A

PROJECT REPORT

ON

STUDY OF ENVIRONMENTAL POLLUTION OF JALGAON CITY

Submitted to

DEPARTMENT OF STATISTICS

In the partial fulfilment of

T. Y. B. Sc.

By

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T. Y. B. Sc. (STATISTICS)

Under the Guidance of

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CERTIFICATE

This is to certify that project report entitled "The Study of Environmental Pollution of Jalgaon City" is bonafide work out by **Yash Sunil Badgujar, Vilas Eknath Ubhale, Yogesh Yuvraj Patil, Monika Sanjay Badgujar, Neha Nitin Parmar, Anjali Nirdosh Patil** students of T. Y. B. Sc. (STATISTICS), M. J. College, Jalgaon for the partial fulfilment of T.Y. B. Sc.

Place: Jalgaon

Date:

Prof. Dr. K. G. Khadse
Project Guide,
M. J. College, Jalgaon

Prof. Dr. K. G. Khadse
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ACKNOWLEDGEMENT

No endeavor achieves success without the advice and the co-operation of others, the help of whom went a long way while working in this project. We are very glad to present project report on “The Study of Environmental Pollution of Jalgaon City” which is prepared as part of final year of graduation in science.

With affirm belief that a guide in project is one, who holds candle in the maze of darkness, I take this opportunity to express my profound gratitude towards my project guide, Prof. Dr. K.G. Khadse who is an eminent teacher of our department and who has enacted the role of a torch in this endeavor.

A project of such a comprehensive coverage could not have materialized without the systematic guidance of our guide and other teachers. We feel greatly delighted in expressing our immense gratitude towards constant encouragement, which greatly helped us in making this project a reality.

We take this opportunity to sincerely thank Prof. Dr. K.G. Khadse, Head of the Department of Statistics, M.J. College, Jalgaon for his valuable guidance and suggestions. Also, we would like to thank all the teachers of our department for all possible help.

Last but not the least we would like thank my family, friends and all others who were directly or indirectly related for giving suggestions and all possible help.

Thank you everyone!!!

Yash Sunil Badgujar

Vilas Eknath Ubhale

Yogesh Yuvraj Patil

Monika Sanjay Badgujar

Neha Nitin Parmar

Anjali Nirdosh Patil

Date:

Place: Jalgaon

DECLARATION BY THE STUDENT

We declare that the project entitled- "The Study of Environmental Pollution of Jalgaon City", submitted by us for the partial fulfilment of our Bachelor Degree of Science in Statistics during 2022-23 is our original work.

We further declare that the analysis has been carried out based on secondary data collected from 'ENVIRONMENTAL PROJECT REPORT OF JALGAON CITY, 2008'.

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INTRODUCTION

Environmental pollution is one of the most important factor which destroying the nature speedily. In daily life various types of pollution we face, like water pollution, air pollution, noise pollution, solid waste pollution. But these environmental pollutions are very dangerous for humans as well as other living-things and nature. So, our main motive should be to control the environmental pollution by applying various methods. Firstly, we should clarify that which type of pollution is there and what are effects of that pollution. So, we are making some statistical analysis about environmental pollution.

OBJECTIVE

The objective of statistical analysis of environmental pollution in a Jalgaon city is to assess and quantify and evaluate the potential health and environmental impacts on the population.

The results of the statistical analysis can be used to inform policy decision, develop strategies for reducing pollution and monitor progress towards environmental goals. It can also help to raise public awareness of environmental issues and encourage individuals and organizations to take action to reduce their environmental footprints.

ABSTRACT OF PROJECT

The required information (data) of Jalgaon city has been taken from 'ENVIRONMENTAL PROJECT REPORT OF JALGAON CITY, 2008'. There are five types of environmental pollution such as Air pollution, Noise pollution, Water pollution, Solid waste, Bio-medical waste.

The different factors of different pollution are analyzed by different statistical methods,

1. **Exploratory data analysis.**
2. **Correlation analysis.**
3. **Analysis of Variance (ANOVA).**
4. **Capability indices.**
5. **Graphical representation.**

Finally, the analyzed data is interpreted and conclusions are drawn. It is hoped that project will help us to know about environmental pollution of Jalgaon city.

MOTIVATION

It is important to decrease environmental pollution which effects the nature, for that purpose we should completely know about pollution near you. So, we take a step ahead to analyze the environmental pollution and verify the different pollutants and check whether there is any pollution or not and if there is pollution then give the appropriate reason of that pollution.

STATISTICAL TERM

• EXPLORATORY DATA ANALYSIS:

Definition: Exploratory Data Analysis (EDA) is a method used in statistics to explore, analyze, and summarize data sets without making any assumptions or formal statistical tests. It involves visually examining data, calculating summary statistics, and using various graphical and numerical techniques to gain insights into the data.

Purpose: The main purpose of EDA is to understand the data and uncover patterns or relationships that may not be readily apparent. EDA can help identify data quality issues, detect outliers, assess data distribution and variability, explore relationships between variables, and generate hypotheses for further investigation.

Techniques: EDA involves several techniques, including data visualization, summary statistics, and data transformation. Some common techniques used in EDA include histograms, scatter plots, box plots, bar charts, descriptive statistics (mean, median, mode, standard deviation, etc.), and data transformations such as log transformations, normalization, or standardization.

• CAPABILITY INDEX:

Definition: Capability index is a numerical measure that quantifies the ability of a process to produce outputs that fall within the defined tolerance limits. It is calculated using process data and provides an assessment of how well a process is performing relative to the specification limits.

Purpose: The purpose of capability index is to evaluate the ability of a process to consistently produce products or services that meet customer specifications. It helps identify if a process is capable of meeting the desired quality levels and if any improvements are needed to reduce variability and increase process capability.

Calculation: Capability index is typically calculated using the formula Cp or Cpk, which takes into account the process spread and the distance between the process mean and the specification limits. Cp is calculated as the ratio of the tolerance width to the process spread, while Cpk also considers the process mean relative to the specification limits.

Interpretation: With higher values indicating better process capability. A Cp or Cpk value of 1 indicates that the process is capable of meeting the specification limits, while values greater than 1 indicate that the process has potential to produce even better results. Values less than 1 indicate that the process may have issues meeting the specification limits and requires improvement.

Importance: Capability index is a valuable tool in quality management and process improvement, as it helps assess the performance of a process in meeting customer requirements. It provides a quantitative measure of process capability, which can guide decision-making, prioritize improvement efforts, and monitor process performance over time.

Limitations: Capability index has some limitations, such as assuming normal distribution of process data, not considering process centering or process stability, and not capturing process performance beyond specification limits. It should be used in conjunction with other statistical process control tools and interpreted cautiously, considering the specific context of the process being assessed.

Applications: Capability index is commonly used in manufacturing, engineering, and other industries where process capability and product quality are critical. It can also be applied in various business processes, such as customer service, supply chain management, and financial operations, to assess and improve process performance.

• GRAPHICAL REPRESENTATION:

Graphical representation is an effective way to visually display data in statistics.

Bar chart: A bar chart uses rectangular bars to represent data. It is used to compare different categories or groups of data. The height length of the bars represents the values or frequencies of the data.

Scatter plot: A scatter plot uses dots to represent data points on a two-dimensional graph. It is used to display the relationship between two variables, with one variable plotted on the x-axis and the other on the y-axis. Scatter plots are useful for identifying patterns or correlations in data.

Histogram: A histogram is a graphical representation of data that shows the distribution of values in a dataset. It uses bars to represent the frequency or count of values in different intervals or bins. Histograms are commonly used to visualize the shape, center, and spread of a dataset.

Pie chart: A pie chart is a circular chart that is divided into slices to represent the proportion or percentage of different categories in a dataset. It is used to show the relative contribution or distribution of different categories in a whole.

• ANALYSIS OF VARIANCE (ANOVA):

ANOVA (Analysis of Variance) is a statistical technique used to compare means of three or more groups or treatments to determine if there are any statistically significant differences among them. ANOVA is commonly used in experimental research and is used to test hypotheses about group differences.

Purpose: ANOVA is used to determine if there are any statistically significant differences among the means of three or more groups. It helps in identifying if there are any significant differences in the population means of the groups being compared.

Assumptions: ANOVA assumes that the populations being compared have normal distributions, homogeneity of variances (i.e., the variances of the groups being compared are equal), and independence of observations. Violation of these assumptions may affect the validity of ANOVA results.

Hypotheses: The null hypothesis (H0) in ANOVA assumes that there are no significant differences among the population means of the groups being compared, while

the alternative hypothesis (Ha) assumes that at least one group mean is significantly different from the others.

Test Statistic: ANOVA calculates an F-statistic, which is the ratio of the variance between the group means to the variance within the groups. If the calculated F-statistic is greater than the critical value or the p-value is less than the chosen significance level (e.g., $\alpha = 0.05$), then the null hypothesis is rejected, and it is concluded that there are significant differences among the group means.

• CORRELATION ANALYSIS:

Correlation analysis is a statistical technique used to determine the strength and direction of the relationship between two or more variables. It helps to understand how changes in one variable are associated with changes in another variable. Correlation analysis is commonly used in research and data analysis to examine the association between variables and make inferences about their relationship.

Purpose: Correlation analysis is used to assess the degree and direction of association between two or more variables. It helps to determine if variables are positively correlated (increase in one variable is associated with an increase in another variable), negatively correlated (increase in one variable is associated with a decrease in another variable), or if there is no significant correlation between the variables.

Pearson's correlation coefficient: Pearson's correlation coefficient, denoted by "r", is a measure of the strength and direction of the linear relationship between two continuous variables. It ranges from -1 to 1, with -1 indicating a perfect negative correlation, 0 indicating no correlation, and 1 indicating a perfect positive correlation. The closer the value of "r" is to -1 or 1, the stronger the correlation, and the closer it is to 0, the weaker the correlation.

