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An Analysis of Air Quality at Municipal Corporation Building of Kota District (Rajasthan) and Interpretate the Data Statistically

Ekta Singh , Research Scholar , Department of Chemistry , Career Point University , Kota, Rajasthan

Dr K.M. Sharma, Professor, Chemistry, Career Point University , Kota, Rajasthan ,

Abstract :

One of the districts in Rajasthan that expanded quickly is Kota, which has a large number of industries, including Kota Thermal, DCM Shriram Units of Stone Industries, Kota Gadepan CFCL, and others. Currently, Kota is renowned for its coaching centres, which have produced a large number of Doctors and Engineers. Every aspect of life has both a positive and a negative side, and growth had both positive and negative impacts.

Therefore, the Kota district's air quality fluctuates as a result of industry expansion, increased automobile usage, and other things. Nonetheless, the global air quality significantly improves during lockdown. Kota has undergone some modifications as well. Hence, the objective is to analyse the data of air before and after the lockdown (COVID-19), interpret the data statistically, and compare the data of pollutants over the course of a 24-hour period.

Keywords:

COVID-19, Air Pollutants, Air Quality, AQI, NAAQS, Sulphur dioxide (SO2), Nitrogen dioxide (NO2), Particulate Matter (PM).

Introduction :

The only planet where life exists is Earth. Because of their unique atmosphere and favourable living conditions. Life needs a number of things to survive. The three most crucial elements are air, water, and food since life cannot live without them. In all three of the aforementioned instances, both living and non-living objects depend heavily on air. Despite only having three alphabets, air is extremely necessary.

Everything is dependent on air, but whether the air we breathe in through respiration is pure or not is a very important subject. The unpleasant reality is that pure air exists. The air quality today is quite terrible. This is due to many factors, not just climate change. Humans play the primary part in this. Who has been causing so much

annoyance to the environment, and this annoyance to the environment has a negative impact on the air, proving that the air is contaminated.

In the environment, there is colourless and odourless air that is mostly composed of the gases oxygen and nitrogen. 78% of the gas mixture is nitrogen, 21% is oxygen, and the remaining 1% is made up of trace amounts of other gases and particulates like argon, neon, water vapours, carbon dioxide, ozone, and others.

Area of Study :

Kota formerly known as Kotah , is a city located in the southeast of northern Indian state of Rajasthan. It is located around 250 kilometers south of the state capital , Jaipur. Situated on the banks of Chambal river, it is the third most populous city of Rajasthan after Jaipur and Jodhpur and 46th most populous city of India. It serves as the administrative headquarters for Kota district and Kota division. Kota has a number of engineering and medical coaching institutes.

Kota is located at latitude $25^0$10’ 57.14’’N and Longitude $75^0$50’ 20.65”E and the population 1,001,694 according to 2011 census of India. It is covered an area of 221.4 km2. It has an average elevation of 271m (889ft). The Kota named for Kotia Bhil.

Kota has a semi-arid climate with high temperature through out the year. Summer are long hot and dry starting in late march and lasting till the end of June. The temperature average above 40^0C in may and June. Frequently exceed 45^0C with temperature as high as 48.5^0C also been recorded.

The average annual rainfall in the Kota district is 660.6mm. Most of the rainfall can be attributed to the southwest monsoon which has its beginning around the last week of June and May last till mid September. Pre monsoon showers begin towards the middle of June with post monsoon rains occasionally occurring in October. The winter is largely dry, although some rainfall does occurs as a result of the western disturbance passing over the region.

Material and Methods :

In this study the concentration of pollutants present in air such as particulate matter 2.5 , particulate matter 10 , sulphur dioxide , nitrogen dioxide , carbon dioxide , argon , neon , etc.

In this study three samples reading were considered for 3 consecutive years 2019, 2020, 2021 i.e. three sample reading for each year of Municipal Coorporation Builiding, location of district Kota with station code- 830.

