L_{max}, Noise Pollution Level Index and Noise Climate in this industrial area.

Table 1. Ambient permissible noise levels in India as per prescribed by CPCB

Area code	Category	Limits in Dba	
		Day time	Night time
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence zone	50	40

2. MATERIALS AND METHODS

2.1 Study Area

Palghar is one of the far Western suburbs of Mumbai city Fig. 1. Population of Palghar is 5, 50,222 (Palghar, 2011). Residential colonies and built up areas are very well developed near railway line zones. Current study was carried out at four different sites in Palghar tehsil viz. Vaitarna, Saphale, Palghar and Boisar. Out of these four sites Saphale is a developing area while Palghar and Boisar are very well developed due to the presence of MIDC (Maharashtra Industrial Development Corporation) in the close vicinity. Due to the geographic restriction Vaitarna is a small undeveloped village with many settlements.

In the current study, noise levels on a normal day and on the last day (Anant Chaturdashi) of Ganesh festival were observed. The main objective of the study was to monitor and evaluate the fluctuating noise level in the different parts of the study area.

Fig. 1. Map showing sampling points

2.2 Instrument Used

Sound level meter of Lutron Electronics (Model number: - SL 4010) was used to monitor sound levels at all the sites mentioned above. The readings were measured in dB (A) unit, where A denotes the “A

weighting" characteristic which is simulated as "Human Ear Listing" response. The time weighting is adjusted to "Fast" by default. The sound level meter is provided with high sensitivity Bruel and Kjaer Prepolarized Condenser Microphone (Type 4226) at the top and readings are generated on the horizontal display.

2.3 Sampling Methodology

While recording the noise levels, the sound level meter was placed at 1 to 1.2m above the ground surface level and one meter away from sound source, then microphone of sound level meter was pointed towards the source of sound and readings were noted down. To minimize the error, readings were taken continuously for 30 minutes at an interval of 2 minutes. The noise levels were recorded on Saturday, 28th September 2012 the last day of the festival and Monday, 17th September 2012, a normal working day. The reading were taken from 4pm to 9 pm from 4 to 4.30 pm, 5 to 5.30 pm, 6 to 6.30 pm , 7 to 7.30 pm, 8 to 8.30 pm and 9 to 9.30 pm. L_{eq} was calculated using following formula

$$Leq, T = 10 \log \left[\frac{1}{n \sum_{i=1}^{n} 10^{\frac{Li}{10}}} \right]$$

Where, L_{eq} = noise levels observed in time interval T and n= n^{th} duration of measurement [21].

L_{eq} is the equivalent continuous equal energy level; and can be applied to any fluctuating Noise Level. It is that constant Noise Level that over a given time expends the same amount of energy as the fluctuating level over the same time period [22]. The readings noted in fractions, were rounded off to nearest integer in the observation tables. To detect the actual rise in the noise level a set of readings was taken on a normal working day. To get better understanding of noise range noise climate (NC) index [23] was calculated using following formula: *NC= L_{10}- L_{90} dB (A).*

Total annoyance caused by noise level was estimated using noise pollution level index (NP) [24]: *LNP= Leq * 2.56∂*

Where, *L_{NP}= Noise pollution level, L_{eq}= equivalent noise level, ∂= standard deviation*

Statistical analysis was carried out to analyse the significant difference between festive and a non-festive day.

3. RESULTS AND DISCUSSIONS

Deviation of noise from its mean point and L_{10}, L_{50}, L_{90} values are shown in Table 2. Table 3 and Table 4 show the equivalent noise (L_{eq}) maximum noise (L_{max}) and minimum noise (L_{min}) recorded at all four sites at different time slots on festive and non-festive day respectively. On festive day fluctuation of noise was more in comparison to non-festive day. On the festive day, 9 pm time slot at Vaitarna showed a decrease in the noise levels as compared to other slots in the same area. Sound levels on all other sites at all the time slots exceeded the permissible limit. On the normal working day i.e. non - festive day sudden depletion in the noise levels was observed. Vaitarna site remained noiseless for all the time slots. Palghar site was the noisiest followed by Boisar and Saphale.

87 dB (A) at 7pm and 69 dB (A) at 5pm in Palghar were the highest $L_{eq,}$ while 53 dB (A) in at 9pm and 42 dB (A) at Vaitarna were the lowest L_{eq} recorded on festive and non-festive days respectively. The continuous monitoring showed the broad fluctuating range. Saphale site showed acute fluctuation followed by Boisar, Palghar and Vaitarna.

L_{10} and L_{90} are defined as peak and back-ground sound levels over certain measurement duration [25]. On festive and non-festive days L_{10} values for Vaitarna, Saphale, Palghar and Boisar site differed by 5 - 10 dB (A), 20 – 27 dB (A), 19 – 20 dB (A) and 15 – 25 dB (A) respectively, whereas the range of fluctuation of L_{90}value for Vaitarna, Saphale, Palghar and Boisarsite was 6 -12 dB(A), 20 – 24 dB(A), 16 – 19 dB(A) and 27 – 33 dB(A) respectively. Highest difference in standard deviation of festive and non-festive day was recorded at Saphale site and least deviation was seen at Palghar site.

