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Original Research Paper

Environmental Noise Pollution in Kolhapur City, Maharashtra, India

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ABSTRACT

Kolhapur is rapidly emerging as industrialized and urbanized cities in the state of Maharashtra. In the recent times, the city has started facing noise pollution problems due to rapid industrial growth, increased human population, high traffic density and modernized man-made activities. The present study was carried out to assess the environmental noise pollution in four different selected locations of Kolhapur city viz., educational area, commercial-cum-residential area, industrial-cum-residential area and silence zone. The key noise pollution indices such as noise climate (NC), equivalent continuous noise level (L_{eq}) and noise pollution level (L_{np}) were computed for the selected noise polluting sampling sites. Results indicated that the highest noise pollution level of 80.15 dB(A) was observed in industrial-cum-residential area followed by 71.17 dB(A) in commercial-cum-residential area, and 70.21 dB(A) in educational area. Least noise pollution level of 45.64 dB(A) was recorded in the silence zone, which also acted as control in the present study. Studies clearly reveal the alarming condition of noise pollution in Kolhapur city.

INTRODUCTION

The onset of ever-changing technological environment as a result of industrialization, urbanization, increasing population, transportation and communication system has taken its toll by increasing the noise pollution. Noise pollution can be distinguished from other types of pollution due to its source and diffusion characteristics, which can adversely affect public health and environmental quality in an urban environment. Noise pollution, in the recent years, has drawn interest of the researchers worldwide due to its physiological, psychological and chronic effects on human beings (Tripathi et al. 2006). Noise effects include impacts on mental and physical health as well as interference with indices of human comfort and emotions such as effects on sleep, conversation, frequency of induced state of annoyance, hearing loss, cardiovascular problems, as well as steady mindset to support tasks performance (Singh & Davar 2004). Therefore, assessing the problem and programming actions for controlling its adverse effects have become issues of immediate concern for community. The Noise Pollution (Regulation and Control) Rules, 2000 have also been implemented by Government of India in the recent past for the regulation and control of noise producing and generating sources.

Kolhapur, a historic place and district headquarters, located in southern-western Maharashtra, is one of the rapidly emerging industrial and urbanized cities after Mumbai and Pune. Availability of ample space and freshwater, pleasant climatic conditions, rich natural resources and first-rate road and railway network are some of the potential key features of Kolhapur city. With rapid industrial growth, increase in human population, number of vehicles and other modernized man-made activities, the city has started facing noise pollution problems in the recent times. Moreover, the severity of problem will amplify in the years to come. It is, therefore, necessary to formulate and implement suitable strategies to combat noise pollution from the futuristic point of view. However, not much effort has been made to investigate the noise pollution levels in Kolhapur city. The present paper focuses the results on noise pollution levels of some selected sites of Kolhapur city.

MATERIALS AND METHODS

Study area: The present study on environmental noise pollution was carried out in Kolhapur city during the period of winter season from December 2008 to February 2009. Situated on the bank of river Panchganga, Kolhapur is located in the extreme southern-western Maharashtra and lies between the latitude 16°42' N and longitude 74°16' E. As per 2001 census, the population of Kolhapur was about 4,19,000 and now crossed 5,00,000. The city is spread over approximately 25 km^2. The annual rainfall in and around Kolhapur is 900 mm, while the minimum and maximum temperature during the course of study was in the range of 20±3°C and 30±2°C, respectively. During the same period the humidity and wind speed were 26±4% and 9-14 km/h, respectively. Nature has bestowed the city and the entire Kolhapur region with its natural beauty thereby leading to pleasant climate.

After a general survey of the city, four sampling sites

were selected for detailed investigation of noise pollution as mentioned in Table 1.

Noise measurements: The noise level monitoring was carried out by using Sound Level Meter (YFE Model YF-20) in 'A' weighting network. The sound level meter was placed 1.3 to 1.5 m above the ground and minimum 3.0 to 3.5 m away from any reflecting surface. For each location, noise measurements were carried out continuously for the period of ten days with seven hours of monitoring per day. The schedule selected during the day time was as follows: morning 10.00-11.00 a.m., afternoon 12.00-1.00 p.m., 2.00-3.00 p.m., evening 4.00-5.00 p.m., 6.00-7.00 p.m., 8.00-9.00 p.m. and night 10.00-11.00 p.m. The night reading was selected as a control. For each hour, the noise levels were recorded after every two minutes (i.e., 30 readings were recorded every hour). The data collected from each location was processed for statistical analysis. All the noise monitoring experiments were carried out under ideal meteorological conditions as mentioned earlier and repeated twice for each location after a gap of 45 days.