Interpretation: The sign (positive or negative) and magnitude (absolute value) of the correlation coefficient "r" indicate the direction and strength of the association between variables. A positive correlation coefficient ($r > 0$) indicates that as one variable increases, the other variable also tends to increase. A negative correlation coefficient ($r < 0$) indicates that as one variable increases, the other variable tends to decrease. A correlation coefficient of 0 ($r = 0$) indicates no correlation or a very weak correlation between the variables.

Assumptions: Correlation analysis assumes that the relationship between variables is linear, the variables are continuous, the data is normally distributed, and there is homoscedasticity (i.e., the variance of the variables is similar across all levels of the variables being compared). Violation of these assumptions may affect the validity of correlation analysis results.

Causation vs. correlation: Correlation does not imply causation. A significant correlation between two variables does not necessarily mean that one variable causes change in the other variable. Correlation only indicates the strength and direction of the association between variables, and further research is needed to establish causation.

NON-STATISTICAL TERM

• AIR QUALITY INDEX:

Air Quality Index (AQI) is a measurement that indicates the quality of outdoor air and its potential impact on human health. It is calculated based on the concentration of air pollutants, such as particulate matter (PM), ground-level ozone (O3), nitrogen dioxide (NO2), sulfur dioxide (SO2), and carbon monoxide (CO), in the air. AQI is typically reported on a scale ranging from 0 to 500, with higher values indicating poorer air quality.

AQI is categorized into different color-coded levels, such as Good, Moderate, Unhealthy, Very Unhealthy, and Hazardous, to indicate the severity of air pollution. Lower AQI values indicate better air quality, while higher AQI values indicate higher levels of air pollution and potential health risks.

AQI is an important tool in environmental monitoring and public health management, as it helps raise awareness about the impact of air pollution on human health and promotes actions to reduce exposure to pollutants. It is used by government agencies, health organizations, and other stakeholders to inform policies, regulations, and public health advisories related to air quality.

• WATER QUALITY INDEX:

Water quality index (WQI) is a numerical indicator that provides an overall assessment of the quality of water based on various physical, chemical, and biological parameters. It is used to measure and communicate the quality of water for different purposes, such as drinking water, recreational water, and ecosystem health. Here is some key information about water quality index:

Purpose: Water quality index is used to summarize and communicate complex water quality data in a simple, understandable format. It helps in evaluating the overall quality of water and identifying potential issues or trends in water quality over time.

Parameters: Water quality index takes into account multiple parameters that are commonly measured in water quality assessments, such as temperature, pH, dissolved oxygen, turbidity, total suspended solids, nutrients (e.g., nitrogen and phosphorus), bacteria (e.g., E. coli), and other pollutants (e.g., heavy metals, pesticides). The specific parameters included in a water quality index may vary depending on the intended use and context of the assessment.

Index calculation: Water quality index is typically calculated by assigning scores or ratings to individual water quality parameters based on predefined guidelines or standards. These scores are then combined using a weighted formula to calculate an overall index value. The weights assigned to each parameter in the index formula may vary depending on the relative importance of the parameters and the intended use of the water.

Interpretation: The index value is usually presented on a scale or range, where higher values indicate better water quality and lower values indicate poorer water quality.

The interpretation of the index value may vary depending on the specific index used and the applicable standards or guidelines. In general, higher index values indicate better water quality, while lower index values indicate poorer water quality.

ENVIRONMENT

"Environment is the sum of all social, economical, biological, physical or chemical factors which constitute the surroundings of man, who is both creator and moulder of his environment".

The term Environment, which etymologically means surroundings, is considered as a composite term for the conditions in which organism live and thus consists of air, water, food and sunlight which are the basic needs of all living beings and plant life, to carry on their life functions. The environment also includes other living things, temperature, wind, electricity, etc. The environment for any living organism has never been constant or static. It has always been changing, sometimes slowly and sometimes rapidly or drastically. Thus, like other organisms, man is also affected by his environment and these changes in environment may benefit or harm the man or other organism living in it.

Natural environment is that part of the planet earth which is especially untouched and has not been invaded by man. But today the man, equipped with a variety of skills and superior technology, has ruined the natural resources without understanding the rebounding repercussions even on his own existence. So, the scientists, climatologists and environmentalists have alarmed the modern man against the devastating impact of unscientific and reckless exploitation of natural environment and pleaded to save the life existing on earth.

Today numerous issues like quality of environment, ecological imbalance, disruption of earth's natural ecosystems, environmental degradation, depletion of protective ozone umbrella, chloro-fluro carbons, ozone hole, global warming and sick environment have been raised. No doubt man is now awakened towards environmental problems and the public interest concerning the quality of environment has reached the emotional peaks but can this tempo be sustained for long time? Today the modern technologies, after exceedingly high rate of rapacious exploitation of natural resources and uncontrolled development by developed countries are responsible for alarming situation of grave environmental crisis and ecological disturbance all over the globe.

Environmental pollution and human efforts for the betterment of living standards are the two sides of the same coin. In the wake of industrialization, consequent urbanization and ever increasing population, the basic amenities of life, viz., air, water and land, are being polluted continuously.

1. AIR POLLUTION

- **INFORMATION:**

"The presence of one or more contaminant such as dust, gas, mist, odour, smoke, smog or vapours in the outdoor atmosphere, in quantities, of characteristics and of duration so as to be injurious to human, plant or animal life or to property or which unreasonably interferes with the comfortable enjoyment of life and property is known as air pollution".

The pollution of our environment is one of the biggest hazards that humanity faces today urban air pollution has worsened the health in the cities of both developed and developing countries. The health impact in developing world have driven by population growth, industrialization and increased vehicle use. The combustion of fossil fuel and their product are responsible for a sizable amount of anthropogenic air pollution and this problem is particularly acute in urban area. According to World Health Organization (WHO), "air pollution is defined as limited to situation in which the outdoor ambient atmosphere contain material in concentration, which are harmful to man and his surrounding environment"

Jalgaon city is a trade and commercial centre of Khandesh region. The population of Jalgaon has increased day by day with the rapid industrialization, fast urbanization, rapid growth in population, drastic increase in vehicles on the road continuously as result level of air pollution increases day by day in the city. The growing trend of air pollution is a serious threat to the health and create several respiratory and heart condition along with cancer, among other threats to the body.

Some of the major air pollutants that pollutes the environment are-

i. Respirable Suspended Particular Matter (RSPM): RSPM cause the worst damage as they can penetrate deep into the lungs.
ii. Sulphur Dioxide (SO_2): Sulphur dioxide is a colourless gas with a pungent, suffocating odour. SO_2 is corrosive to organic material and it irritates the eyes, nose and lungs.
iii. Nitrogen Oxides (NO_x): Nitrogen oxide are produced by combustion of all fossil fuels including coal and gas-fired power station and motor vehicles.
iv. Carbon Monoxide (CO): Fossil fuel combustion normally produces carbon dioxide but sometimes, when such combustion is incomplete it also become a source of carbon monoxide.

The release of low amount of pollutants into the air does not lead to any serious effects because the atmosphere has a considerable absorptive capacity. When the concentration of pollutants in air becomes so high that they cannot be tolerated by atmosphere's regulating cycles, dangerous consequences arise as polluted air is not suitable for breathing.

- # COLLECTION OF DATA:

Table 2.1 : Level of average air pollutants in JCMC area

Sr. No	Locations	RSPM (mug/m3)	SO2(mug/m3)	NO3(mug/m3)	CO (mg/m3)
	Standards	**200**	**80**	**80**	**2**
1	Bajrang pool	72.1	14.2	65.1	0.7
2	Prabhat chowk	81.5	16.1	60	0.81
3	B.J. Market	60.3	13.3	62	0.75
4	Ajanta chowk	75.6	16.5	68	0.82
5	Golani market	70.2	11.5	58	0.91
6	Gujral petrol pump	58.1	14.6	52	0.51
7	Akashwani chowk	72.9	17.8	59	0.68
8	Court chowk	78.5	17	61	0.72
9	Bendale chowk	76.4	18.2	63	0.78
10	Icchadevi chowk	85.6	18	65	0.81

- # ANALYSIS:

❖ EXPLORATORY ANALYSIS:

Table 2.2 : Mean and Standard Deviation of Given Data

	RSPM	**SO_2**	**NOx**	**CO**
Mean	**73.12**	**15.72**	**61.31**	**0.75**
Standard Deviation	**8.19**	**2.13**	**4.25**	**0.1**

<u>Conclusion</u> : Means of RSPM, SO_2, NO_x and CO levels of Jalgaon City is less than standard given CPCB.

❖ CAPABILITY INDEX :

$$Cpk = \frac{(USL - Mean)}{3SD}$$

Where,

USL- Upper Specification Limit.
SD- Standard Deviation.

Assumptions:

i. Verified that data is normally distributed.
ii. Verified that Process is in control.

Table 2.3 : Capability Indices

RSPM	SO_2	NOx	CO
5.164021164	**10.05946792**	**1.465882353**	**4.16666667**

Conclusion : As Cpk > 1 , for all the pollutants, then process is increasingly capable.

Average Capability Index = 5.2104

Conclusion : Cpk for Jalgaon city is 5.2104, process is highly capable.

❖ AIR QUALITY INDEX (AQI) :

$$AQI = \frac{Observed\ value}{Standard\ value}\ X\ 100$$

Table 2.4 : Air Quality Index

RSPM	SO_2	NOx	CO
36.56	19.65	76.6375	37.5

Table 2.5 : Standard Air Quality Index and status of monitoring area

Sr. No.	Range (AQI)	Class
1	0 to 20	Excellent
2	20 to 40	Good
3	40 to 60	Fair
4	60 to 80	Poor
5	80 to 100	Bad
6	Above 100	Dangerous

Coclusion : According to AQI,

- Status of RSPM is Good.
- Status of SO_2 is Excellent.
- Status of NO_x is Poor.
- Status of CO is Good.