Table 2. Different noise parameters on festive and non-festive days

	4:00 PM									
Site	**Festive day**					**Non- festive day**				
	Mean	**SD**	**L_{10}**	**L_{50}**	**L_{90}**	**Mean**	**SD**	**L_{10}**	**L_{50}**	**L_{90}**
Vaitarna	57	2	61	57	55	44	4	51	45	40
Saphale	76	3	80	76	72	52	3	57	51	50
Palghar	76	3	81	77	72	63	2	68	63	63
Boisar	80	2	84	79	78	55	3	60	54	52
	5:00 PM									
Site	**Festive day**					**Non- festive day**				
	Mean	**SD**	**L_{10}**	**L_{50}**	**L_{90}**	**Mean**	**SD**	**L_{10}**	**L_{50}**	**L_{90}**
Vaitarna	59	2	62	59	57	47	3	52	46	46
Saphale	77	3	82	78	74	54	3	59	53	52
Palghar	81	3	87	80	79	68	2	72	67	67
Boisar	80	2	86	80	79	57	4	63	57	54
	6:00 PM									
Site	**Festive day**					**Non- festive day**				
	Mean	**SD**	**L_{10}**	**L_{50}**	**L_{90}**	**Mean**	**SD**	**L_{10}**	**L_{50}**	**L_{90}**
Vaitarna	59	2	63	58	58	46	3	52	45	45
Saphale	79	3	86	78	77	55	3	60	54	52
Palghar	83	5	88	85	78	61	5	71	60	58
Boisar	80	2	85	80	79	54	5	63	52	52
	7:00 PM									
Site	**Festive day**					**Non- festive day**				
	Mean	**SD**	**L_{10}**	**L_{50}**	**L_{90}**	**Mean**	**SD**	**L_{10}**	**L_{50}**	**L_{90}**
Vaitarna	58	1	60	58	57	53	2	57	52	52
Saphale	84	5	89	85	78	48	2	53	48	46
Palghar	86	3	91	85	83	59	3	66	58	57
Boisar	80	2	85	80	78	55	4	62	55	52

	8:00 PM									
Site	**Festive day**					**Non- festive day**				
	Mean	**SD**	**L_{10}**	**L_{50}**	**L_{90}**	**Mean**	**SD**	**L_{10}**	**L_{50}**	**L_{90}**
Vaitarna	59	2	63	58	56	41	4	48	40	38
Saphale	81	8	88	84	71	62	4	70	62	58
Palghar	85	2	89	85	82	62	4	69	61	60
Boisar	83	2	87	84	80	55	7	72	52	51
	9:00 PM									
Site	**Festive day**					**Non- festive day**				
	Mean	**SD**	**L_{10}**	**L_{50}**	**L_{90}**	**Mean**	**SD**	**L_{10}**	**L_{50}**	**L_{90}**
Vaitarna	53	2	57	53	50	41	3	46	41	39
Saphale	82	9	89	86	69	50	4	55	52	44
Palghar	83	3	88	84	79	55	3	61	54	54
Boisar	83	3	86	84	79	51	5	59	50	45

Table 3. Noise levels on festive day (Anant Chaturdashi)

	4:00 PM			**5:00 PM**			**6:00 PM**			**7:00 PM**			**8:00 PM**			**9: 00 PM**		
	L_{eq}	**L_{max}**	**L_{min}**	**L_{eq}**	**L_{max}**	**L_{min}**	**L_{eq}**	**L_{max}**	**L_{min}**	**L_{eq}**	**L_{max}**	**L_{min}**	**L_{eq}**	**L_{max}**	**L_{min}**	**L_{eq}**	**L_{max}**	**L_{min}**
Vaitarna	58	61	54	59	62	56	59	63	57	58	63	56	59	64	54	53	57	50
Saphale	76	80	71	78	83	72	80	87	76	86	90	72	84	88	61	85	89	60
Palghar	77	81	72	82	87	79	85	89	71	87	92	81	86	89	81	84	89	78
Boisar	80	87	78	81	88	79	81	88	79	81	86	78	84	87	79	83	86	77

Table 4. Noise level on non-festive day (Normal working day)

	4:00 PM			**5:00 PM**			**6:00 PM**			**7:00 PM**			**8:00 PM**			**9: 00 PM**		
	L_{eq}	**L_{max}**	**L_{min}**	**L_{eq}**	**L_{max}**	**L_{min}**	**L_{eq}**	**L_{max}**	**L_{min}**	**L_{eq}**	**L_{max}**	**L_{min}**	**L_{eq}**	**L_{max}**	**L_{min}**	**L_{eq}**	**L_{max}**	**L_{min}**
Vaitarna	46	52	39	48	56	46	49	58	45	53	60	52	43	50	38	42	48	38
Saphale	53	62	51	55	63	52	56	61	51	49	56	46	65	72	58	52	56	43
Palghar	65	72	63	69	75	67	66	77	58	62	71	57	66	76	60	57	64	52
Boisar	56	64	51	59	67	53	62	72	52	58	67	51	64	73	50	54	59	45

Table 5. Noise pollution level (NP) on Festive and Non-Festive days

Time	Festive day Vaitarna	Festive day Saphale	Festive day Palghar	Festive day Boisar	Non festive day Vaitarna	Non festive day Saphale	Non festive day Palghar	Non festive day Boisar
4:00 PM	62.49	83.36	83.70	86.08	56.82	61.12	70.92	63.84
5:00 PM	63.45	85.84	88.87	87.31	55.01	62.07	74.05	68.08
6:00 PM	63.54	88.23	96.83	87.16	57.42	62.67	78.92	73.84
7:00 PM	61.47	97.84	94.70	87.01	58.76	55.23	70.51	67.42
8:00 PM	65.18	103.93	91.83	89.44	52.01	74.55	75.36	82.05
9:00 PM	58.82	108.19	91.18	90.77	48.21	62.30	63.85	67.86