Noise pollution indices: Different percentile values like L_{10}, L_{50} and L_{90} were computed from the sampled data and these parameters were used for the evaluation of Noise Climate (NC), Equivalent Continuous Noise Level (L_{eq}) and Noise Pollution Level (L_{np}) (Tripathi et al. 2006). Following equations were used to compute the noise pollution indices.

$$NC = L_{10} - L_{90} \quad ...(1)$$

$$L_{eq} = L_{50} + \frac{NC^2}{60} \quad ...(2)$$

$$L_{np} = L_{eq} + NC \quad ...(3)$$

Where, NC is Noise Climate; L_{10} is the level of sound exceeding for 10% of total time of measurement or Peak Noise Level; L_{50} is the level of sound exceeding for 50% of total time of measurement or Mean Sound Level; L_{90} is the level of sound exceeding for 90% of total time of measurement or Background or Residual Noise Level; L_{eq} is Equivalent continuous noise level and; L_{np} is the Noise Pollution Level.

RESULTS

Noise Climate (NC): The data on the NC, computed for the four selected areas of Kolhapur city, are depicted in Fig. 1. It was observed that the highest NC values for all the selected areas varied markedly. It could be clearly seen that the highest NC of 7.9 dB(A) was observed in Industrial-cum-Residential area during 4.00-5.00 p.m. The highest NC values observed in Commercial-cum-Residential, Educational and Silence zone were 6.7 dB(A) during 6.00-7.00 p.m., 6.6 dB(A) during 12.00 -1.00 p.m. and 2.8 dB(A) during 10.00-11.00 a.m. and 2.00-3.00 p.m., respectively. Similarly, the lowest NC values observed were 4.3 dB(A) during 10.00-11.00 p.m., 5 dB(A) during 10.00-11.00 p.m., 3.2 dB(A) during 8.00-9.00 p.m. and 2.1 dB(A) during 10.00-11.00 p.m. for Industrial-cum-Residential, Commercial-cum-Residential, Educational and Silence areas, respectively. As far the highest and lowest NC values of all the four selected zones are concerned, a characteristic pattern was observed showing decrease in NC value from Industrial-cum-Residential area to Silence zone irrespective of any tested time period. For highest NC values, the sequence (in decreasing order) obtained was Industrial-cum-Residential > Commercial-cum-Residential > Educational > Silence zone. Similar characteristic pattern of sequence was observed for lowest NC data as well.

Equivalent Continuous Noise Level (L_{eq}): The Equivalent Continuous Noise Level (L_{eq}) quantifies the noise environment as a single value of sound level for any desired duration. This descriptor correlates well with the effects of noise on people. L_{eq} is also sometimes known as Average Sound Level. L_{eq} at different sampling zones varied from 72.25 dB(A) to 41.28 dB(A) as shown in Fig. 2. The highest L_{eq} was recorded in Industrial-cum-Residential zone [72.25 dB(A)] during 4.00-5.00 p.m., while the lowest L_{eq} recorded was 46.82 dB(A) during 10.00-11.00 p.m. In Commercial-cum-Residential area, the highest and lowest L_{eq} observed were 64.47 dB(A) during 6.00-7.00 p.m. and 45.52 dB(A) during 10.00-11.00 p.m., respectively. In Educational area the highest and lowest L_{eq} were 63.71 dB(A) during 12.00-1.00 p.m. and 42.51 dB(A) during 10.00-11.00 p.m., respectively; in Silence zone, however, the highest and lowest L_{eq} were 42.84 dB(A) during 2.00-3.00 p.m. and 41.28 dB(A) during 10.00-11.00 p.m., respectively. For highest L_{eq}, the sequence (in decreasing order) obtained was as follows: Industrial-cum-Residential > Commercial-cum-Residential > Educational > Silence zone. Similar characteristic pattern of sequence was also observed for the lowest L_{eq} data.