❖ GRAPHICAL REPRESENTATION :

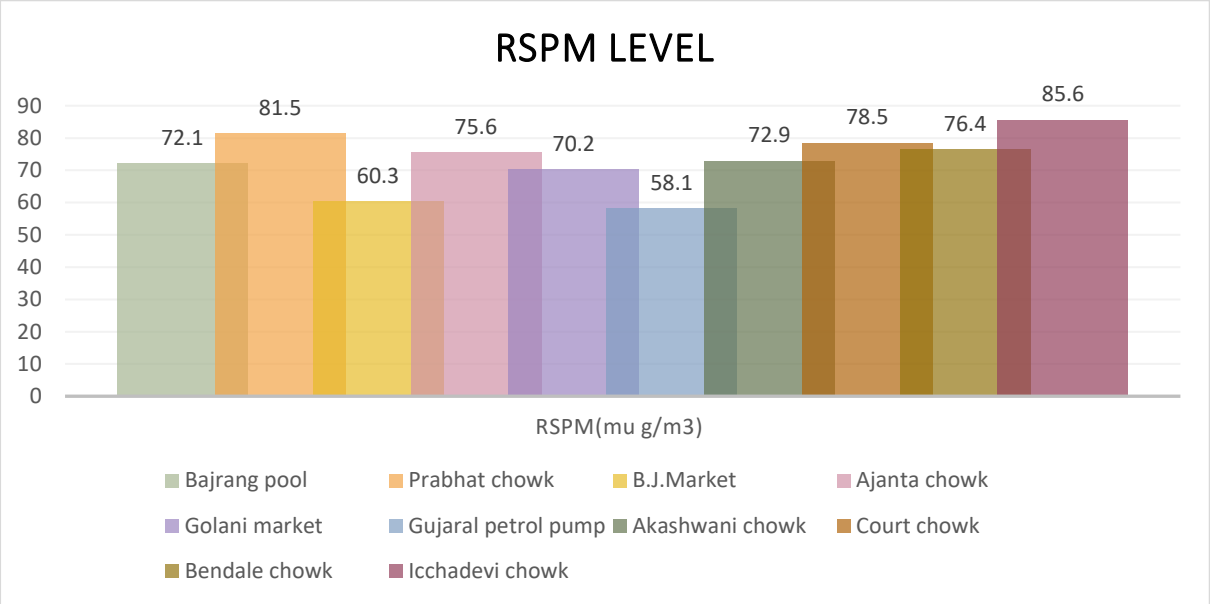

Figure 2.1 : RSPM level in Jalgaon city

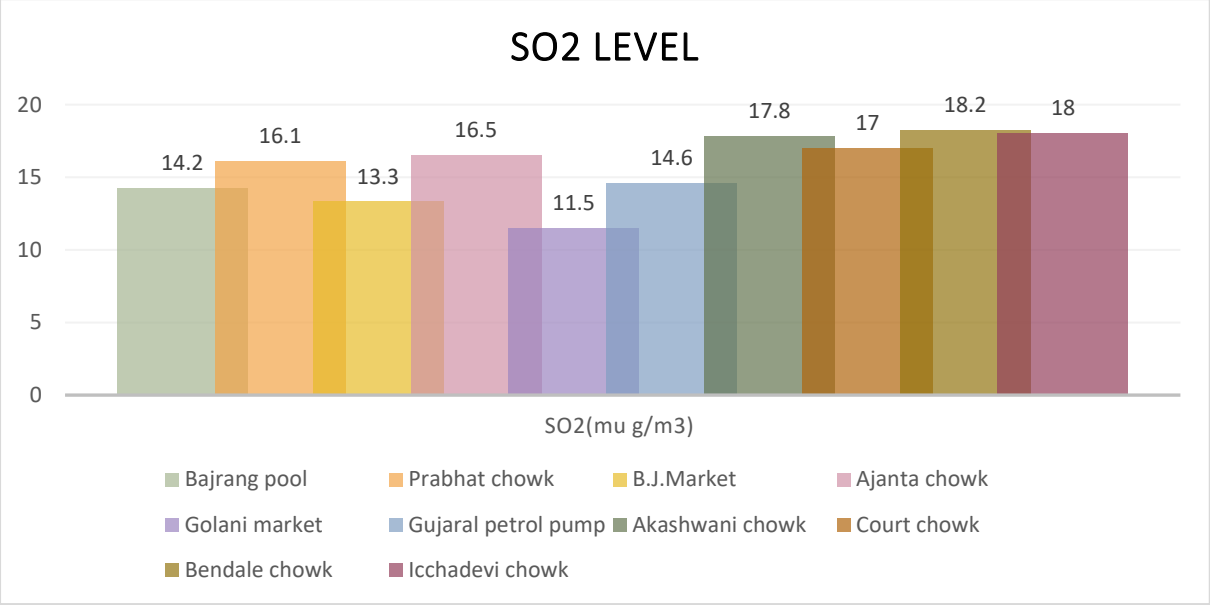

Figure 2.2 : SO_2 level in Jalgaon city

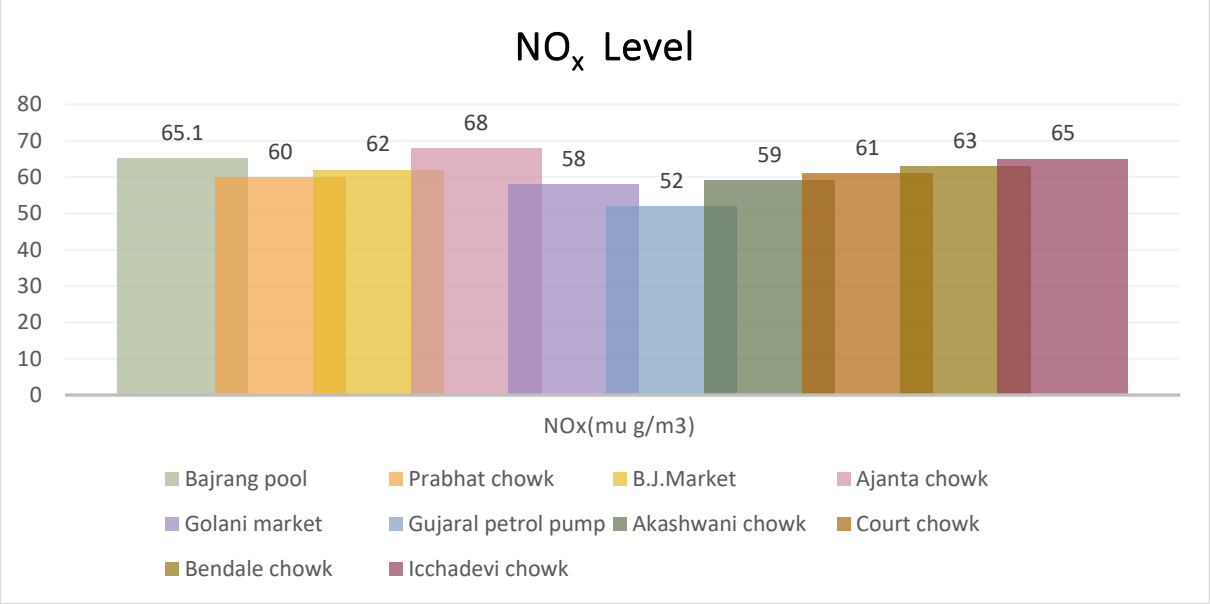

Figure 2.3 : NOx level in Jalgaon city

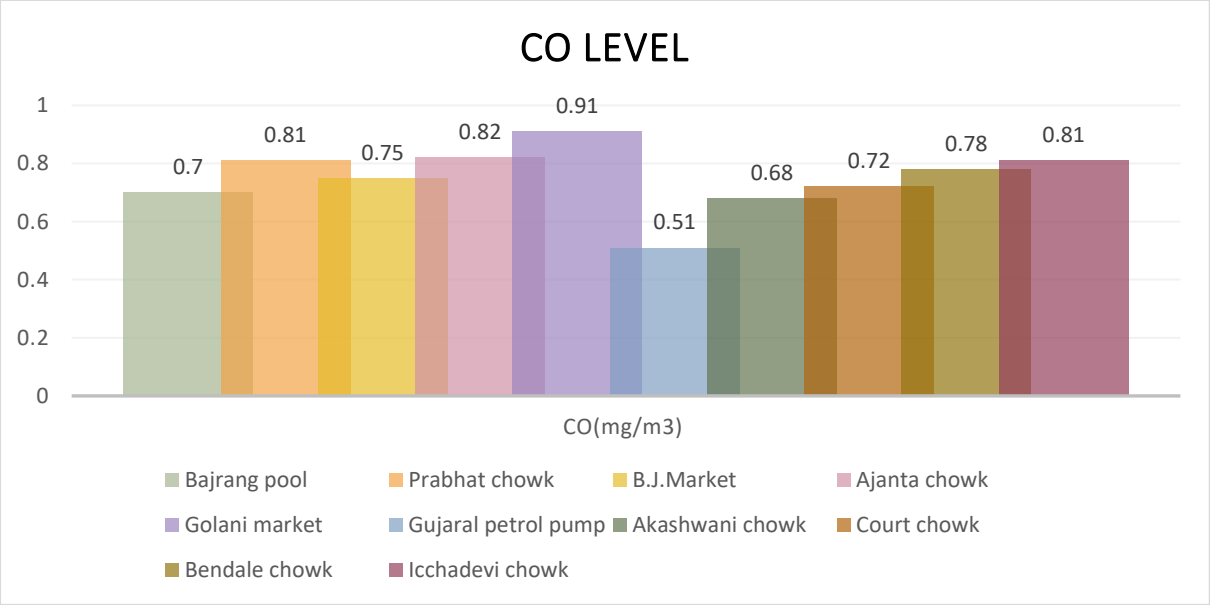

Figure 2.4 : CO level in Jalgaon city

- **RESULT: <u>From above we can conclude that air pollution in Jalgaon city is under control</u>**

2. NOISE POLLUTION

• INFORMATION:

"Noise pollution is the unwanted sound dumped into the environment without regard to the adverse effect it may have".