Table 6. Noise climate (NC) index of sampling points

NC	Festive day Vaitarna	Non festive day Vaitarna	Festive day Saphale	Non festive day Saphale	Festive day Palghar	Non festive day Palghar	Festive day Boisar	Non festive day Boisar
4:00 PM	5.76	11.45	7.63	7.00	7.70	5.75	8.04	7.80
5:00 PM	4.70	5.70	7.90	6.60	7.55	5.55	6.55	9.40
6:00 PM	5.10	7.25	8.90	8.30	10.35	13.10	6.00	10.55
7:00 PM	3.10	5.15	11.10	6.15	8.45	8.55	7.00	10.15
8:00 PM	6.55	9.95	17.05	11.80	7.00	9.30	6.55	21.15
9:00 PM	6.50	7.40	20.00	11.15	8.40	7.30	6.80	13.90

4. CONCLUSION

On festive days high and comparatively steady noise levels were recorded and analysed using noise pollution level index (Table 5). Comparative analysis of noise using noise pollution level index indicated that Saphale is the noisiest site while Vaitarna is least noisy site of the study area. Palghar and Boisar site show moderate noise pollution and less fluctuation as compared to Saphale site .Equivalent noise levels of festive days were high as compared to the non-festive days on all sites but majority of time slots of all sites showed high noise climate (NC) index on non-festive days (Table 6). Main reason behind this is wide fluctuation range of noise on non-festive days. According to different categories of noise risk zones [25]. L_{eq} values of all sites were assessed to find out level of risk due to high noise levels (Table 7). Vaitarna site indicated the category of safe zone on festive and non-festive day. Saphale site exhibited low to moderate risk zone category for 4pm, 5pm and 6 pm time slot for festive days and for rest all time slots of festive day it showed the category of high risk zone. For Palghar site festive day time slot of 7pm and 8pm showed extremely high risk while rest all slots showed risk categories between moderate to high. Boisar site indicated high risk on festive day. On non-festive day Saphale, Palghar and Boisar site indicated safe zone, safe to low risk zone and safe to moderate zone category respectively.

Table 7. Noise risk zone

Intensity of noise in dB (A)	Category of zones
< 66	Safe
66 – 71	Tolerable
71 – 76	Low risk
76 – 81	Moderate risk
81- 86	High risk
> 86	Extremely high risk

[25]

The Ganesh festival is celebrated with great enthusiasm in all areas of Palghar tehsil. On the day of Anant Chaturdashi (Last day of the festival), immersion procession includes immersion of idols from houses as well as from community groups. The procession involves use of loudspeakers, banjos and firecrackers and continues till hours, this affects the usual sound level. People are often unaware of the consequences of the noise pollution on the human health and environment. Hence it is essential to create awareness amongst the community about the impacts of noise pollution. Restriction from local governments such as defined time limit for procession, limitation on the use of loud musical instruments can also help in controlling the noise pollution.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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STUDIES ON FOLIAR SOUND ABSORPTION CAPACITIES OF SOME URBAN TREES BY IMPEDANCE TUBE METHOD

AMBIKA JOSHI, VISHWAS DESHMUKH , NITESH JOSHI AND PAYAL RANE

Abstract

Noise pollution is a common problem in urban areas with ever increasing vehicular density. Urban trees help in noise attenuation. Various methods are employed to measure sound absorption coefficients of substances .Sound absorption coefficient is normally measured using expensive instruments and calculating absorption coefficients. The absorption coefficient of a substance falls within a scale from 0 to 1. The concept of this absorption coefficient was established by Sabine. In the current work sound absorption ratios of leaves of some tree species are derived using a impedance tube, function generator, standard audio amplifier, omnidirectional microphone and oscilloscope connected together. A sound absorption ratio was derived to measure sound absorption on a relative scale in a closed system calculate sound absorption ratio Sabine□s formula was used and absorption ratio was derived. Sound absorption ratio towards unity indicates poor sound absorption capacity. Sound absorption ratio of leaves of different tree species was studied. Observations were made using oscilloscope connected to a long impendence tube and a speaker at different frequencies like 500Hz, 700Hz etc. In designing the tube 500Hz □ 1000Hz was taken as operating frequency for the reverberation testing and used in sound absorption test. To reduce the effect of attenuation due to walls of tube it was desired to have a large diameter of tube and long length so that at least two minima and one maximum could be found. An omnidirectional microphone was used to study standing pattern. Readings were taken with and without samples so that every time when samples were replaced by the other the initial setting was not disturbed. Initial setting wave pattern was maintained by adjusting i/p power (i.e. current & voltage) of the speaker. At 500Hz the noise levels are closer to audible range, hence it was used as reference and for comparison of absorption by plants at other frequencies. According to the study, leaves of different plant species showed different absorption at different frequencies. Barringtonia acutangulaGoerb, Eucalyptus globulusLabill, Ficus benghalensisL, Ficus glomerataRoxb, Ficus religiosa L, Mangifera indicaL, Polyatlhia longifoliaThev, Sterculia urensL and Thespesia populnea Soland are good sound absorption the method is relatively inexpensive and easy to use to measure sound absorption of foliar surfaces.

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9. Role of *Ipomoea carnea* in Phytoremediation of Heavy Metals

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Abstract

Land in industrial areas receives many solid wastes, including heavy metals. Metals taken up by the plants are incorporated into their tissues depending upon their mobility within the plant. The surplus of heavy metals can severely reduce growth and biomass production in plants.

To understand the fate of some heavy metals in plants, five heavy metals were chosen for their interactions with *Ipomoea carnea* jacq. Subsp. *fistulosa* which is an exotic weed distributed in tropical countries of Asia and America migrated from the American tropics into India. The species is then supposed to have escaped and naturalised elsewhere. As *Ipomoea carnea* is found growing everywhere including waste dumps. The selected heavy metals were Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb) and Zinc (Zn).

