Review Article

Utilization of Community as a Resource for Depolluting Cities

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Abstract

There exists an intimate relationship between a city, its community and pollution. Most of the pollution can be attributed to the anthropogenic manipulation of city's resources, done to service the community. This pollution, in turn, creates conditions that challenge the wellbeing of the community as well as that of the city's natural resources. In recent times, urbanization has surpassed the rate of development of pollution mitigation strategies. As municipal corporations struggle to treat and dispose the ever increasing wastes and control various forms of environmental contamination, the pollution load of developing cities is steadily on the rise. This article suggests ways to utilize community as a tool for mitigation of pollution. First, it is suggested that the city be divided into zones based on pollution load (spatial and annual occurrence) with the help of environmental testing and monitoring techniques. This creates a clear picture of the nature and extent of pollution in various parts of the city. Training activities and pollution prevention programs can be conducted for the communities residing in these parts, focusing on the nature of pollution load that they contribute towards. Such zoning would also optimize decisions regarding regulations, policies and fund allocation. Another concept explored in this article deals with identification of pollution causing and pollution reducing agents. Various activities and objects, like open dumping of wastes, vehicular pollution, open discharge of sewage, etc., can be labelled as pollution causing agents. Similarly, scavengers such as crows (that feed on wastes), community initiatives such as waste segregation at source or reuse of waste, etc., can be classified under pollution-reducing agents. This categorization enables planners to develop community development initiatives that generate awareness regarding activities and aspects that cause pollution and help in integrating trends that cause lesser or no pollution. Policy development with sensitivity toward the existing social strata is also touched upon. Thus, this article attempts to explore strategies to aid depollution of cities by conditioning its community and human resource.

Keywords: Depollution, Community development, Environmental testing, Environmental monitoring.

Introduction

Background

The development of industries and urban centers in India has seen steady ascension over recent years. The industrial production (output of businesses integrated in industrial sector) of India in the month of June '15 stood at 3.8% as compared to-2.8% for Canada, 1.5% for United Kingdom and 1.3% for United States in the same month [1]. Also, the Ministry of Statistics and Programme Implementation (Government of India) recorded a 48% increase in the number of urban households between 2001 and 2011 [2]. Needless to say, the pollution load on the natural and socioeconomic environment has increased in conjunction with this growth. This calls for efficient management of pollution in order to ensure the wellbeing of the community as well as that of the natural environment, but the statistics reveal otherwise. Estimates on the basis of 2001 census data place the combined sewage generation of all Class I cities and Class II towns at 20,129 million liters per day (MLD) whereas the installed treatment capacity is a mere 6190 MLD, leaving a total capacity gap of 22939 MLD (78.7%) [3]. As a direct result of this gap, nearly 80% of sewage generated in India flows untreated into our rivers, lakes and ponds. The status of air pollution reflects the same picture. For

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instance, the city of Pune in 2010 saw an annual emission of $PM_{2.5}$ at 16,650 tons, PM_{10} at 36,600 tons, SO_2 at 3600 tons, NO_x at 127,350 tons, CO at 438,200 tons and that of CO_2 at 11.9 million tons, which led to around 3600 premature deaths, 10,800 cases of adult chronic bronchitis and 79,250 cases of child acute bronchitis [4]. In light of these statistics, it is safe to conclude that India is in need of focused and precise policy development as well as infrastructure development in order to ensure sustainable growth.

Objectives

This article proposes a method to evolve community development and empowerment strategies as well as suggestions to meet the gaps in policy development with respect to pollution management and mitigation. The method involves identifying the nature and distribution of pollution load over a region. Similar to the spatial environmental planning program undertaken by the Maharashtra Pollution Control Board (MPCB) that involves the preparation of district and state environmental atlases, it is proposed that the pollution distribution data be used to divide the command area into zones, called "Pollution Zones." Mapping of the social strata in these zones would help in development of training/awareness activities that are sensitive toward the nature of pollution in that zone as well as its occupant community. The impacts on pollution of various social practices, objects, trends and elements of society can be observed to classify these as "Pollution Causing Agents" or "Pollution Reducing Agents". Such classification would further aid in creating awareness regarding the various practices/ objects that a community shall adopt in order to mitigate or reduce pollution.