Noise is any sound independent of loudness that can produce an undesirable physiological or physiological effect in an individual and that may interfere with the social ends of an individual or group. These social ends include all of our activities-communication, work rest, recreation and sleep. "Noise pollution can be defined as unwanted or offensive sound that unreasonably introduced into our daily activities".

It has many sources, most of which are associated with urban development: road, air and rail transport; Industrial noise, neighbourhood and recreational noise. A number of factors contribute to problems of high noise levels including 1) Increasing population, particularly were it leads to increasing urbanization and urban consolidation; activities associated with urban living generally lead to increased noise levels. 2) Increasing volume of road, rail and air traffic.

Noise may adversely affect human health both physiologically and psychologically. The WHO suggest the noise can affect human health and well-being as a number of ways, including annoyance reaction, hearing loss, stress, high blood pressure, sleep disturbance, interference with communication, effect on social behaviour, distraction and lost productivity and a general reduction in the quality of life.

Noise can be emitted from a point source (electric fan) an area source (discotheque) or a line source (moving train). Noise pollution comes from a variety of source, including 1) Road traffic 2) industrial equipment 3) construction activities and so on.

In Jalgaon city the noise pollution increases at different area of the city with respective noise level show is the following table with corresponding standards:

- Slow response: Measuring the level at time 1 sec.
- Fast response: Measuring the noise level at time $\frac{1}{8}$ sec.

Decibel:

Noise intensity is measured in decibel (dB) units. That is the magnitude of the fluctuation is air pressure caused by sound waves. The decibel scale is logarithmic, each 10 dB increase represent a tenfold increase in noise intensity. The normal level of sound is 60 dB.

- # COLLECTION OF DATA:

Table 3.1 : Average Noise Pollution Level in Different Area of Jalgaon

Area	Time	Noise Level (Db)		Standards
		Slow response	Fast Response	
MIDC	**9.15**	69	72.1	75
	12.30	84.3	88.2	
	15.30	82	87.8	
	18.15	72.5	83.9	
	21.30	68.3	70.9	
Golani Market and Shastri Tower	**9.15**	63.1	72.5	65
	12.30	89.3	92.7	
	15.30	68.4	70	
	18.15	72.6	83.2	
	21.30	62.9	67.4	
Mahabal Colony and Ramanand Nagar	**9.15**	38.2	42.5	55
	12.30	35.3	37.9	
	15.30	32.4	36.7	
	18.15	42.9	54.3	
	21.30	40.7	43.6	
Civil Hospital Area and NMU	**9.15**	23.8	32.8	50
	12.30	32.5	35.3	
	15.30	30.3	31.9	
	18.15	36.9	38.4	
	21.30	25.1	36.8	

- # ANALYSIS:

❖ ANALYSIS OF VARIANCE (ANOVA):

1) For Slow Response:

H0: The effect of noise pollution level are same for different areas of Jalgaon city

Vs

H1: The effect of noise pollution level are not same for different areas of Jalgaon city

Table 3.2 : ANOVA for Slow Response

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
MIDC	5	376.1	75.22	55.597
Golani Market and Shastri Tower	5	356.3	71.26	117.973
Mahabal Colony and Ramanand Nagar	5	189.5	37.9	17.485
Civil Hospital Area and NMU	5	148.6	29.72	29.002

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	7980.1095	3	2660.0365	48.3517725	3.0243E-08	3.238871517
Within Groups	880.228	16	55.01425			
Total	8860.3375	19				

<u>Conclusion</u>: We reject the H0 at α=0.05.

Result: The effect of noise pollution level are not same for different areas of Jalgaon city.

2) For Fast Response:

H0: The effect of noise pollution level are same for different areas of Jalgaon city

Vs

H1: The effect of noise pollution level are not same for different areas of Jalgaon city

Table 3.3 : ANOVA for Fast Response

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
MIDC	5	402.9	80.58	71.707
Golani Market and Shastri Tower	5	385.8	77.16	111.553
Mahabal Colony and Ramanand Nagar	5	215	43	48.5
Civil Hospital Area and NMU	5	175.2	35.04	7.333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	8127.7575	3	2709.253	45.3255	4.79682E-08	3.238872
Within Groups	956.372	16	59.77325			
Total	9084.1295	19				

<u>Conclusion</u> : We reject the H0 at α=0.05.

Result: The effect of noise pollution level are not same for different areas of Jalgaon city.

❖ CORRELATION ANALYSIS:

- **Scatter Plot:**

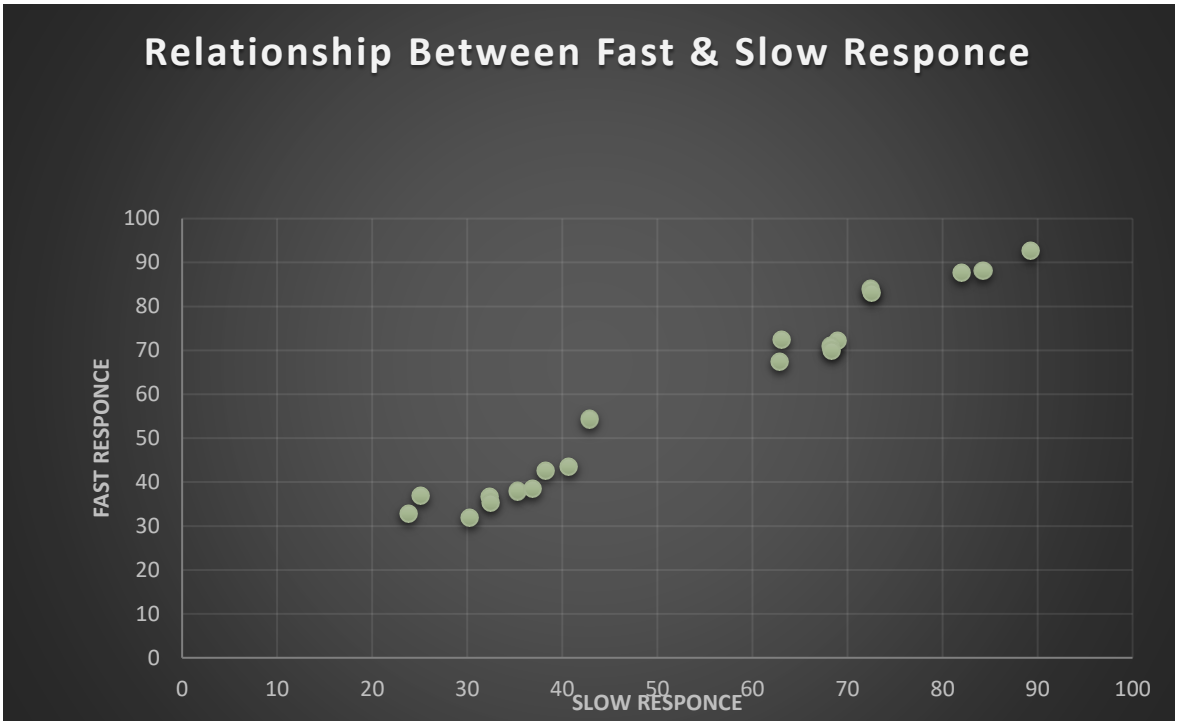

Figure 3.1 : Scatter plot for fast and slow response

Conclusion: There is linear positive relationship between fast and slow response.

- **Correlation Coefficient (r):**

$$r = \frac{cov(x,y)}{sd(x) * sd(y)}$$

$$r = 0.986$$

Conclusion: There is very strong positive correlation between fast response and slow response.

❖ AVERAGE NOISE LEVEL:

$$L = 10 * \log\left\{\frac{\sum_{i=1}^{n} 10^{Li}}{N}\right\}$$

Where,

Li – Observed noise level of i^{th} observation (in bels). i=1,2,…..,N.

N – No. of observations.

- **Average Noise pollution level for Slow Response:**

Table 3.4 : Average Noise Pollution Level in Different Area for slow response

Area	Average Noise Level	Standard Value of Noise Level
MIDC	79.63910268	75
Golani Market and Shastri Tower	82.45633532	65
Mahabal Colony and Ramanand Nagar	39.34302454	55
Civil Hospital Area and NMU	32.20686615	50

Conclusions:

- In MIDC noise pollution is slightly greater than standard value.
- In Golani Market and Shastri Tower area there are heavy noise pollution.
- In Mahabal Colony and Ramanand Nagar noise pollution is very low as compared with standard given.
- In Civil Hospital Area and NMU there is very low noise pollution.

- **Average Noise pollution level for Fast Response:**

Table 3.5 : Average Noise Pollution Level in Different Area for fast response

Area	Average Noise Level	Standard Value of Noise Level
MIDC	84.87773004	75
Golani Market and Shastri Tower	86.24136609	65
Mahabal Colony and Ramanand Nagar	48.07113047	55
Civil Hospital Area and NMU	35.69311384	50

Conclusions:

- In MIDC noise pollution is slightly greater than standard value.
- In Golani Market and Shastri Tower area there are heavy noise pollution.
- In Mahabal Colony and Ramanand Nagar noise pollution is low as compared with standard given.
- In Civil Hospital Area and NMU there is very low noise pollution.

- **RESULT: In the industrial area (MIDC) and market area there is heavy noise pollution but in residential area (Mahabal Colony and Ramanand Nagar) and silent zone (Civil Hospital Area and NMU) there are very low noise pollution.**

3. WATER POLLUTION

- **INFORMATION:**

"Alteration in physical, chemical and biological characteristics of water which may cause harmful effects on human and aquatic biota is known as water pollution".