Five concentrations of each of the heavy metals were selected to provide a range and meanwhile, control was also set up. The plants were grown for 6 and 9 weeks period. The concentrations of heavy metals were determined using Atomic Absorption Spectrophotometer method (AAS).

The study concluded that if plants were grown for a short period or limited period they may help in improving the quality of soil by effectively removing the heavy metal but continued growth leads to a stage of equilibrium between metal concentrations in and out of plant organs. The Potential of *Ipomoea carnea* to effectively absorb the metals is Zn > Cd; Pb > Cu > Cr and retain them is Cd > Zn; Pb > Cu > Cr.

Keywords: *Ipomoea carnea*, bioremediation, heavy metals.

1. INTRODUCTION

A deteriorating environment is one of the major issues that we face today. Any modification in the physical or biological component of the surrounding which could be harmful to organisms is known as pollution. A harmful substance introduced in the ecosystem as a result of human activity has the potential to get accumulated to harmful levels. There are several reasons for the occurrence of pollution, the major one being urbanization. Intensive urban growth and industrialization started increasing the level of pollution converting our landscapes into vessels of waste. Developmental activities have depleted our natural resources and generated a huge amount of wastes leading to the pollution of air, water and soil. Untreated waste (sewage) plays a major role in the pollution of rivers causing loss of productivity and environmental degradation.

1.1. Types of Pollutants

Biological pollutants: These pollutants include pollen, microbes, viruses, dust mites, insects, several parasites and pathogens and invasive species documented from various sources. (Elliott M., 2003).

Organic pollutants: Usually substances that are biodegradable fall under the category of organic pollutants. They are naturally occurring in the environment but excessive demand has led to massive production causing them to be a cause of concern. PCB - Polychlorinated biphenyls, PAH - polycyclic aromatic hydrocarbons, PBDE - polybrominated diphenyl ethers, petroleum and OCP - organochlorine pesticides are a few that become major pollutants. (El-Shahawi M.S. et al., 2010).

Inorganic pollutants: Metals, salts and substances of mineral origin are considered to be inorganic pollutants. (Wong M.H., 2012). These pollutants can be found naturally but various anthropogenic activities such as metallurgy, smelting and mining processes have introduced them into the environment at higher levels.

Heavy metals: "Heavy metals" is a general collective term, which applies to the group of metals and metalloids with an atomic density greater than 4 g/cm 3, or 5 times or more, greater than water (Nriagu and Pacyna 1988). Heavy metals present naturally in trace amounts are arsenic, cadmium, chromium, cobalt, lead, mercury, nickel and selenium are toxic even at very low concentrations, whereas few heavy metals such as Cu, Zn and Fe are of biological importance and growth, however at high concentrations, can cause damage to the organism by accumulating and displacing vital nutrients in the tissues.

Sources of heavy metals in the environment: Heavy metals are released from natural as well as manmade activities. Natural sources of heavy metals are volcanic eruptions, forest fires, weathering of rocks and sea-salt sprays, whereas the anthropogenic processes include vehicular exhaust, burning of fossil fuels, industrialization, insecticides used in agriculture, metallurgy, mining, smelting, and wastewater.

Heavy metals in soil and Effect on agricultural productivity: Soil and water are both indispensable factors of an ecosystem that are essential for the growth and development of living organisms. An impact on the composition of soil has a corresponding and directly proportional effect on the water resources. The composition of parent rock, degree of weathering and climatic conditions are responsible for the release of heavy metals into the soil. (Arunakumara K. K. I. U. et al., 2013). Heavy vehicular traffic in urban areas is one of the major factors for the contamination of soils with heavy metals. The fate of these heavy metals in the environment is dependent on their bioavailability for their uptake by plants. Phytoavailability of metals plays an important role in the assessment of metal-contaminated sites, the metal availability depends upon the source, metal speciation, pH and other physicochemical properties of soils. (Wuana R.A. and Okieimen F.E., 2011). Agricultural productivity and food safety are solely dependent on the quality of soil and water. Thus making the monitoring of agricultural practices necessary to ensure food safety. The presence of heavy metals in soil and water hampers agricultural production, subsequently lowering the quality and quantity of the yield, consequently affecting the health of consumers. Several studies have reported that crops such as *Oryza sativa, Zea mays* and *Brassica juncea* absorb heavy metals and accumulate them in the plant body thus posing a threat to the health of the consumers. (Murakami M.N. 2007; Meers, E. et al., 2010, Bitther, O.P. et al., 2012).

1.2. Impact of Heavy Metals on Human Health

Phytoremediation of heavy metals: Soil, water and air are the components of the environment that are being affected by the presence of an excessive amount of heavy metals. Industrial activities and runoff of fertilizers and pesticides from agricultural land, sewage water irrigation and coal combustion lead to soil and water contamination by heavy metals. Soils act as a reservoir for heavy metals released into the environment, causing a significant environmental problem with a negative impact on human health and agriculture.

Several physical and chemical methods have been used to clean up the soils of heavy metals, but most of them are expensive and tedious, therefore an alternative, effective and cheap method of soil cleanup is required. Phytoremediation is a concept that uses green plants to remove environmental contaminants. (Cunningham, S.D. & Berti, W.R. 1993; Raskin I. et al., 1997). Phytoremediation is a useful technique for recovering soils containing metal pollutants, utilizing hyperaccumulator plants. The term "hyperaccumulator" is used to describe plants with the ability to tolerate and grow in metalliferous soils, they can extract and accumulate high amounts of heavy metals without enduring toxic impact on the plant health. These plants accumulate 10 to 500 times more metals than ordinary plants. (Chaney R. L. et al 1997). Approximately 500 plant species have been reported in a total based on their extent

of accumulating heavy metals. (Kramer U., 2010). Phytoremediation includes the following mechanisms for the removal of heavy metals such as rhizofiltration, phytoextraction, phytostabilization, phytovolatilization and phytodegradation.