Noise Pollution Level (L_{np}): L_{np} is a combination of Noise Climate (NC) and Equivalent Continuous Noise (L_{eq}) as stated in Eq. 3. It gives an idea of noise pollution with fluctuations in noise level. It is considered as the best indicator of physiological and psychological impact of noise. The highest L_{np} observed was 80.15 dB(A) during 4.00-5.00 p.m. in Industrial-cum-Residential area, while the lowest was 51.12 dB(A) during the night at 10.00-11.00 p.m. Similarly, the highest and lowest L_{np} in Commercial-cum-Residential area was 71.17 dB(A) during 6.00-7.00 p.m. and 50.52 dB(A) during 10.00-11.00 p.m., respectively; in Educational area L_{np} was 70.21 dB(A) during 12.00-1.00 p.m. and 46.01 dB(A)

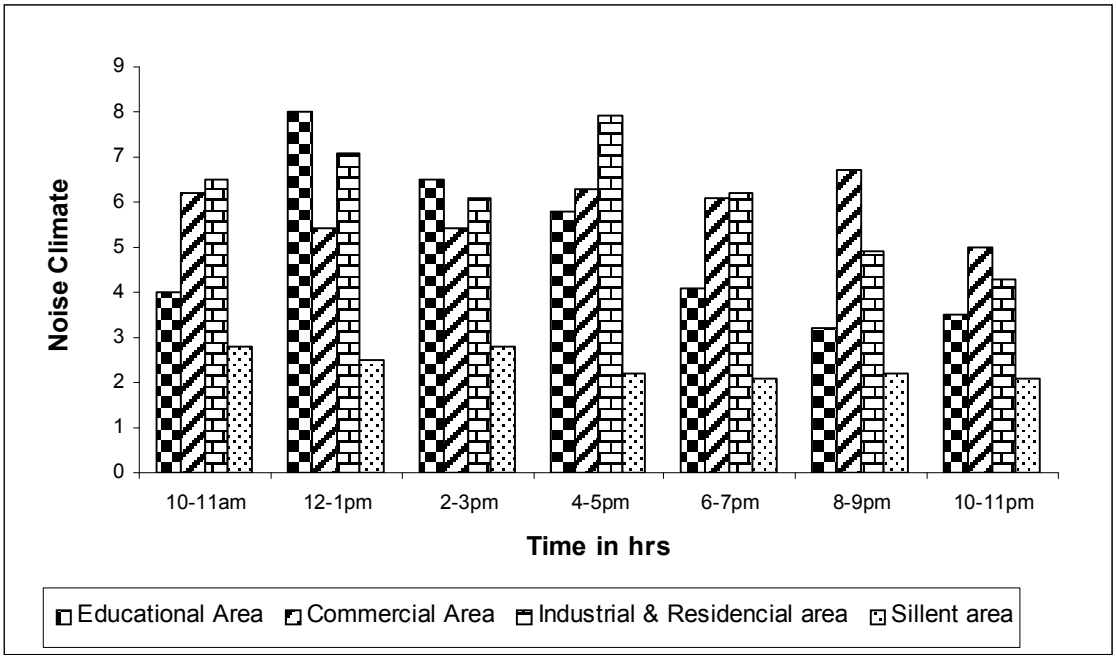

Fig. 1: Measurement of noise climate (NC) at different sampling sites.