Compare the data of pollutants concentration and interpretate the data of pollutant statistically of location Municipal Coorporation Builiding of Kota district.

Statistical parameters are :

1. Count
2. Average

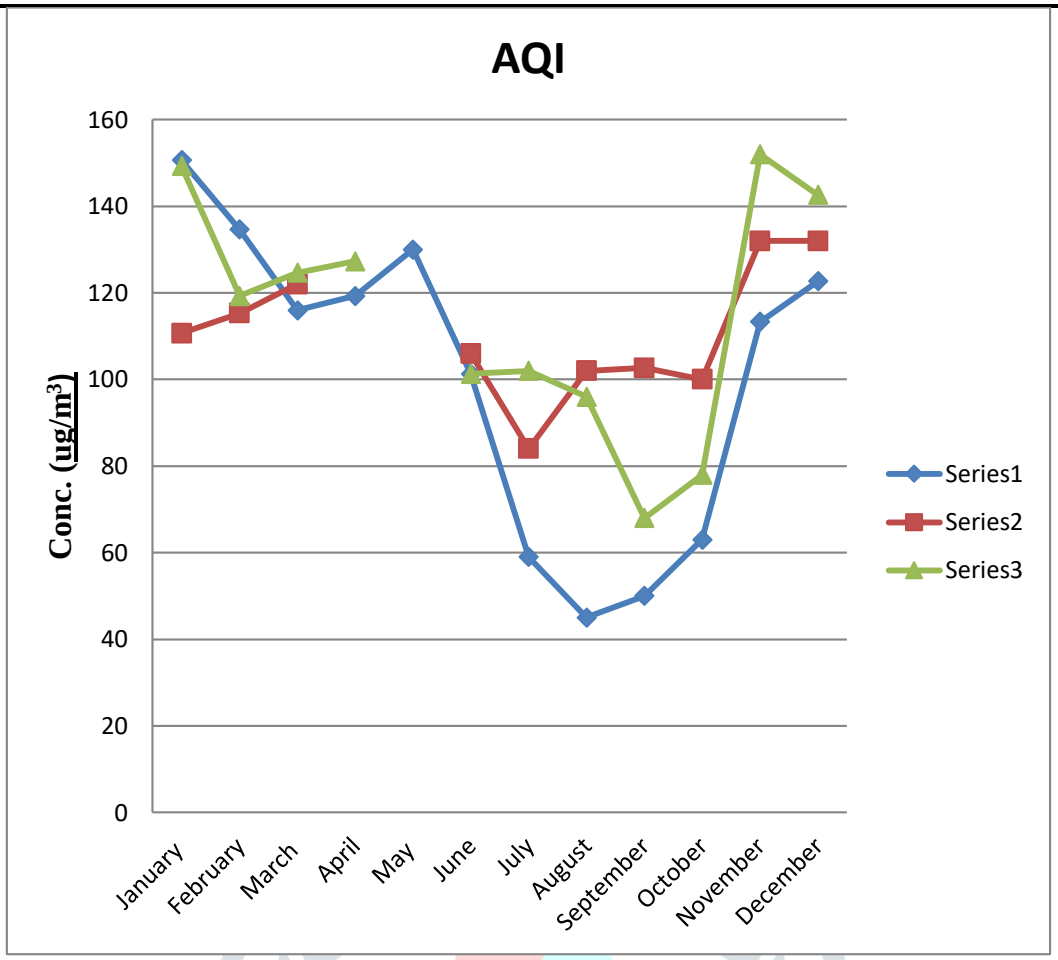
3. Sum
4. Median
5. Range
6. Variance
7. Standard deviation
8. Minimum
9. Maximum
10. Coefficient of variation

Table 1.1
Air Quality Parameter AQI of Continuous Ambient Air Quality Monitoring Station at Municipal Coorporation Builiding, at district Kota for three consecutive year 2019, 2020, and 2021
(Station code:830)