TABLE 1: Major heavy metal pollutants, their sources and effects on humans. (SOURCE: Pallavi Menon 2020)

Heavy metal	Sources	Effects
Arsenic (As)	Fungicides. Metal smelters Pesticides.	Bronchitis Dermatitis Poisoning
Cadmium (Cd)	Cd and Ni batteries Electroplating Nuclear fission plant Pesticides & fertilizer Welding	Gastrointestinal disorder Hypertension Lung disorder and cancer Osteomalacia & Osteoporosis Renal dysfunction
Chromium (Cr)	Electroplating Industry - Leather, Textile, Stainless Steel and Alloys, Paints, Pulp and Paper. Mining	Bronchitis Damage to the nervous system Dermatitis Fatigue Kidney disorders Weakened immunity
Copper (Cu)	Chemical industry Metal piping Mining Pesticide production	Anemia Gastrointestinal Irritation Liver and kidney damage.
Iron (Fe)	Construction Pipe making Steel manufacturing	Chronic inhalation may cause a benign pneumoconiosis Conjunctivitis & retinitis Lung cancer
Lead (Pb)	Automobile emission Burning of coal Mining Pesticide & paint Smelting	Congenital paralysis Damage to the nervous system Fatal infant encephalopathy Mental retardation & developmental delay in children
Mercury (Hg)	Batteries Paper industry Pesticides	Damage to the nervous system Gingivitis Minor psychological changes Protoplasm poisoning Spontaneous abortion Tremors
Zinc (Zn)	Brass manufacture Metal Plating Plumbing Refineries	Corrosive effect on the skin Damage to the nervous membrane

Rhizofiltration: It is the Uptake of heavy metals from wastewater by absorption done by plants roots. (Prasad and Freitas, 2003)

Phytoextraction: In this technique, plants extract metals from soil; the uptake is through the roots and is translocated to the shoots. (Salt D.E. et al., 1995; Chaney R.L. et al., 1997). Hyper accumulators absorb the metals from contaminated sites. The recovery of the extracted metals is also a viable option by harvesting the plants appropriately and incinerating them later. Apart from being able to tolerate high amounts of heavy metals phytoextraction species have an expansive root system and a rapid rate of growth. (Marques et al., 2009).

Phytovolatilization: In this process, plants are used to extract soluble contaminants from soil by the roots, transported to the leaves and then released into the atmosphere by volatilization. (Tollsten L. and Muller P., 1996). Selenium metal is volatilized plants, after its conversion to dimethyl selenide by microorganisms and algae. (Neumann P.M. et al., 2003). However, in this technique, the amount of the contaminant transpired is dependent on the water flow, which could be low in field conditions.

Phytostabilization: In this process, the contaminants are stabilized by the plant roots by immobilizing them; this is achieved by binding them to soil particles, microbial interaction, accumulation and precipitation in the roots. As a result, the migration of contaminants in the soil and water is reduced.

Phytodegradation: Phytodegradation is a method in which organic contaminants are broken down due to metabolic processes by enzymes such as dehalogenase, oxygenase and reductase into simpler molecular forms which are incorporated into the plant tissues (Black H, 1995; Salt D.E. et al., 1998; Chaudhry T.M. et al 1998). These enzymes can break down organic pollutants found in herbicides.

Plants used for phytoremediation: Certain plants from Fabaceae, Brassicaceae, Asteraceae, Euphorbiaceae families have been identified to have the potential to uptake heavy metals. Plants of *Brassica juncea* accumulated a concentration of lead up to 500mg/L. (Ghosh M. and Singh S. 2005), *Helianthus annuus* L. and *Salix alba* L. (Borišev M. et al., 2012).

In the current work the use of *Ipomoea carnea*.Jacq a common weed in the country is used to explore its potentials in remediating some heavy metals. The metals Cadmium, Chromium, Copper, Lead and Zinc were supplied to the plant and their concentrations were determined post-harvest.

2. MATERIALS AND METHODS

Cuttings of *Ipomoea carnea* were planted in polythene bags. These bags contain soil mixed in the proportion of three parts of reading loam to one part of farmyard manure. 250 ml of water was given to each bag daily. After the first five days needed for the establishment of the cuttings, the plants were subjected to 250 ml of the test solution of heavy metals, every third day. One set was maintained as a control, to which identical amounts of only water were administered. Identical watering schedules were maintained for all the sets of plants.

The design of treatment is given below:

TABLE 2: Schedule of treatments of ***Ipomoea carnea*** with heavy metals (12 replicates each)

Metal	Cadmium		Chromium		Copper		Lead		Zinc	
Days of the Harvest	**45**	**60**	**45**	**60**	**45**	**60**	**45**	**60**	**45**	**60**
Concentration in ppm	/	/	/	/	/	/	/	/	/	/
15	/	/	/	/	/	/	/	/	/	/
50	/	/	/	/	/	/	/	/	/	/
150	/	/	/	/	/	/	/	/	/	/
300	/	/	/	/	/	/	/	/	/	/
500	/	/	/	/	/	/	/	/	/	/
Control	/	/	/	/	/	/	/	/	/	/

The plants were harvested at 6 and 9 weeks and morphological parameters were recorded along with heavy metal concentrations in the roots and leaves. For the sake of our convenience, we have discussed the concentrations of the heavy metals in the tissues, which were measured using atomic absorption spectrophotometer.