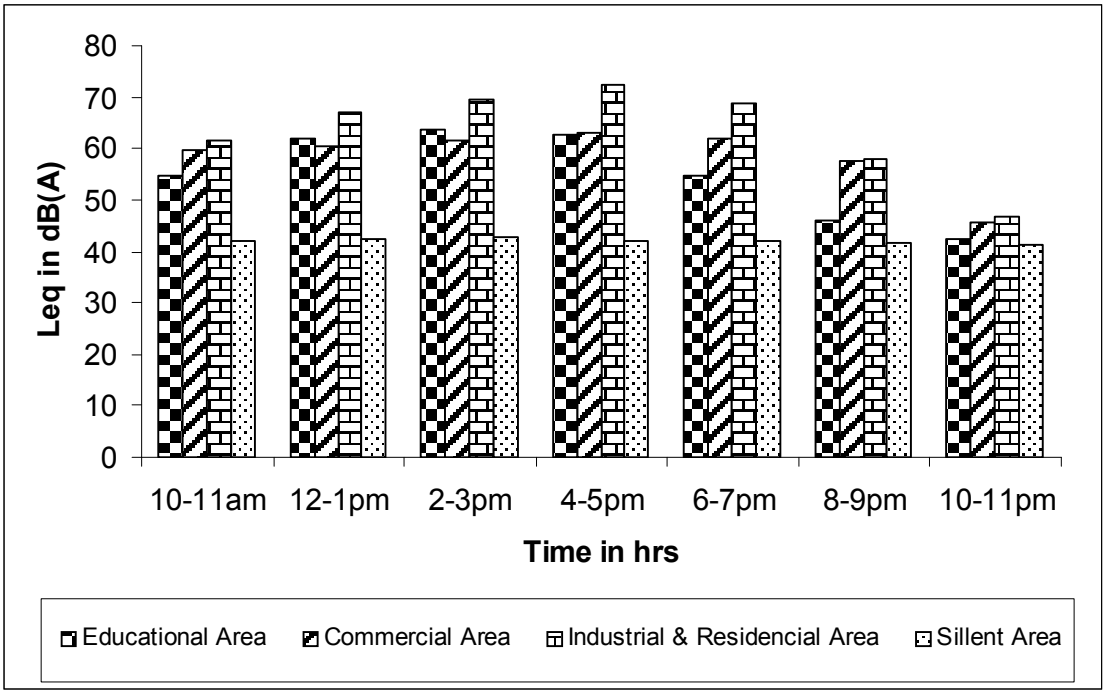

Fig. 2: Measurement of equivalent continuous noise (Leq) at different sampling sites.

during night 10.00-11.00 p.m.; while in Silence zone it was 45.64 dB(A) during 2.00-3.00 p.m. and 43.38 dB(A) during night 10.00-11.00 p.m., respectively. For highest L_{np} the sequence (in decreasing order) obtained was Industrial-cum-Residential > Commercial-cum-Residential > Educational > Silence zone. Similar characteristic pattern of sequence was also observed for lowest L_{np} data.