Months	Years		
	2019	2020	2021
January	150.67	110.67	149.33
February	134.67	115.33	119.33
March	116.00	122.00	124.67
April	119.33	NA	127.33
May	130.00	NA	NA
June	101.33	106.00	101.33
July	59.00	84.00	102.00
August	45.00	102.00	96.00
September	50.00	102.67	68.00
October	63.00	100.00	78.00
November	113.33	132.00	152.00
December	122.67	132.00	142.67

Air Quality Index Categories and Range with Colour Code and Possible Health Impact

AQI	*REMARK*	*COLOR CODE*	*POSSIBLE HEALTH IMPACT*
0-50	GOOD		MINIMAL IMPACT
51-100	SATISFACTORY		MINOR BREATHING DISCOMFORT TO SENSITIVE PEOPLE
101-200	MODERATE		BREATHING DISCOMFORT TO THE PEOPLE WITH LUNGS, ASTHAMA, AND HEART DISEASES
201-300	POOR		BREATHING DISCOMFORT TO MOST PEOPLE OR PROLONGED EXPOSURE
301-400	VERY POOR		RESPIRATORY ILLNESS ON PROLONGED EXPOSURE
401-500	SEVERE		AFFECT HEALTHY PEOPLE AND SERIOUSLY IMPACT EXISTING DISEASES



Series 1 : 2019 **; Series 2** : 2020 ; **Series 3** : 2021

Statistical Interpretation of Data :

1. Average

A mean is simply defined as the average of the given set of numbers. The mean is also considered as one of the measures of central tendencies in Statistics. It gives the central value of the set of values. Mean is also said to be arithmetic mean.

Mean is the sum of all the given data values divided by the total number of data values given in the set. It is given by:

Mean = Sum of Given Data / Total Number of Data

Average = $(x_1+x_2+x_3+\ldots+x_n)/n$

2. Median

The Median is defined as the middle value of a sorted list of numbers. The middle number is found by ordering the numbers. The numbers are ordered in ascending order. Once the numbers are ordered, the middle number is called the median of the given data set.

If the given number of observations/data is odd, then the formula to calculate the median is:

Median = {(n+1)/2}th term

If the given number of observations is even, then the formula to find the median is given by:

Median = [(n/2)th term + {(n/2)+1}th term]/2

Where,

"n" is the number of observations.

3. Maximum

The maximum is the highest observation value in all given data.

4. Minimum

The minimum is simply the lowest observation value in following data.

5. Variance

Variability is measured by the variance.

5.1. Population variance

When you have collected data from every member of the population that you're interested in, you can get an exact value for population variance.

The **population variance** formula looks like this:

Formula	Explanation
$\sigma^2 = \frac{\sum(X-\mu)^2}{N}$	• σ^2 = population variance • $\sum$ = sum of… • X = each value • μ = population mean • N = number of values in the population

5.2. Sample variance

When you collect data from a sample, the sample variance is used to make estimates or inferences about the population variance.

The **sample variance** formula looks like this:

Formula	Explanation
$s^2 = \frac{\sum(X - \bar{x})^2}{n - 1}$	• s^2 = sample variance • $\sum$ = sum of… • X = each value • $\bar{x}$ = sample mean • n = number of values in the sample

With samples, we use $n - 1$ in the formula because using n would give us a biased estimate that consistently underestimates variability. The sample variance would tend to be lower than the real variance of the population.

Reducing the sample n to $n - 1$ makes the variance artificially large, giving you an unbiased estimate of variability: it is better to overestimate rather than underestimate variability in samples.

It's important to note that doing the same thing with the standard deviation formulas doesn't lead to completely unbiased estimates. Since a square root isn't a linear operation, like addition or subtraction, the unbiasedness of the sample variance formula doesn't carry over the sample standard deviation formula.

6. Range :

The **range** is the spread of your data from the lowest to the highest value in the distribution. It is a commonly used measure of variability.

The formula to calculate the range is:

$$R = H - L$$

- R = range
- H = highest value
- L = lowest value

7. Standard Deviation :

The **Standard deviation** is the average amount of variability in your dataset. It tells you, on average, how far each value lies from the mean.