Digestion procedure: 1gm of dried sample was taken in an evaporating dish. 10 ml of conc. HCL and 10ml of conc. HNO_3 was added to the sample. The evaporation dish was then placed on the burner and heated till completely dry. The evaporating dish was allowed to cool and 10 ml of conc. Perchloric acid was added and heated till dense white fumes appeared. Further 5ml of Conc. HCL and 20 ml Distilled water was added and the evaporating dish was placed on a hot plate for 30 min. The evaporating dish was then cooled and its content was removed in a 50 ml volumetric flask and the final volume was made up to 50 ml using distilled water. The solution was filtered using a Whatman filter paper No.1. Finally, the sample was aspirated in the Atomic Adsorption Spectrophotometer. (Levenson R., 2001)

3. RESULTS AND DISCUSSIONS

3.1. Metals in Leaves and Roots

Cadmium: The 6-week old plants showed that the roots contained a very high amount of Cadmium as compared to the leaves. The 9-week old plants showed that with a longer duration of treatment, the Cd content of the leaves decreased except for 15 ppm treatment. Cd content of roots increased at longer durations.

Chromium: The 6-week old plants showed that the roots contained more Cr at the lower concentrations, 15 ppm and 50 ppm and the leaves contained more Cr at the higher concentrations 150 ppm, 300 ppm, and

500 ppm. The 9-week old plants showed that with a longer duration of treatment, the Cr content of the leaves decreased, except for 500 ppm, and the chromium content of the roots increased except for 15 ppm treated plants. In general, it can be said that the 9-week old plants showed that the roots contained more chromium than the leaves.

TABLE 3: Concentration of Heavy Metals in Leaves after 6 weeks of treatment.

Concentration in ppm	Cad	Cr	Cu	Pb	Zn
0	0	0	4	2	32
15	23	0.5	26	25	55
50	52	0.9	47	70	75
150	63	3.7	130	190	120
300	125	3.9	245	275	260
500	78	3.8	282	482	355

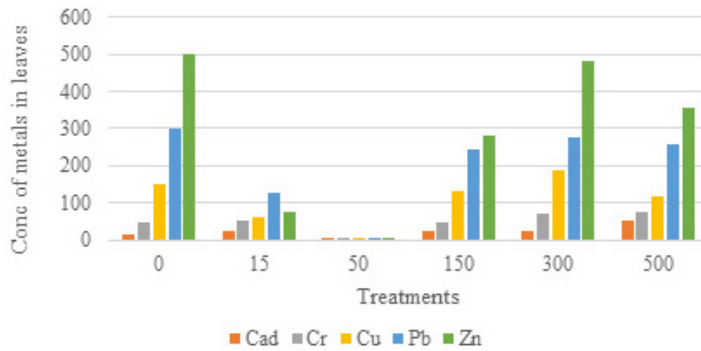

FIGURE 1: Concentration of Heavy Metals in Leaves after 6 weeks of treatment.

Copper: The 6-week old plants showed that the leaves contained a higher amount of Cu than in the roots. The 9-week old plants showed that the Cu content of the leaves decreased and that of the roots increased except in 500 ppm treated plants.

Lead: The 6-week old plants showed that the leaves contained a very high amount of Pb as compared to the roots. The 9-week old plants also showed a similar trend except at 500 ppm Pb treatment where the Pb content of both leaves and roots were nearly the same. There seemed to be a decrease in the Pb content of both leaves and roots, with a longer duration of 9 weeks.

Zinc: The 6-week old plants showed that the leaves contained a very high amount of Zn as compared to the roots. Analysis after 9 weeks showed that the metal contents of the roots of 15ppm, 300 ppm, and 500 ppm treated plants were higher than those of the leaves and in 50ppm

and 150 ppm treated plants the Zn contents in leaves were higher than in the roots. A longer duration of 9 weeks resulted in a decrease in the Zn contents of roots, except in 150ppm and 300ppm treated plants where a decrease in Zn contents of the roots was noted.

TABLE 4: Concentration of heavy metals in leaves after 9 weeks of treatment.

Concentration in ppm	Cad	Cr	Cu	Pb	Zn
0	0	0	2	5	26
15	20	0.2	5	28	32
50	17	0.5	27	30	67
150	22	0.8	48	100	95
300	42	3.6	42	195	100
500	24	5.9	73	140	128

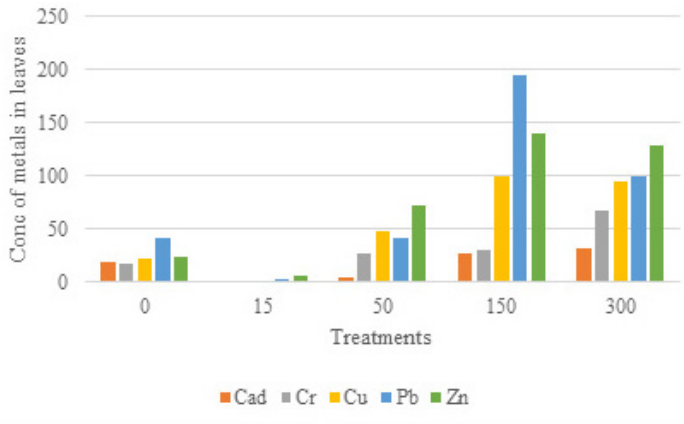

FIGURE 2: Concentration of heavy metals in leaves after 9 weeks of treatment.