Water pollution refers to the contamination of water bodies, such as rivers, lakes, oceans, groundwater, and even drinking water sources, with harmful substances or pollutants, resulting in adverse effects on water quality, aquatic life, and human health.

Water pollution can arise from various sources, including industrial discharges, agricultural runoff, untreated sewage and wastewater, stormwater runoff, oil spills, chemical spills, and litter. Pollutants can come in many forms, such as nutrients, chemicals, heavy metals, pathogens, sediment, and plastics. When pollutants are discharged directly into water bodies from a single identifiable source, such as industrial or municipal wastewater treatment plants, factories, and oil refineries.

Water pollution can have severe environmental impacts. It can harm aquatic ecosystems, killing fish and other aquatic organisms, disrupting habitats, and impairing water quality. Eutrophication, a process where excessive nutrients, such as nitrogen and phosphorus, enter water bodies and cause harmful algal blooms, can deplete oxygen levels in water, leading to "dead zones" where aquatic life cannot survive. Water pollution can also impact coastal areas and coral reefs, leading to the loss of biodiversity and ecosystem services.

Water pollution can pose risks to human health. Consuming contaminated water can cause waterborne diseases such as cholera, dysentery, hepatitis, and other gastrointestinal and respiratory illnesses. Polluted water used for agricultural irrigation can also contaminate crops, posing risks to food safety and human health.

All the important physico-chemical parameters such as temperature, pH, electrical conductivity, total suspended solids, total dissolved solids, total hardness, calcium, magnesium, chlorides, alkalinity, dissolved oxygen, chemical oxygen demand, biochemical oxygen demand, total phosphate, total viable count and most probable number are monitored with the view of understanding the pollution loads as well as to evaluate the trends of these loads in the surface water bodies in order to formulate management plans accordingly.

- **COLLECTION OF DATA:**

Table 4.1 : Water sampling sites for analysing water samples of Jalgaon city

Sr. No.	Sites	Description and Justification for site selection
1	River Girna — S1	Near Bambhori village recreational point
2	River Waghur — S2	No injection of effluents or sewage directly
3	Girna Treatment Plant — S3	Saokheda treatment plant
4	Waghur Treatment Plant — S4	Khandari Waghur treatment plant
5	Mahabal colony — S5	Ground water from the high-class society of Mahabal area
6	Nimkhedi — S6	Ground water from the middle-class society of Nimkhedi area
7	Mehrun — S7	Ground water nearby Mehrun lake low density area and recreational point
8	MIDC — S8	Carrying industrial effluent and sewage directly into Ground water
9	Waghur lake — S9	Sewage and effluent is not directly injected into the lake
10	Khedi Nala - S10	Carrying industrial effluent and sewage of the city
11	Lendi Nala- S11	Carrying agriculture run off completely through the high-density area and sewage used for irrigation
12	Gujar Nala — S12	Flowing along with the western side carrying sewage of the Nimkhedi Gaothan area
13	Pimprala Nala — S13	Carrying sewage of Pimprala Gaothan

Table 4.2 : Analysed physico-chemical parameters of different water samples

Area code	pH	Electrical Conductivity	TDS	Total Hardness	Chlorides	DO	COD	BOD	Alkalinity
Standard values	**8.5**	**300**	**500**	**300**	**250**	**6**	**10**	**5**	**120**
s1	6.7	134.9	1970.1	377	1.7	8	410	112	74.5
s2	6.7	135.9	1870.1	277	3.2	8.4	441.2	111.8	54.4
s3	8.1	137.1	69.7	47.4	26.2	7.4	26.2	21.1	36.6
s4	6.8	135.8	42.5	32	1.2	8.6	18	14	18.2
s5	7.5	150.5	150.5	80.1	2.6	4	29.5	0.9	69.9
s6	7.3	139.9	77.9	369.2	1	3.5	47.1	1.7	53.4
s7	8	144	76.9	268.9	1.8	3.4	35.3	1.5	76
s8	8.8	217.5	169.4	1021.3	7.5	8.5	191	43	121.1
s9	8.1	150.5	377.8	170.9	2.7	8.7	180	42	55.2
s10	9.5	117.5	2099.2	4655.1	914.6	2234.5	24476	6189	2109.6
s11	8.5	1196.6	4122.6	5721.6	745.5	0.02	15342	3300	3545.6
s12	10.5	93.1	2393.1	825.6	1002	0.1	9822	2821	6768.1
s13	11.6	380	1107.7	1025.3	1217.5	824.4	15720	3840	7814.6

- **ANALYSIS:**
  - **CORRELATION ANALYSIS:**
    - To check the relationship between different chemical parameter such as Chlorides, DO, BOD, COD, Alkalinity.

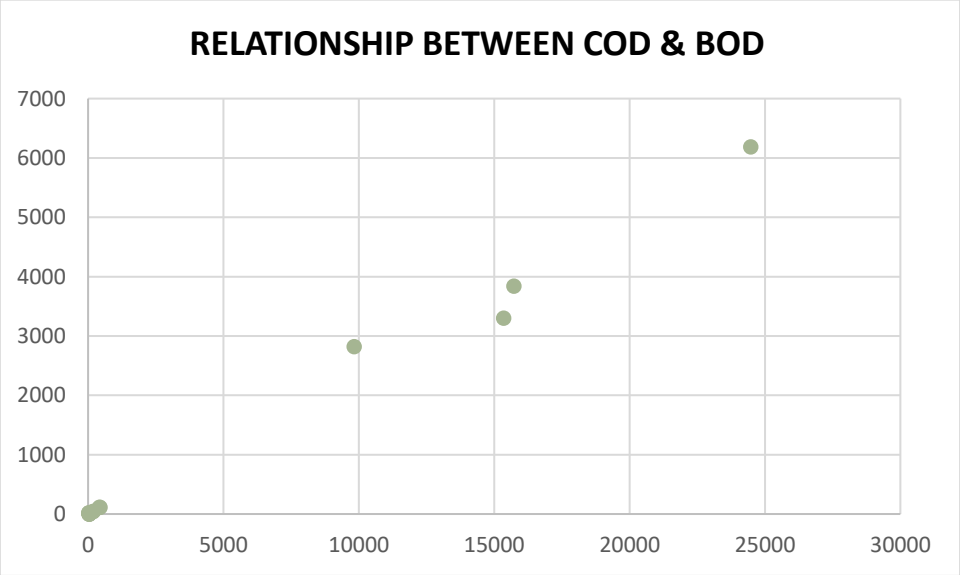

Figure 4.1 : Scatter plot for COD and BOD

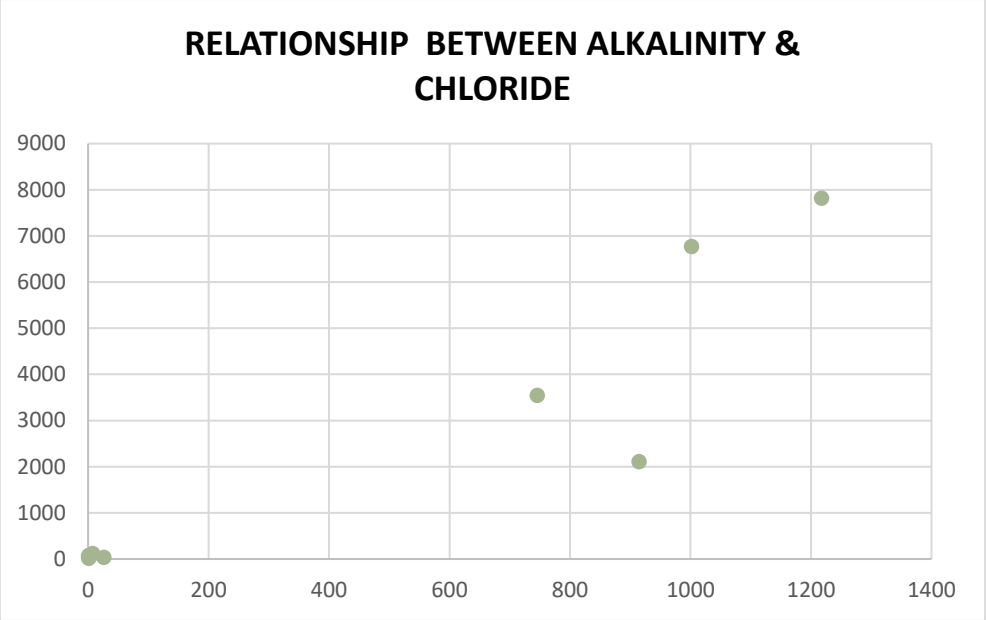

Figure 4.2 : Scatter plot for Chloride and Alkalinity

Table 4.3 : Correlation Coefficient for chemical parameter

	Chlorides	*DO*	*COD*	*BOD*	*Alkalinity*
Chlorides	1				
DO	0.578163164	1			
COD	0.898900291	0.805026611	1		
BOD	0.908005454	0.822873667	0.995895275	1	
Alkalinity	0.933628007	0.292004749	0.685390743	0.698418328	1

Conclusion: Chloride exhibited strong positive linear relationship with alkalinity (0.93) and there is very strong positive correlation between BOD and COD (0.99).

- To check the relationship between different physical parameter such as pH, Electrical Conductivity, TDS, Total Hardness.

