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Impact of Air Pollution: A Case Study of Ludhiana City, Punjab, India

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Abstract

Humans are modifying the environment in the name of development. Development which started with making of tools and stabilized agriculture gave way to industrialization and automobilisation. With the help of scientific and technological development man has achieved new dimensions and has enhanced his quality of life by adding several facilities and amenities. The automobiles are considered as one of the major causes which contribute much to the air pollution. According to the study carried out by the Pollution Control Board Ludhiana in 2009, there were more than 7 lakhs of vehicles within the city and till date they have increased many folds. The main constituent of the emissions of the vehicles are carbon mono-oxide, sulphur dioxide, hydro carbons, lead salts etc. Growing industrialization and automobilisation has rendered the whole atmosphere polluted and its impact is very dangerous not only for man but also to the environment itself. About half of the vehicular air pollution is due to increased number of the auto-rickshaws. In the city 83% of auto-rickshaws are diesel driven which is the cause of spread of unburnt hydro carbons. Effects of air pollution are the most prominent in causing pulmonary diseases, continued exposure to sub-lethal concentration leads to physiological effects. The fine particles in particular those with the fibrous structure e.g. asbestos might cause lung impairment.

Key Words: Environment, Air pollution, industrialization and Automobilisation

Introduction

In present days, environmental conditions are demanding a degree of concern which has never been specified by man in the course of history. Humans are modifying the environment in the name of development. Development which started with making of tools and stabilized agriculture gave way to industrialization and automobilization. With the help of scientific and technological development man has achieved new dimensions and has enhanced his quality of life by adding several facilities and amenities. The industrial development is proceeding at a very fast rate. Revolution in transportation sector has also occurred not only in developed countries but in developing countries. Also in the field of agriculture, resource utilization, power consumption, engineering and all other scientific fields' man has achieved accomplishment of high level. But the recent strong feeling is that all these developments have been responsible for the degradation of the environment and there is an urgent need to evolve an environmental friendly technology. Some of the problems produced by technological and scientific developments are-

- 1) Rapid deforestation and ecological imbalance
- 2) Over utilization of resources
- 3) Pollution due to industrialization and automobilization
- 4) Disturbances in sensitive areas like ozone layer tropical forests etc.
- 5) Extinction of several species of flora and fauna
- 6) And finally health problems faced by the people

The problems of environmental degradation are being faced by all the cities of the world in one way or the other way and Ludhiana city is one of them which has been taken as a case study.

Objectives

1. To identify the sources of Air pollution.
2. To check the intensity of Air Pollution.
3. To study the effect of air pollution by automobiles on human health.
4. If the Air Pollution is prevalent in its acute form in a particular area
5. To explain the impact of industrialization on environment.
6. To study the spatial distribution of Air Pollution.
7. To analyse the steps taken by the state pollution control board.

Methodology

Research work in geography is based on data obtained either by any published source as collected through field work. There for there is an urgent need to study the various source of data collection so that precise and accurate conclusion can be drawn.

To begin with, the base map of Ludhiana was acquired from the Ludhiana Municipal Corporation. The published data regarding the statistics of relevant printed literature regarding the present status of Air quality and the steps taken by government was collected from Ludhiana Pollution control Board. The information regarding Number of registered large scale, small scale of other industrial units was provided by the office of district Industries offices, Published data regarding the total Number of Buses station supervisor. Steps taken to control pollution by buses were also acquired from transport department Punjab. Data regarding Number of vehicles registered was collected from D.T.O. office.

We visited the area near Buddha Nalaha and observed various sources of pollution. We visited Industrial area and observed that Industrial Waste was not properly disposed resulting in creating unhygienic conditions and also observed the increasing intensity of Air Pollution by vehicles.

Few areas like clock tower, Bus stand, Jagraon bridge were randomly selected & also observed the source of Air Pollution making the areas unhygienic. Randomly hospitals were selected to know the number of patients affected by Air Pollution diseases.

Study Area

Ludhiana city occupies the position of industrial capital of Punjab. It is situated almost in the heart of the state on G.T. road about 95 km away from state capital Chandigarh. It is developing fast in the field of industries, automobiles, urbanization, utilization of resources and all other scientific and technological fields. But the fast development of city possess various problems of environment such as air pollution, water pollution, noise pollution, solid waste management, traffic congestion etc.

In this research paper the patterns of air pollution in Ludhiana city mainly due to the development of industries and aotomobolisation has been discussed in details.

Air Pollution

Air pollution is defined as the occurrence or release into the atmosphere of any foreign materials or gases which are harmful for man, vegetation, animal, property etc. It is the presence of air pollutants in the environment which adversely affect the surroundings. The main air pollutants are sulphur-di-oxides, hydrogen, lead etc. The pollution of air is an indirect result of our pursuit of ever higher standard of living .Air pollution may derive from burning of fuel for heat and power, processing of material and disposal of wastes.