DISCUSSION

The present work deals with the study of environmental noise

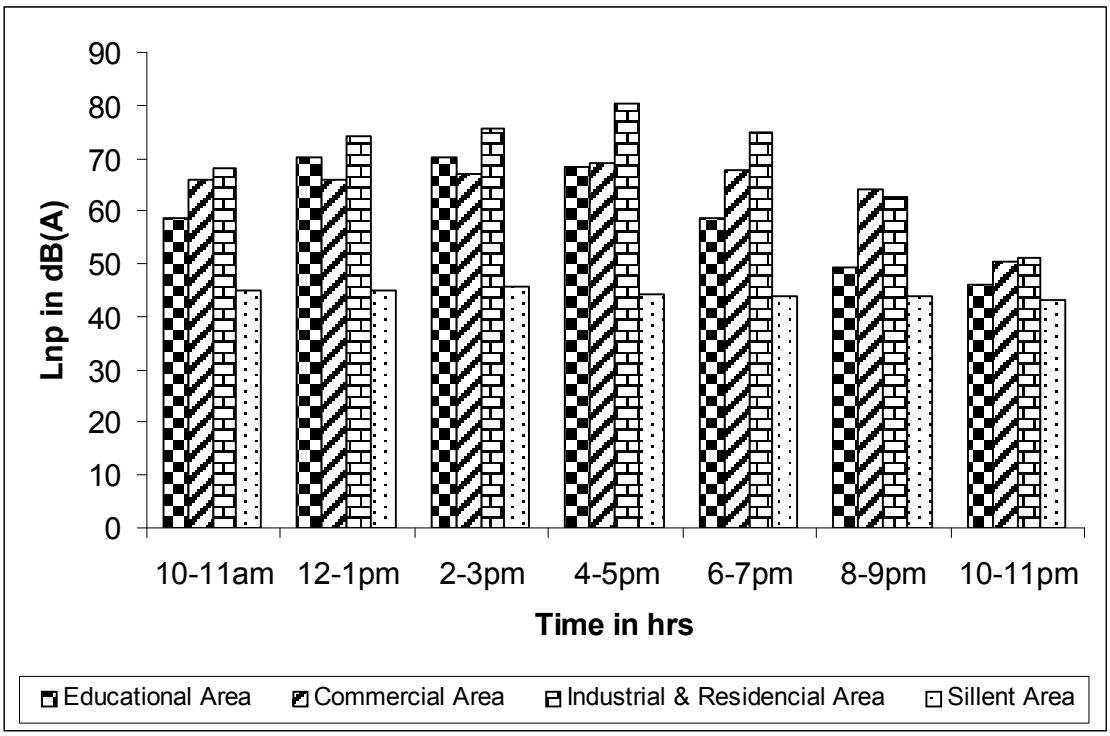

Fig. 3: Measurement of noise pollution level (Lnp) at different sampling sites.

pollution levels in some selected locations of Kolhapur city (Table 1). The objectives of the study were: (i) to conduct systematic study of noise pollution levels at the selected locations; (ii) to study the various noise level indices for the selected locations and (iii) to assess noise levels based on national criteria and determine mitigation measures against noise pollution.

The results of noise pollution indicate that the noise pressure levels (L_{eq}) were highly variable and significant at the different sampling locations and were the manifestation of variety of man-made activities (Table 3). In Educational area, which is considered to be as a Silence zone, the mean or average sound pressure level (L_{eq}) was observed well above [63.71 dB(A)] the prescribed Environmental Noise Standards [50 dB(A)] as laid down by Ministry of Environmental and Forests (MoEF) and Central Pollution Control Board (CPCB), New Delhi in India (Table 2). This may be attributed to the very busy SIBER Square on which large number of people including students are moving and crossing around, and business activities and large number of vehicles plying on the university road. Moreover, these vehicles many times disturb the road side teaching classes of the educational institutions. As far the Industrial-cum-Residential area and Commercial-cum-Residential area are concerned, in both the mixed area cases the noise pressure levels (L_{eq}) were marginally below the prescribed industrial and commercial limits, respectively, but were well above the residential limits (Table 3). In the present day scenario, although the noise levels are marginally below, in the near future the L_{eq} values will definitely surpass the prescribed limits as evident from the present growth trend of industries and population in Kolhapur. The information gathered through questionnaire (data not shown) from the citizens residing in Industrial-cum-Residential and Commercial-cum-Residential areas indicated clearly that the higher noise levels being generated in these areas are annoying the people to a larger extent. It is very well known that noise can damage human health depending on its intensity, frequency and duration of exposure, as well as the individual susceptibility. The disorders may be auditory or extra-auditory. Moura-de-Sousa & Cardoso (2002) noted that a noise up to 50 dB(A) may be annoying, but one can be adapted to the situation. A 55 dB(A) noise causes a light stress, excitement, dependence and discomfort and a 65dB(A) noise causes a deep stress. At a 80 dB(A) level of noise, the organism is likely to release biological morphine into the body, resulting in a feeling of pleasure that may lead to a type of dependence. At a 100 dB(A) it is possible to have an irreversible hearing loss. The hearing effects of a noise that is intense enough are noise-induced permanent threshold shift, noise-induced temporary thresh-

Table 1: Sampling sites for noise pollution monitoring in Kolhapur.

Sr.No.	Sampling Sites/ Locations	Category	Remarks
1.	University Road, SIBER square	Educational Area	Considered as a silence zone
2.	Rajarampuri	Commercial-cum-Residential area	One of the busy areas of Kolhapur
3.	Udyamnagar	Industrial-cum-Residential area	Mixed area where large number of small and medium scale industries are located
4.	New Palace area	Silence zone	Very calm area and was specifically selected as a control area for this study

Table 2: Environmental noise standards as prescribed by Ministry of Environment and Forests (MoEF) and Central Pollution Control Board (CPCB).