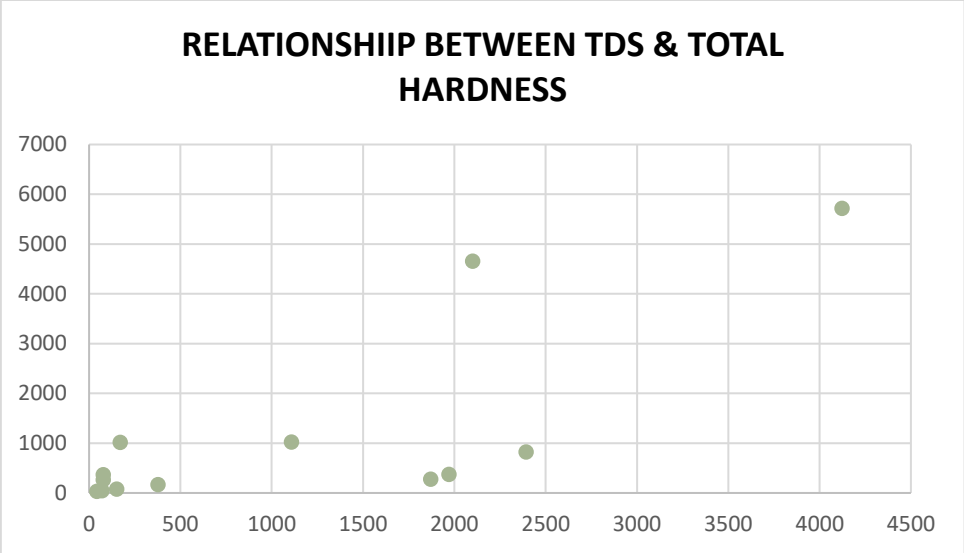

Figure 4.3 : Scatter plot for TDS and Total Hardness

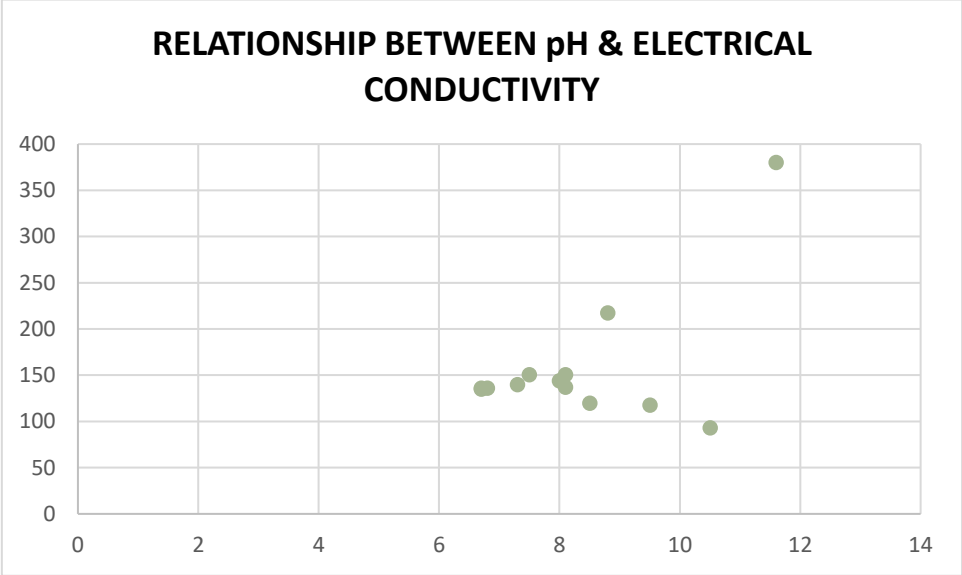

Figure 4 Scatter plot for pH and Electrical Conductivity

Table 4.4 : Correlation Coefficient for physical parameter

	pH	*Electrical Conductivity*	*TDS*	*Total Hardness*
pH	1			
Electrical Conductivity	0.543725198	1		
TDS	0.24464495	-0.216468295	1	
Total Hardness	0.243053614	-0.151596317	0.805685834	1

Conclusion: pH is moderately correlated with electrical conductivity (0.54) in water and There is very strong correlation between TDS and Total Hardness (0.80).

❖ WATER QUALITY INDEX (WQI):

$$WQI = antilog \sum_{n=1}^{9} Wn * \log qn$$

Where,

$$Wn = \frac{K}{Sn} \text{ , here } K = 1$$

$$qn = \frac{Vn}{Sn} X\ 100$$

Sn – Standard value

Vn – Observed value.

Table 4.5 : Standard WQI and status of water body

Water Quality Index	Status
0-25	Excellent
26-50	Good
51-75	Poor
76-100	Very Poor
100 and above	Unsuitable for drinking

- **Water Quality Index for different water sources:**

Table 4.6 : Water Quality Indices of water sample of Jalgaon city

Sr. No.	Sites	Water Quality Index (WQI)
1	River Girna — S1	43.71
2	River Waghur — S2	44.32
3	Girna Treatment Plant — S3	4.92
4	Waghur Treatment Plant — S4	4.75
5	Mahabal colony — S5	11.46
6	Nimkhedi — S6	13.26
7	Mehrun — S7	12.69
8	MIDC — S8	35.23
9	Waghur lake — S9	34.1
10	Khedi Nala - S10	418.83
11	Lendi Naia- Sil	50.41
12	Gujar Nala — S12	62.05
13	Pimprala Nala — S13	316.4

Conclusion: According to WQI of river Girna and river Waghur, it shows water is having a good quality status which is then treated in respective treatment plant to make its status excellent for drinking as well as other domestic purposes. All the ground water samples except MIDC are having good quality status. On the other hand obviously nala water samples shows heavy pollution load.

- **Water Quality Index for different types water sources:**

Table 4.7 : Water Quality Index for different types of Water Sources

Types	WQI
River and Treatment plant	37.27
Ground water	22.04
Nala	267.45

Conclusion: According to WQI of River and Treatment Plant, it shows water is having a good quality status. Also Ground Water is showing Excellent quality status and it is more efficient to drink. Nala water showing very poor quality of water.

- **Average Water Quality Index of Jalgaon city:**

It is calculated by taking geometric mean of WQI of water samples of Jalgaon city.

1) Except all nala water samples.

WQI = 16.77

2) Including all nala water samples.

WQI = 32.41

Conclusion: According to WQI of Jalgaon city it shows good water quality status.

- **RESULT: We can conclude that there is no heavy water pollution in Jalgaon city.**

4. SOLID WASTE

- **INFORMATION:**

"Solid waste is the organic and inorganic waste material produced by household, commercial, institutional and industrial activities that have no value in the eyes of the owner".

Solid waste pollution refers to the contamination and accumulation of solid waste materials in the environment, such as discarded or abandoned items, garbage, and litter, which can have harmful effects on the ecosystem, human health, and wildlife.

Sources of solid waste pollution: Solid waste can come from various sources, including residential households, commercial and industrial activities, construction and demolition sites, agricultural waste, and institutional waste. Improper disposal and management of solid waste can result in pollution of land, air, and water.

Environmental impact of solid waste pollution: Solid waste pollution can have significant environmental impacts. When solid waste is dumped in landfills, it can release harmful chemicals and toxins that can seep into the soil and contaminate groundwater. Decomposing solid waste produces methane, a potent greenhouse gas that contributes to climate change. Solid waste littered in natural habitats can harm wildlife by ingestion or entanglement, disrupting ecosystems and biodiversity.

Human health impact of solid waste pollution: Improper management of solid waste can pose health risks to humans. Accumulated solid waste can become breeding grounds for disease-carrying pests like mosquitoes and rodents, leading to the spread of diseases such as dengue, cholera, and hepatitis. Improper burning of solid waste can release harmful pollutants into the air, causing respiratory issues and other health problems.

Plastic use and its disposal cause environmental pollution and undesirable effects on health. Quantity of solid waste is increasing daily due to social, economic and technical change. The waste generation is large in high-income groups followed by middle and low-income groups.

- **COLLECTION OF DATA:**

Table 5.1 : Physical composition of solid waste generated in Jalgaon city

Sr. No.	Physical Composition	Income Groups (%)			Average	Variance
		LIG	MIG	HIG		
1	Compostable	45	72.2	68	61.73	214.41
2	Paper	4.5	4.25	5.5	4.75	0.43
3	Plastic	3.5	2.9	3.6	3.33	0.14
4	Glass	0.9	0	9	3.3	24.57
5	Metal	0.5	0	0.5	0.33	0.08
6	Rag	5.4	0.13	1.7	2.41	7.32
7	Earthen matter	40	20.3	11.4	23.9	214.21
8	Leather	0.2	0.22	0.3	0.24	0.0028

- **ANALYSIS:**

❖ **GRAPHICAL REPRESENTAION:**

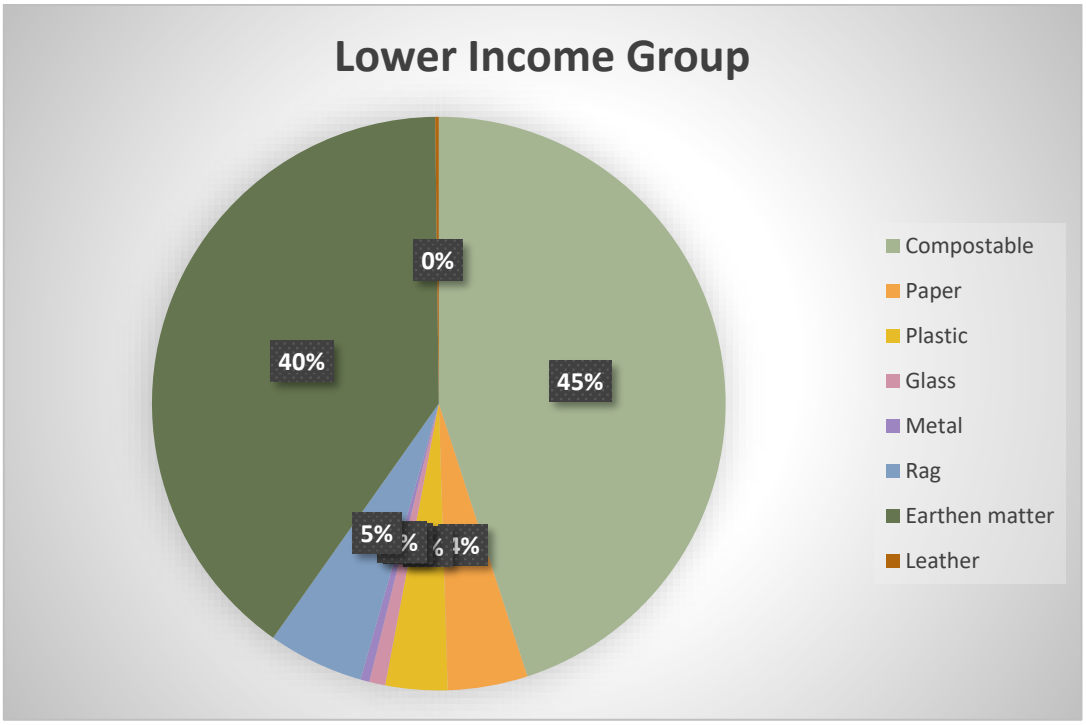

Figure 5.1 : Physical composition of solid waste generate by lower income group of Jalgaon city