Industrialization and Air Pollution

In Ludhiana various small, medium and large scale industries have been set up for the economic development of the city but this development is becoming a major cause of air pollution. The industries like metallurgical, fertilizers, dying, etc are developing fast. The smoke through factory chimneys of most of the industries is an important factor to pollute the air. Millions of tons of gaseous pollutants are thrown into the atmosphere daily by various industries in Ludhiana. The major industrial sources of air pollution in Ludhiana are

- 1) Textile industry including dying, finishing, wool combing etc
- 2) Industries like steel re-rolling, vegetable ghee mills, chemical industries and industries related to food products
- 3) Furnaces: Majority of these industries use steam as heat transfer medium. Fuel used for production of steam is coal, fuel oil and diesel.

Shortage of conventional fuel has generated interest in utilizing agriculture residuals such as paddy straw, wheat straw etc. An increasing emphasis has been placed on the use of rice husk as an alternate fuel due to its easy availability at lesser cost. As rice husk contains cellulose and resinous substances, its burning increases smoke content in the air causing irritation to the eyes. More than two thousand metric tones rice husk is burnt every day by industry as fuel which result in significant amount of unburnt carbon and particulate matter

along with gaseous pollutants. In addition to burning of rice husk air pollution is also caused by smoke coal and oil burning. Large numbers of large and small scale industries are located near or within the residential and commercial areas e.g. Industrial Area A. As this area is very much close to residential areas people are being suffered from many problems. According to Ludhiana industrial board registered industries are in less number as compared to unregistered industries.

Table 1

Number of Industries Registered at Industrial Board Ludhiana (2008-09)

Type	No.
1 large scale industries	75
2 SIDO (Small scale industries organization)	25300
3 Non SIDO	
a) Handloom	710
b) Handicraft	290
c) Textiles	1325
d) Miscellaneous	661
Total	2886

Source - Industrial Board Ludhiana

Besides this there are a great number of unregistered industries also

Automobilisation and Air pollution

Automobiles are mobile polluters the number. of vehicles in Ludhiana city have increased many fold with improvement of living standard of people. The automobiles are considered as one of the major causes which contribute much to the air pollution. According to the study carried out by the Pollution Control Board Ludhiana in 2000, there were more than 7 lakhs of vehicles within the city and till date they have increased many folds. The main constituent of the emissions of the vehicles are carbon mono-oxide, sulphur dioxide, hydro carbons, lead salts etc. About half of the vehicular air pollution is due to increased number of the auto-rickshaws. 83% of auto-rickshaws are diesel driven which is the cause of spread of unburnt hydro carbons. The next causative factor of the air pollution is that bus stand of the city is located on the Link Road, around main residential areas of Model Town, Model Gram, Extension Kochchar Market. Consequently the Link Road, Ferozpur Road, Bharat Nagar Chowk, Partap Chowk etc. are congested with the buses. Besides buses and auto rickshaws the problem is multiplied by the ever increased the number of automobiles like scooters, cars etc in all parts of the city.

Besides industrialization and automobilization domestic air pollutants are also adding to the ratio of air pollution.

Present set up of Monitoring Stations

According to the W.H.O. criteria residential, commercial, and industrial areas has to be kept in mind while selecting the location of monitoring stations by the pollution control board. Accordingly three stations set up at Ludhiana are at the following locations.

1. Milk Plant- representing the background (rural) concentration of the pollutants.
2. Municipal Corporation- representing the residential and highly commercialized area.
3. Rita Sewing Machine-representing highly industrialized area of the city.

Regular monitoring was started in Ludhiana city in 1988. Monitoring was to be done at all the stations three times a week as follows:

- i) SPM, twenty four hours sampling with eight hours averaging
- ii) Oxides of nitrogen, twenty four hours sampling with four hours of averaging

The same procedure of monitoring has been adopted even today.

Present status of Ambient Air Quality in Ludhiana city

The presented data represents a monitoring period of only 12 month for SPM and 12 month for oxides of nitrogen. Since concentration depend on the prevailing meteorological conditions. The interpretation of the data, therefore, needs to be conducted with due care and single monthly extremes cannot be over interpreted. The interpretation, therefore, concentrates on analyzing the general pattern such as comparison of mean values, the general influence of wind direction (transport of pollutants to the sampling site) and seasonal variations where the influence of varying weather conditions can be easily observed.