Standard deviation is a useful measure of spread for **normal distributions**.

7.1. Population Standard deviation

When you have collected data from every member of the population that you're interested in, you can get an exact value for population standard deviation.

The **population standard deviation** formula looks like this:

Formula	Explanation
$\sigma = \sqrt{\frac{\sum (X - \mu)^2}{N}}$	• σ = population standard deviation • $\sum$ = sum of… • X = each value • μ = population mean • N = number of values in the population

7.2. Sample Standard deviation

When you collect data from a sample, the sample standard deviation is used to make estimates or inferences about the population standard deviation.

The **sample standard deviation** formula looks like this:

Formula	Explanation
$s = \sqrt{\frac{\sum (X - \bar{x})^2}{n - 1}}$	• s = sample standard deviation • $\sum$ = sum of… • X = each value • $\bar{x}$ = sample mean • n = number of values in the sample

8. Coefficient of Variation :

The coefficient of variation (CV) is a statistical measure of the dispersion of data points in a data series around the mean. The coefficient of variation represents the ratio of the standard deviation to the mean, and it is a useful

statistic for comparing the degree of variation from one data series to another, even if the means are drastically different from one another.

Below is the formula for how to calculate the coefficient of variation:

$V = \sigma/\mu$

where: σ=standard deviation

μ=mean

Please note that if the expected return in the denominator of the coefficient of variation formula is negative or zero, the result could be misleading.

Table no: 1.2
Statistical Analysis of AQI of Continuous Ambient Air Quality Monitoring Station at Municipal Cooperation Building at district Kota for three consecutive year 2019, 2020, and 2021 (Station code:831)

Serial no	Statistical Parameters	2019	2020	2021
1	Count	12	10	11
2	Sum	1205	1106.67	1260.66
3	Average	100.41	110.66	114.60
4	Median	114.66	108.33	119.33
5	Maximum	150.66	132	152
6	Minimum	45	84	68
7	Range	105.66	48	84
8	Variance	1324.12	227.34	787.06
9	Standard deviation	36.38	15.07	28.05
10	Co-efficient of variation	0.362	0.136	0.244

Result And Discussion:

Particulate Matter 10 : Particulate Matter are inhalable pollutants particles with a diameter less than 10 micrometers. Particles that are larger than 2.5 micrometers can be deposited in airways; resulting in health issues. Exposure can result in eye and throat irritation, coughing or difficulty breathing and aggravated asthma. More frequent and excessive exposure can result in more serious health effects.

Particulate Matter 2.5 : Fine Particulate Matter are inhalable pollutants particles with a diameter less than 2.5 micrometers that can enter the lungs and bloodstream: resulting in serious health issues. The most severe impacts

are on the lungs and heart. Exposure can result in coughing or difficulty breathing, aggravated asthma and the development of chronic respiratory diseases.

Ozone (O3) : Ground level Ozone can aggravate existing respiratory diseases and also lead to throat irritation, headaches and chest pain.

Sulphur Dioxide (SO2) : Exposure to sulphur dioxide can lead to throat and eye irritation and aggravate asthma as well as chronic bronchitis.

Nitrogen Dioxide (NO2) : Breathing in high levels of nitrogen dioxide increases the risk of respiratory problems, coughing and difficulty breathing are common and more serious health issues such as respiratory infections can occur with longer exposure.

Carbon Monoxide (CO) : Carbon Monoxide is a colorless and odorless gas and when inhaled at high levels can cause headache, nausea, dizziness and vomiting. Repeated long term exposure can lead to heart diseases.

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References :

1.Abinaya Sekar, Jasna R S, Binoy B V, Prem Mohan, George Kuttiparichel Varghese, "The Detailed Data Analysis of Air Quality Changes due to Covid-19 Lockdown in India and its Perception by Public", DOI: 10.21203/rs.3.rs-74610/v1.