The identification of nature of pollution as well as that of the community in every region can help in realizing gaps in the legislation and policies that exist for that region. The division of the region into zones offers policy makers an opportunity to develop dynamic and focused policies, optimized for the community and the nature of pollution prevalent in that region.

This article outlines the methodologies to be adopted to accomplish these objectives.

Methodology

To identify the spatial distribution of pollution load, the command area can be divided into square grids. Spacing of the grid lines would depend upon the total area being considered and the desired precision of data. Samples of water and air need to be taken from each grid. The number of samples shall depend upon the population density and pollution potential of that region. Greater the pollution potential more would be the samples to obtain greater accuracy in experimental results. Visual observations pertaining to the solid waste management facilities of the region shall be recorded.

The annual occurrence of pollution can be observed by collection of data from various agencies such as MPCB, Central Pollution Control Board (CPCB) and Indian Meteorological Department (IMD).

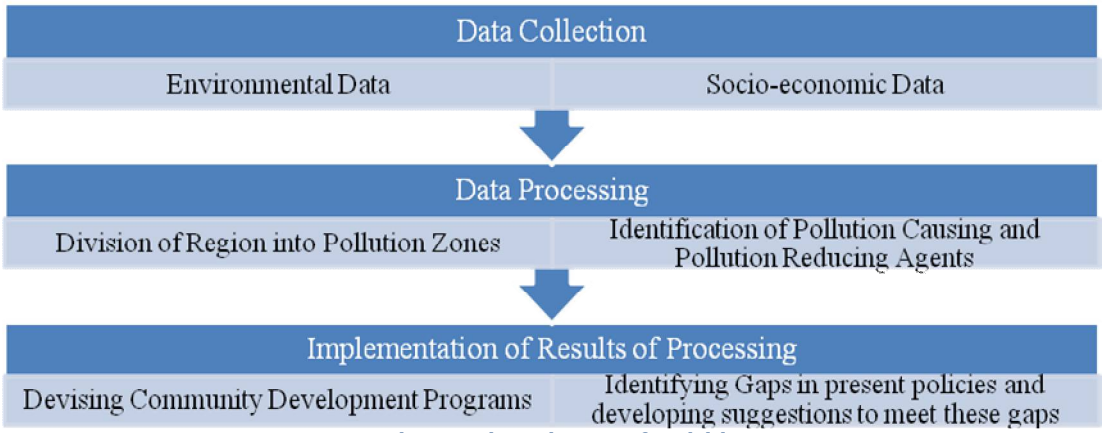

Figure 1.Flow Diagram of Activities

Water

Water is said to be "polluted" if it possesses characteristics that render it unfit for human consumption or discharge into the natural environment. The samples of water shall include those from surface reservoirs, household water supply systems and groundwater samples. These

samples shall be tested and compared to the prevalent standards to determine if they are polluted. Details regarding parameters to be tested for are provided in the table.

Parameter	Unit	Equipment required
Dissolved oxygen	mg/ L	Titration/ water analysis kit
pH	pH units	pH meter/ water analysis kit
Biochemical oxygen demand	mg/ L	Incubation followed by titration
Total coliforms	MPN/ 100 mL	By culture technique

Other parameters such as color, odor, alkalinity, chemical oxygen demand (COD), presence of metals, etc., can be tested for depending upon the purpose served by the source of the sample. Visual observations regarding sewage management and treatment facilities shall also be recorded.