Table 2 shows a general overview of the statistically relevant values of SPM at 8 p.m. for the three stations. Figures clearly indicate that 8 p.m. values at milk plant station are significantly lower than those of tow other stations. The difference between the municipal corporation (city center) and the Rita sewing machine representing the industrial areas is remarkable

Table 2

SPM concentration in the ambient air in selected station of Ludhiana City in mg/m³ (2000 – 01)

Month	Milk plant station	Municipal corporation station	Rita sewing machine station
January	245.4	307.18	519.8
February	240.75	312.91	505.82
March	160	571.89	690.24
April	297.33	328.81	540.76
May	207.96	284.92	447.14
June	184.20	160.5	364.87
July	192.84	244.8	447.14
August	198.66	260.9	418.0
September	276.18	335.28	475
October	368.72	391	494.08
November	342.05	391.39	472.8
December	331	431.9	476.86

Source – Pollution Control Board Ludhiana

Table 3

Concentration of Nitrogen Oxides in the ambient air at selected stations of Ludhiana City in mg/m (2008-2009)

Months	Milk Plant	Municipal Corporation	Rita Sewing Machine
January	57.56	58.99	57.5
February	53.75	50.82	59.52
March	57.56	57.63	56.68
April	56.54	56.92	56.68
May	54.6	55.6	55.6
June	49.6	52.4	49.6
July	50.2	47.1	50.2
August	48.55	50.8	52.37
September	49.2	43.2	53.02
October	47.5	53.81	54.89
November	53.12	46.26	60.3
December	49.15	49.25	43.98

Source –Pollution Control Board Ludhiana(2010)

Above table shows the concentration of nitrogen oxides in the ambient air of the selected stations from January to December (2008-09)

Dispersion Condition of Air Pollution in Ludhiana

The concentration of pollutants and their impact on human health, plants and materials not only depend on the emission of but in particularly on the way the pollutants after their emission in to the atmosphere are dispersed and finally removed. This period is called Transmission Period. Three significantly different periods are

- i) Monsoon period (July-September) - Many factors result in low concentration of pollutants. Although the wind speed is moderate, wash out due to high rainfall lead to disposal of pollutants.
- ii) Summer period (April-June) - It is characterized by high solar radiation moderate stability, little precipitation .So there is high SPM concentration. Burning of agricultural residual lead to high SPM background (rural) concentration.
- iii) Winter period (October-March) - It is characterized by expectations of medium range concentration of SPM, High range of SPM actually found during october- November might be an indication that burning of agriculture residual after the monsoon harvest might have a substantial impact on air quality.

Under these monitoring stations many types of instruments are used to check the quantity of pollutants emitted daily in the atmosphere. At first suspended particulate matter in the ambient atmosphere in the size range of 0.1-100 microns are collected on 8" x 10" glass microfibre sheets by means of high volume air samplers and estimated gravimetrically. Oxides of nitrogen are determined by bubbling the ambient air samples through a solution of sodium arsenide and sodium hydroxide and then determined spectrophotometrically.

Adverse Effects of Air Pollution

Growing industrialization and automobilisation has rendered the whole atmosphere polluted and its impact is very dangerous not only for man but also to the environment itself. Some of the effects of air pollution are:

- i) Reduction of visibility, produced by the scattering of light from surface of air borne particles.
- ii) Conversion of metals, coating of fabrics and vegetation, mainly due to acid mists, oxidants of various kinds and particularly products of combustion and industrial processing.
- iii) Food, foliage and ornamental crops harmed by air pollutants, the effect result in leaf damage and decreased yield. Some of the substances responsible for plant damage are ethyl, sulphur di oxide, mist, fluorides etc.
- iv) Effects of air pollution are the most prominent in causing pulmonary diseases, continued exposure to sub-lethal concentration leads to physiological effects. The fine particles in particular those with the fibrous structure e.g. asbestos might cause lung impairment.
- v) Chances of frequent cold, cough, eye irritation, asthma, lung cancer may also increase respiratory illness in early childhood is associated with chronic exposure to modestly elevated levels of sulphur di- oxides of particulate matters.
- vi) Acid rain causing an irreparable damage to agricultural crops, forests and human beings.
- vii) Increased concentration of SPM will lead to intensifying the green house effect and ultimately the increased temperature.
- viii) Occurrence of SMOG combined with sulphuric acid causes respiratory trouble in human beings.

Suggestions to Control Air Pollution

Following suggestions are made to control air pollution

- 1) To decrease the industrial emission there should be
 - i) Preparation of the inventory of the existing boilers and their full use.
 - ii) Establishment of emission patterns depending on boiler design and operation.
 - iii) Optimizing boiler operation by making technical adjustments.
 - iv) Usage of Bag Filters and Electrostatic Precipitators.

- v) Rise in the height of chimneys.
- vi) Enforcement of pollution control measures.

2) Mechanical devices should be used to reduce the emission of gases and particulate matters from automobiles. Engine efficiency should be increased.

3) Existing monitoring network is not sufficient and number of Monitoring stations should be increased. Monitoring of additional components like carbon monoxide and hydrocarbons should be started.

4) As a long term measures land use planning conducive to sustainable development in harmony with environment should be done on top priority. Specific areas of industrial, commercial and residential development should be demarcated so that the effects of air pollution are minimized.

5) Development of more and more green belts will reduce the impact of air pollution

6) Public awareness programs should be launched to educate the people about the hazards of air pollution and the important role they can play to improve the quality of the air. The effect of pollutants should be brought into limelight and people should be enlightened.

Proper implementation of the abovesaid suggestions and government policies will definitely lead to better tomorrow.

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