TABLE 5: Concentration of heavy metals in roots of ***Ipomoea carnea*** after 6 weeks of treatment in ppm

Concentration in ppm	Cad	Cr	Cu	Pb	Zn
0	0	1	5	1	25
15	30	1.2	23	25	27
50	50	2.2	27	20	48
150	175	2.8	48	40	90
300	220	3.7	72	80	126
500	340	2	110	160	155

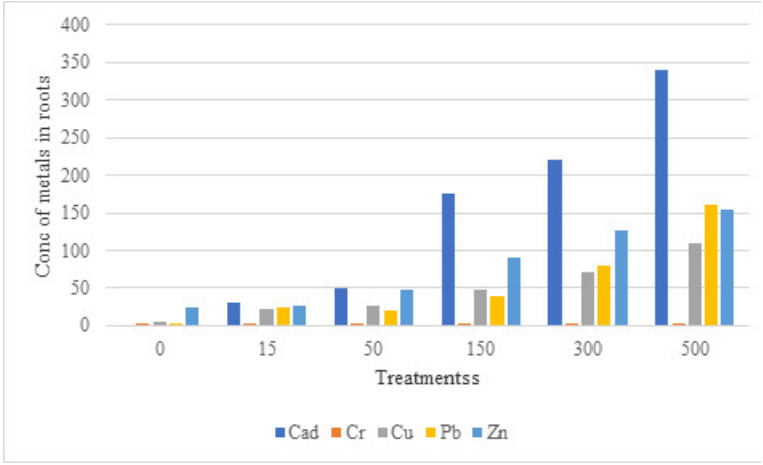

FIGURE 3: Concentration of heavy metals in roots of *Ipomoea carnea* after 6 weeks of treatment in ppm.

TABLE 6: Concentration of heavy metals in roots of ***Ipomoea carnea*** after 9 weeks of treatment.

Concentration in ppm	Cad	Cr	Cu	Pb	Zn
0	2	0	10	0	28
15	60	1	25	7	30
50	75	2.3	40	23	55
150	255	3.9	65	30	80
300	205	13.3	90	78	125
500	362	5.8	115	130	208

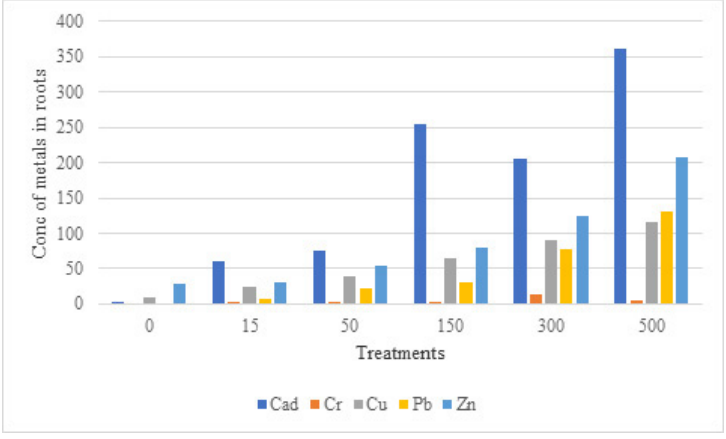

FIGURE 4: Concentration of heavy metals in roots of *Ipomoea carnea* after 9 weeks of treatment.

4. CONCLUSION

For almost two decades phytoremediation has been used which has now evolved as a cost-effective alternative to conventional methods to remediate contaminated soils. Green plants are used to remediate and reclaim soils and water contaminated by a wild range of pollutants including heavy metals (Salt et al., 1998; Meagher, 2003). Almost the first step in a phytoremediation study is to screen and select the plant with features like fast growth, high biomass, high bioaccumulation, non-invasive and easily adaptable. In conclusion, it may be said that plants in contact with metal contaminated soils, absorb and retain the metals for a short period (of about 6 weeks) as at this stage a maximum amount of absorption and accumulation of heavy metals takes place. Indefinite and continued absorption of the metal is not possible as is seen by the above experiments. There is a tendency in plants to lose metals to the soils at longer durations.

In general, if put in a nutshell, the behaviour of *Ipomoea carnea* concerning the fine heavy metals tested is somewhat like this.

- Accumulation in roots in 6 weeks – Cd > Zn > Pb > Cu > Cr
- Accumulation in leaves in 6 weeks:
- At lower concentrations is Zn > Pb > Cu > Cd > Cr
- At higher concentrations is Pb > Zn > Cu >Cd > Cr

Metal content of the roots, after a further treatment of 3 weeks after the above observation is:

Cd > Zn > Cu > Pb > Cr

(Increase in the metal content of the root after 3 weeks after the observation)

Loss from the leaves over 3 weeks after the above observation

a) At lower concentrations – the metal content is Zn > Pb > Cu > Cd > Cr
b) At higher concentrations – the metal content is Pb > Zn > Cu > Cd > Cr

Therefore potential of *Ipomoea carnea* to effectively absorb the metals in Zn > Cd; Pb > Cu > Cr and retain them is Cd > Zn; Pb > Cu > Cr

The findings have relevance to the situation where plants are expected to detoxify toxic metals from solid waste dumps. The growth of plants for limited durations may help in improving the quality of soil by effectively removing the metals. The continued growth of plants, leads to a stage of equilibrium between metal concentrations in and out of plant organs.

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14.