Area Code	Type of Area	Environmental Noise Standards (L_{eq}) in *dB(A)	
		Day Time	Night Time
(A)	Industrial area	75	65
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Notes: Day time shall mean from 6.00 a.m. to 10.00 p.m.; Night time shall mean from 10.00 p.m. to 6.00 a.m.; Silence zone is defined as an area comprising not less than 100 metres around hospitals, educational institutions and courts. The silence zones are zones which are declared as such by the competent authority; Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

Table 3: Comparison of observed L_{eq} data with Environmental Noise Standards

Sr. No.	Type of Area	Observed L_{eq} during Day Time	Environmental Noise Standards (L_{eq}) in *dB(A) during Day Time		Remarks
			For Industry or Commercial area	For Residential area	
1.	Industrial-cum-Residential Area (Mixed Area)	72.25	75	55	Marginally below Industrial limits but above residential limits
2.	Commercial-cum-Residential Area (Mixed Area)	64.47	65	55	Marginally below industrial limits but above residential limits
3.	Educational Area (Silence Zone)	63.71	50	-	Well above limits
4.	Silence Zone (Control)	42.84	50	-	Below limits

old shift, and acoustic trauma. Usually, these effects are accompanied by tinnitus (Singh & Davar 2004).

The urban noise, or environmental noise pollution, however, is not a recent phenomenon. A poem of 1350 complaints about the noise made by blacksmiths and references to noises from the London streets dates back to the 1800s (Anthrop 1973). Presently, in the city of Kolhapur, the urban noise complaints are restricted to only Diwali and Ganpati festivals. However, it is predicted that in the near future the frequency of noise complaints will increase significantly because of rapid increase in population, business activities and industrialization.

Previously, several researchers worldwide have studied the urban noise pollution (Ozer et al. 2009, Tripathi et al. 2006, Yusoff & Ishak 2005, Ziauddin et al. 2007). Overall trend of the research papers show that noise pollution is becoming a severe problem in the urban environment, and Kolhapur city is no exception to it.

SUGGESTIONS

Considering the present trend and future prospects of Kolhapur city, it is imperative for the government and the local authorities to take necessary steps or actions to save people from the menace of noise pollution. Some of the preventive steps in Kolhapur city, which can be taken by the government or regulatory agency are:

1. Improvement and proper maintenance of road conditions which will smoothen the flow of traffic.
2. Enforcement to ban the use of horns in silence area or zones as well as restriction of horns by vehicles when

passing by residential areas.
3. Ban on use of heavy vehicles in commercial and residential areas during day time or diversion of traffic to minimize noise pollution.
4. Intensive plantation in open spaces, near residential and industrial places.
5. Periodic noise inspection on roads.
6. Noise impact assessment for any new or additional projects before granting the approval.
7. Proper enforcement of already existing legislation to control noise pollution.
8. Creating awareness among the masses through environmental workshops, campaign, mass media, press, radio, TV, newspaper, etc.

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REFERENCES

Anthrop, D.F. 1973. Noise Pollution. United States of America: Lexington Books. The Situation, pp. 1-4.

Moura-de-Sousa, Carolina, and Cardoso, M.R.A. 2002. Urban noise in the city of Sao Paulo, Brazil: An important problem of public health. Noise Hlth., 4(16): 57-63.

Ozer, S., Yilmaz, H., Yesil, M. and Yesil, P. 2009. Evaluation of noise pollution caused by vehicles in the city of Tokat, Turkey. Sci. Res. Ess., 4(11): 1205-1212.

Singh, Narendra and Davar, S.C. 2004. Noise pollution sources, effects and control. Journal of Human Ecology, 16(3): 181-187.

Tripati, B.D., Pathak, Vinita and Upadhyay, Alka R. 2006. A case study of noise pollution in the city of Varanasi. Ind. J. Environ. Prot., 26(8): 737-741.

Yusoff, Sumiani and Ishak, Asila 2005. Evaluation of urban highway environmental noise pollution. Sains Malaysiana, 34(2): 81-87.

Ziauddin, A., Bahel, R.S. and Siddiqui, N.A. 2007. Noise pollution levels in the city of Dehradun. Eco. Env. & Conservation, 13(4): 891-893.