Air

Air pollution refers to the addition of such substances to air that change the composition of the atmosphere and adversely affect the biotic environment. The data regarding air quality may be obtained by setting up monitoring stations throughout the region or from existing monitoring stations set up by the Government of India under various initiatives such as the National Air Monitoring Programme (NAMP). The data shall include information about SO_2, NO_x, CO and respirable suspended particulate matter (RSPM). Data regarding other parameters such as CO_2, ozone, respirable lead, etc., can be collected according to their relevance to the region under consideration.

Solid Waste

The data regarding solid waste generation and management shall be obtained from the relevant authorities. Visual observations regarding waste management facilities shall be recorded (open dumping of wastes, availability of public waste collection bins, etc.).

Data Processing

Once the data has been collected and a record of the various parameters pertaining to water, air and waste management is available, this data shall be mined to isolate abnormal data (data with erroneous values). The normal data thus obtained will be scrutinized against the prevalent standards for air and water quality. Waste management facilities shall be evaluated with an object to determine if they maintain a hygienic environment. Public surveys and focused group discussions may also be conducted to aid this evaluation. Each type of pollution, i.e., air, water and mismanagement of waste shall be analyzed for spatial distribution and annual occurrence. An evaluation of the relative ratios of the degree of pollution for all three factors shall be done. The adjacent grids that give higher results for a particular type of pollution (say, air pollution) shall be clubbed together and the resultant area shall be designated as a "Pollution Zone" (e.g., Air Pollution Zone). This processing of data, as well as the identification of trends and distribution characteristics, can be done using various data processing and mining tools such as MATLAB.

Socioeconomic Analysis

A socioeconomic survey of the command area shall be conducted to identify the characteristics of the community residing in each zone. The survey can be conducted by visiting the concerned regions and making visual observations, by way of questionnaires and by referring to various documentations of the demographics done by the authorities, like the District Statistical Analysis Report.

Creating a demographic map of the pollution zones not only helps in development of community-sensitive policies and programs, but also aids in better understanding the potential impact of pollution on the community and the necessary mitigation measures to be adopted against this impact.

Classification of "Pollution Causing Agents" and "Pollution Reducing Agents"

Every community has certain elements and practices that involve interaction with the natural environment, be it immersion of idols in water bodies, open dumping of wastes, burning of effigies or planting of trees, conducting cleanliness drives and proper use of sanitation facilities. External factors such as presence of scavengers (crows, rodents, etc.) or urban wildlife, climatic changes, infrastructural development as well as legislation

and policies also impact the extent of pollution and its effects on a region.

An extensive study shall be conducted to identify and document the factors (biotic and abiotic), community-specific practices as well as individual practices and trends that have an impact on pollution generation. These elements shall be divided into two categories, "Pollution Causing Agents" and "Pollution Reducing Agents". Such a classification would be greatly beneficial in creating awareness among communities regarding the pollution-generation potential of their everyday practices and guide them towards adopting activities that cause lesser or no pollution.

Conclusion

The division of the command area into pollution zones will serve as an effective pointer for the development of mitigation measures that need to be adopted for various regions throughout the area. Identification of communities residing in these zones will aid in optimizing these efforts by introducing scope for community development activities focused toward the specific pollution load in that region. The documentation of pollution causing and reducing agents hones this approach further by providing ready information regarding activities and their impacts on pollution. When integrated together, all this information would help in devising a holistic approach toward pollution prevention and mitigation. It would provide a region-specific context while developing awareness programs and community training programs. The target population would identify with the issues being addressed through these programs and hence would have higher motivation to accept and adopt them. Information about the socioeconomic distribution within the community would aid in development of policies and programs that target the community of a particular economic background, leading to better understanding and relevance of efforts within the target population. Awareness regarding pollution causing and reducing agents would lead to adoption of more environmentally sustainable practices as a community as well at an individual level.

The mitigation of pollution and prevention of further environmental degradation can only be achieved through focused, precise and effective measures. The concept proposed in this article attempts to integrate these characteristics into a holistic approach towards community development that would lead to a cleaner and more healthy urban environment.

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