2.Abhishek chauhan , "COVID-19: Disaster or an Opportunity for Environmental Sustainability" The Impact of the COVID-19 Pandemic on Green Societies. Springer, Cham. PP.169-193.

3. Aditya Roy , Chetan Mishra , Sarthak Jain , Naveen Solank "A Review of General and Modern Methods of Air Purification", Journal of Thermal Engineering, Vol. 5, No. 2, Special Issue 9, pp. 22-28, February, 2019 Yildiz Technical University Press, Istanbul, Turkey.

4.Akvilė Feiferytė Skirienė and Žaneta Stasiškienė, "COVID-19 and Air Pollution: Measuring Pandemic Impact to Air Quality in Five European Countries", Atmosphere 2021, 12(3), 290.

5.David Núñez-Alonso, Luis Vicente Pérez-Arribas, Sadia Manzoor, and Jorge O. Cáceres, "Statistical Tools for Air Pollution Assessment: Multivariate and Spatial Analysis Studies in the Madrid Region", Hindawi Journal of Analytical Methods in Chemistry Volume 2019, Article ID 9753927, 9 pages.

6.Deep kumar B Rathi and Shantilal D Rathod, "Statistical Analysis of Ambient Air Quality in Aurangabad City, Maharashtra, India", Mod Chem appl 4: 184.

7.Edward Ming-Yang Wu, Shu-Lung Kuo, "A Statistical Analysis Model to Monitor Air Pollution Status in an Air Quality Total Quantity Control District", Atmosphere 2013, 4(4), 349-364.

8.Humaib Nasir, Kirtika Goyal ,Dolonchapa Prabhakar, "Review of Air Quality Monitoring : Case Study of India", Indian Journal of Science and Technology, Y 2016, Volume: 9, Issue: 44, Pages: 1-8.

9.Jayshri Kala, Prof. Gunwant Sharma, Prof. Sudhir Kumar and Dr. Satish Pipralia "Study of Ambient Air Quality Status on Urban Roads using Air Quality Index -A Case of Jaipur City (Rajasthan, India)", International Journal of Theoretical & Applied Sciences 6(1): 138-147(2014).

10. Dr. Mahendra Pratap Choudhary and Himanshu Gupta "Assessing Ambient Air Quality of Kota City, Rajasthan in terms of Air Quality Index", International Journal of Modern Trends in Engineering and Research (IJMTER) Volume 03, Issue 07, (July– 2016).

11. Neelima Nair, B.R.Bamniya , G.S.Mahecha and Dhavan Saini "Analysis of Ambient Air Pollution and Determination of Air Quality Status of Udaipur, Rajasthan, India", International Research Journal of Environment Sciences ISSN 2319–1414 Vol. 3(6), 5-10, June (2014).

12. Nidhi Sharma, Shweta Taneja, Vaishali Sagar, Arshita Bhatt "Forecasting air pollution load in Delhi using data analysis tools", ELSEVIER, Procedia Computer Science Volume 132, 2018, Pages 1077-1085.

13. Dr. Rashmi Sharma " A Study of Air Quality Status of Some Cities of Rajasthan", IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS), Volume 11, Issue 1 Ver. I (Jan. - Feb. 2016), PP 36-39.

14. Reka Keresztes And Eszter Rapo, "Statistical Analysis Of Air Pollution With Specific Regard To Factor Analysis In The Ciuc Basin, Romania", Studia Universitatis Babes-Bolyai. Chemia, vol. 62, no. 3, Sept. 2017, pp. 283+.

15. Shiv Lal, Shulbha Kothari " Comparative Studies of Air Pollution of Major Cities of Rajasthan , India" International Journal of Engineering Research, pp: 506-508, 9,10 March 2018.

16. Zeki Argunhan and Ali Serkan Avci, "Statistical Evaluation of Indoor Air Quality Parameters in Classrooms of a University", Hindawi Advances in Meteorology Volume 2018, Article ID 4391579, 10 pages.