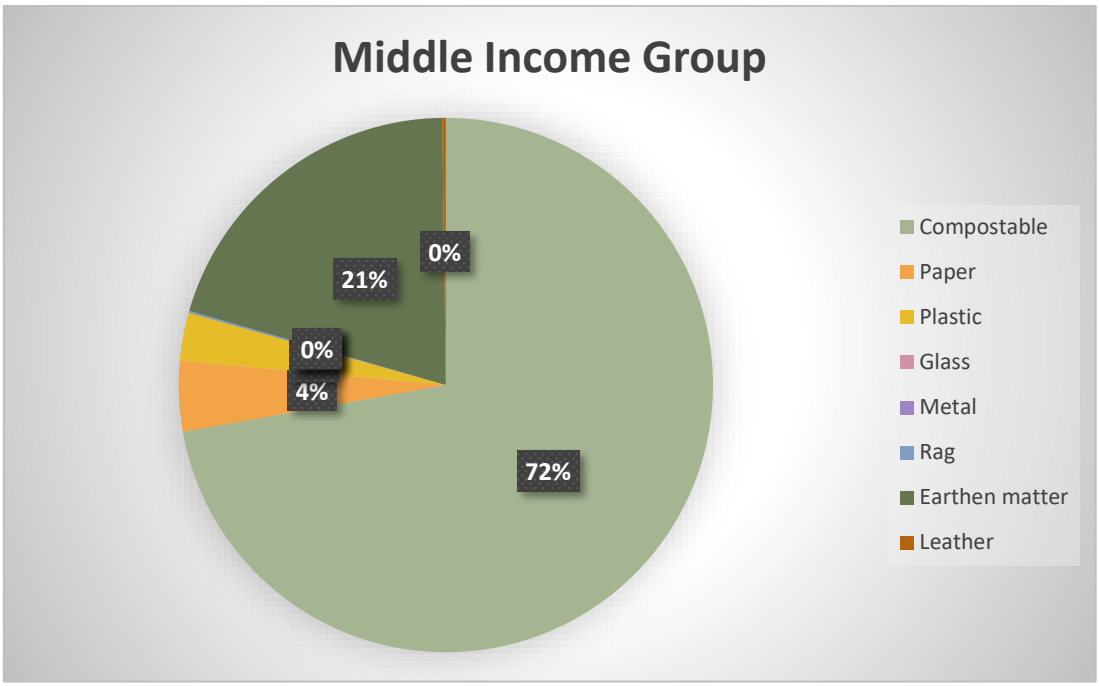

Figure 5.2 : Physical composition of solid waste generate by middle income group of Jalgaon city

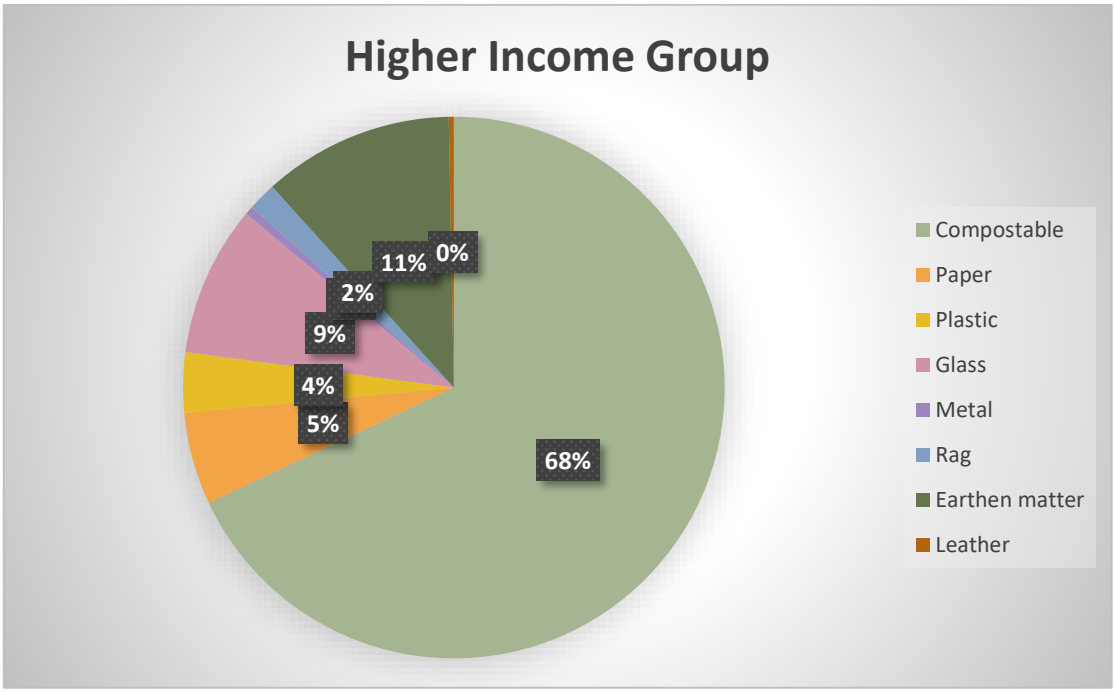

Figure 5.3 : Physical composition of solid waste generate by higher income group of Jalgaon city

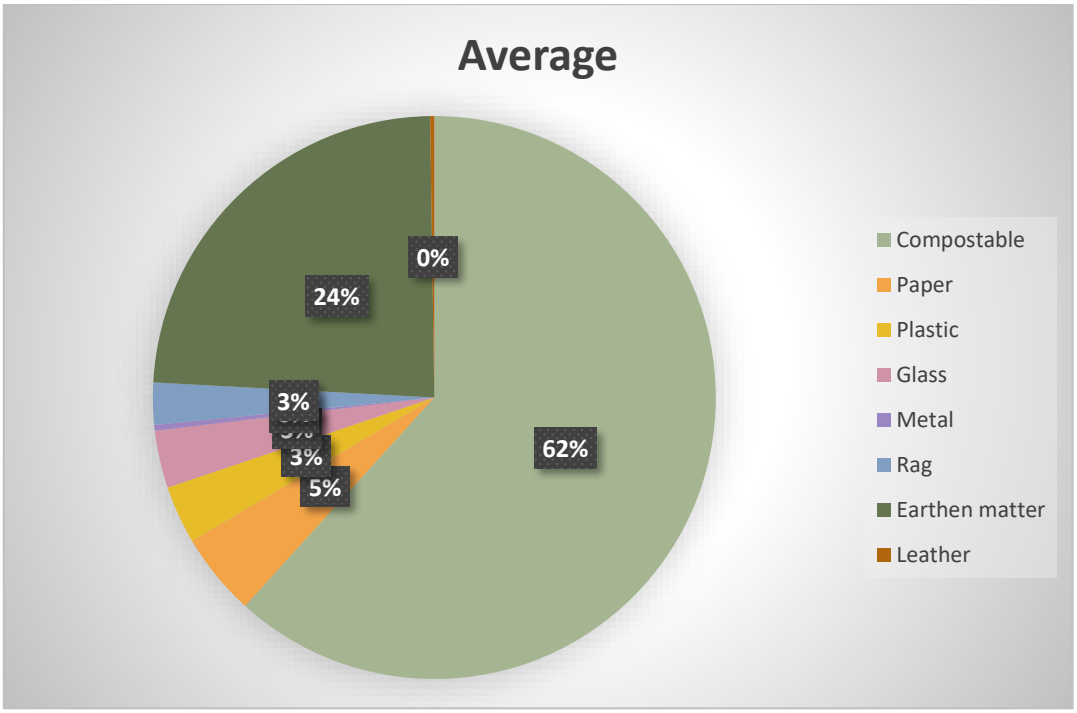

Figure 5.4 : Average physical composition of solid waste

- **RESULT: <u>The major composition of solid waste is compostable waste as compare to other compositions.</u>**

5. BIO-MEDICAL WASTE

• INFORMATION:

"The waste obtained from dispensary and hospitals is known as bio-medical waste".

The indiscriminate disposal of bio-medical waste poses a great risk to human health and the environment. The exposure of highly infectious waste like living or non-living pathogens, human body parts, solid cotton, dressing linen, laboratory culture stocks, waste of experimental animals used in research, wastes generated by veterinary hospitals, colleges, animal houses and livestock could cause serious diseases.

Biomedical waste is typically classified into different categories based on its characteristics and potential hazards. Common categories include:

Sharps waste: This includes used needles, syringes, scalpels, and other sharp objects that can puncture the skin and cause injuries or infections.

Infectious waste: This includes waste contaminated with blood or other bodily fluids, cultures, and other materials that may contain infectious agents.

Pathological waste: This includes human or animal tissues, organs, body parts, and fetuses.