Classroom Learning Before Covid-19 and Learning Through the Hybrid Education During the Pandemic

Shahida Shaikh*

The Shutdown of Educational Institutes

The COVID-19 pandemic promptly affected education, compelling the government to make a critical change to learning and all economic frameworks. This prompted reactions by advanced education establishments and strategy producers to guarantee the coherence of realization which prompted an emotional change in the experience of the educators and students.

In India, the COVID-19 flare-up was declared as a 'crisis by the pandemic' in the entirety of its states and associated domains. To battle COVID-19, lockdown was forced on March 25, 2020 which has antagonistically influenced the educational and economical framework in the country.

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M.A.(SOCIOLOGY)

SEMESTER - I

PAPER - I

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SOCIOLOGY PAPER - III

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Mariyah Gour is with **Balaji Kendre**.
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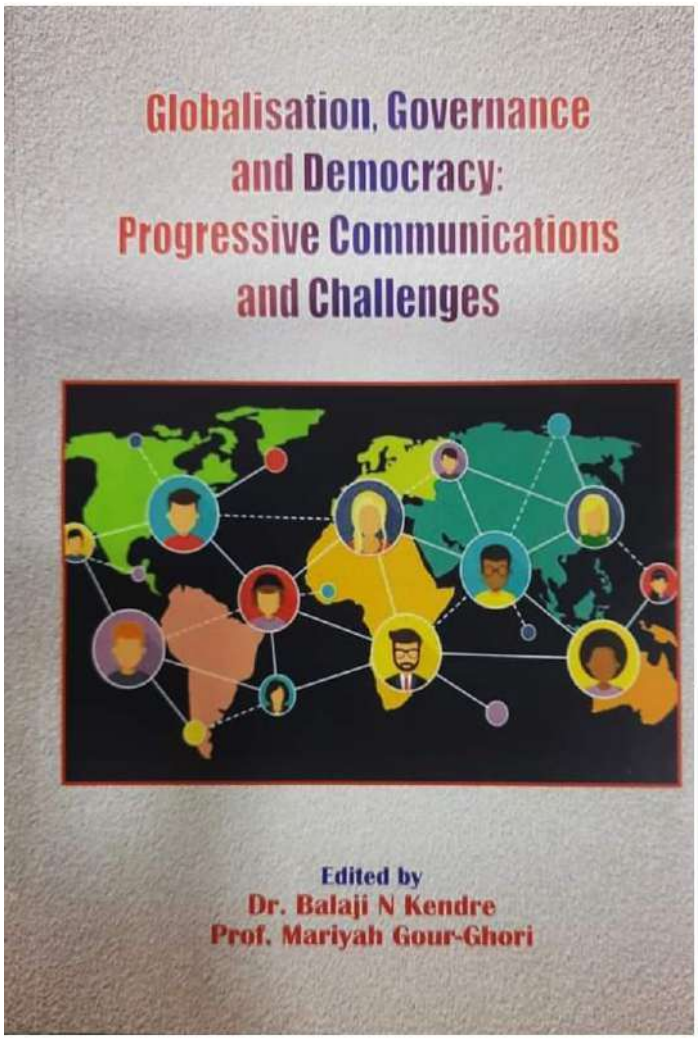
Happy to share publication of my first book, Globalization Governance and Democracy: Progressive Communications and Challenges as co-editor with my Guide, Dr. Balaji Kendre by University of Mumbai Press.



14 h ·

Tribute to Bharat Ratna late Shri. Rajiv Gandhi former Prime Minister of India on the occasion of his 32nd death anniversary. He is remembered for his sacrifice and he is in the hearts and minds of Indians because of his immense contribution to the India and world in different fields.
We wish to inform you all that the Rajiv Gandhi Centre for Contemporary Studies (RGCCS) of University of Mumbai had organized National Seminar on 7th and 8th February 2022 on the theme Globalisation, Governance and Democracy: Progressive Communications and Challenges. The theme was one of the mandates of the RGCCS. We thank Prof. Devanand Shinde former Hon. Vice Chancellor of University of Mumbai and Prof. Shuahs Pednekar Hon. Vice Chancellor University of Mumbai for their support and

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Dr. Balaji N. Kendre is a Professor and Head of the Department of Sociology, Incharge Director/ Chair Professor Rajiv Gandhi centre for Contemporary Studies, Incharge Coordinator Master of Social Work Programme, University of Mumbai, Mumbai. He is also Chairperson Board of Studies in Sociology, Master of Social Work (I/c) and Rajiv Gandhi Centre for Contemporary Studies(I/c) at University of Mumbai. Teaching and Research Includes Sociology of Migartion, Communication, Law, Environment and Development Studies. He has 19 Years teaching Experience at Post Graduate level at Shivaji University Kolhapur and University of Mumbai, Mumbai. He has successfully guided 09 M.Phil Research Scholars and 09 Ph.D Scholars. He has published three books and also published more than fifteen articles in different academic journals and participated in national and international seminar and conferences. He is life Member of Indian Sociological Society, New Delhi, Marathi Samajshatra Parished, Pune and Indian Science Congress Association, Kolkota. He is also presently elected Member of Managing Committee of Indian Sociological Society, New Delhi.

Dr. Mariyah Gour Ghori holds the position of an Associate Professor and Head, Dept. of Sociology, Rizvi College of Arts, Science and Commerce since 22 years. She writes extensively on current issues in journals and newspapers and her mesmerizing Urdu Poems and Ghazals have also bought her laurels throughout her life. From a vernacular medium student to scaling the academic heights of the Mumbai University examinations, from a conservative family ideologies to the revolutionary modern thoughts, from a reserved girl to a bold contemporary poetess - she has fought bravely to fulfill her passion of serving the society through her active involvement in field work and extensive activities at grass route levels.

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