Pharmaceutical waste: This includes expired or unused medications, pharmaceutical containers, and other pharmaceutical-related waste.

Chemical waste: This includes chemicals, solvents, and other hazardous substances used in healthcare or research settings.

Radioactive waste: This includes waste contaminated with radioactive substances used in diagnostic or therapeutic procedures.

Proper management of biomedical waste is critical to prevent potential health and environmental risks. It typically involves several steps, including segregation, packaging, transportation, treatment, and disposal, following local, national, or international regulations and guidelines. Some common methods of biomedical waste management include:

Three types of bio-medical waste treatment methods:

Incinerator: Involves the burning of wastages produced by hospitals, veterinary facilities and medical research facilities. (Capacity 70kg/hr with temp. of 1st chamber 800+50°c and 2nd chamber 1050+50°c) ex. body part.

Autoclaves: Autoclaves are closed chambers that apply heat and sometimes pressure and steam, over a period of time to sterilize medical equipment. Autoclaves have been used for sterilize medical instruments for reuse surgical knives and clamps.

Shredder: The biomedical waste shredding machine is used to destroy waste such as syringes, scalpels, glass vials, blades, plastics, catheters, broken ampules, intravenous sets/bottles, blood bags, gloves, bandages etc.

- **COLLECTION OF DATA:**

Table 6.1 : Status of Biomedical waste of Jalgaon city

Sr. No	Months	No. of member joint current year	Total no. of members till end of current month	No. of member sending BMW during month	Quality of BMW received and disposed during this month in kg			"Total quantity of BMW recd.& disposed till end of current month
					Incinerator	autoclave	shredder	
1	Jan-08	2	294	203	5575.5	1010.1	268.985	6854.585
2	Feb-08	5	299	200	5435.91	898.25	257.055	6591.215
3	Mar-08	1	300	207	6423.56	1107.65	305.77	7836.98
4	Apr-08	2	302	217	5124.27	1218.69	391.549	6734.509
5	May-08	0	302	213	6652.85	1398.85	463.075	8514.775
6	Jun-08	7	309	209	5166.64	1593.15	520.89	7280.68
7	Jul-08	13	322	212	4793.3	1501.5	493.376	6788.176
8	Aug-08	1	323	210	5000.25	1526.36	522.726	7049.336
9	Sep-08	1	324	211	4737.4	1316.77	440.062	6494.232
10	Oct-08	1	325	203	4869.84	1227.32	394.87	6492.03
11	Nov-08	5	330	217	4945.141	1197.4	367.226	6509.767
12	Dec-08	2	332	222	5330.12	1254.27	382.262	6966.652
13	Jan-09	4	336	224	5512.1	1525.57	452.66	7490.33
14	Feb-09	2	338	221	4620.4	1469.1	396.538	6486.38
15	18-03-2009	37	375	223	3342.3	871.402	217.82	4431.522

- # ANALYSIS:

❖ EXPLORATORY ANALYSIS:

Table 6.2 : Mean and Variance of Disposed BMW

	Incinerator	Autoclave	Shredder
Mean	**5168.6387**	**1274.42547**	**391.6576**
Variance	**552747.1**	**49876.5262**	**8458.2162**

Conclusion: The mean of Incinerator is greater than means Autoclave and Shredder.

❖ PERCENTAGE PROPORTION:

Table 6.3 : Proportion of Disposed BMW

Methods	Proportion (%)
Incinerator	**76%**
Autoclave	**19%**
Shredder	**6%**
Total	**100%**

Conclusion: Incinerator have highest percentage of disposed BMW (76%).

❖ GRAPHICAL REPRESENTATION:

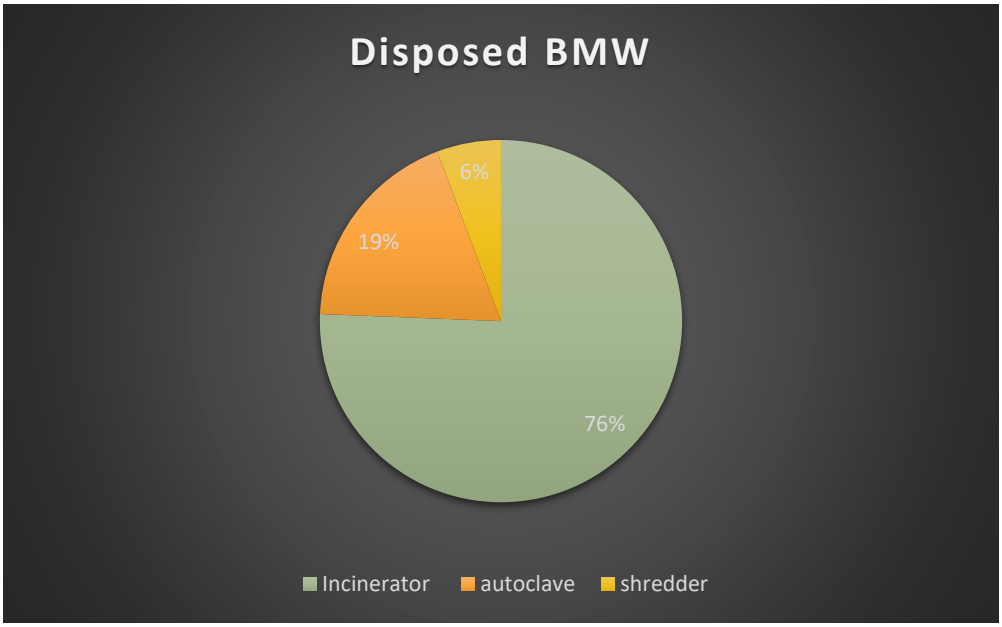

Figure 6.1 : Proportion of disposed BMW

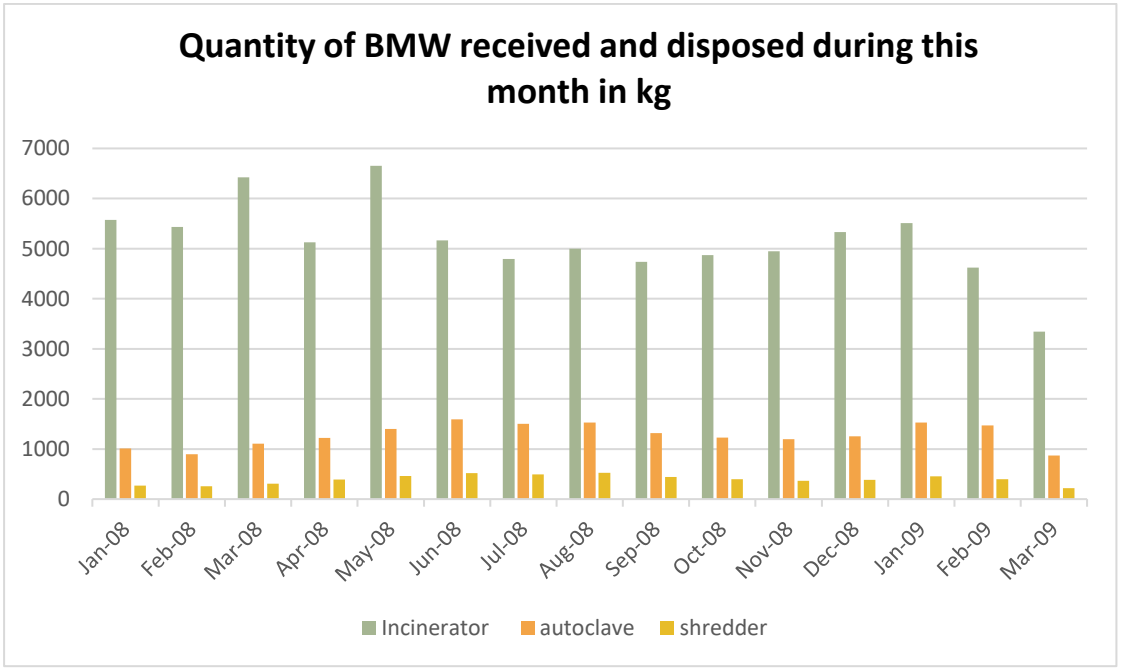

Figure 6.2 : Quantity of BMW received and disposed during this month in kg

- **RESULT: <u>The Bio-Medical waste is mostly decomposed by Incinerator as compared to other two.</u>**

CONCLUSIONS

There is no any hazardous effect of air pollution on the environment but level of Nitrogen Oxides (NO_x) very close to standard given by Central Pollution Control Board (CPCB), that mean it can be slightly effect on environment in the future. Noise pollution is partially affecting the environment, as the noise pollution level in the industrial and market area exceeds as compare to the standard given by CPCB. Water pollution in the Jalgaon city is too low which is good for health of environment but nala water sources are too polluted. Solid waste is mostly divided into compostable waste so we can easily break them into natural element which cann't effect the environment. The bio-medical waste mostly decomposed by incinerator so it can be completely destroyed that's why there is no any adverse effect of bio-medical waste on environment.

LIMITATIONS OF PROJECT WORK

This project work is limited for Jalgaon city of Maharashtra. But the data is taken from '2008' project report of Jalgaon city so the in present or in future the pollution of Jalgaon city may be change.

REFFERENCES & SOFTWARE USED

• REFERENCES:

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- Statistical Quality Control by Montgomery.
- Environmental project report of Jalgaon city 2008-2009.
- THE STUDY OF ENVIRONMENTAL POLLUTION OF JALGAON CITY, Dr. Parag A. Khadke Asst. Professor, School of Earth Sciences (Geography), Swami Ramanand Teerth Marathwada University, Nanded.

• SOURCES:

- www.google.com
- cpcb.nic.in
- **https://udghoshna.files.wordpress.com/2014/08/noise-pollution**

• SOFTWARES:

- MS – EXEL
- MS – WORD
- MINITAB