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Study of Ambient Air Quality in Rewa City (M.P.) in Reference of Respirable Suspended Particulate Matter (Rspm), Sulphur Di Oxide and Nitrogen Oxide.

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Abstract : Air Pollution occurs due to the presence of undesirable solid or gaseous particles in the air in quantities that are harmful to human health and environment. Ambient air quality is known to be influenced by emission from the source, Meteorological condition and topography of the area. The concentration of particulate matter was found above the permissible limit in most of the sites while the concentration of gaseous pollutants was found within the permissible limit as per the standards given by Central Pollution Control Board (CPCB, 2009). Air pollution has been a steadily growing problem since the industrial revolution which started by the invention of technology that could use new source of energy. The sources were coal, oil and gases. This study was undertaken to asses the quality status ambient air pollutants SPM, RSPM, SO2 and NOx. The analysed values of SPM, RSPM, SO_2 and NOx at the sampling sites clearly illustrates that the ambient air of Rewa city is primarily deteriorated by particulate matters (SPM, RSPM) and least by gaseous pollutants (SO_2 and NOx). Concentrations of all the pollutants were found to be highest during winter season followed by summer and least during post monsoon season respectively.
Keywords- Ambient air quality, RSPM, SPM, SO2 and Nox.

Introduction - Air pollution is one of the severe problem world is facing today. Rapid urbanization, unregulated industrialization, growing transportation on poor road condition, metal plating and agricultural activities, construction debris, garbage burning, and population growth deteriorates the ambient air quality. (Mangalekar *et.al*.,2013, Tsang *et.al*.,2008, Chaurasia *et.al*.,2013, Sharma & Sharma 2016). Particulate matter and gaseous emissions of pollutant emission from industries and auto exhaust are responsible for rising discomfort, increasing airway diseases and deterioration of artistic and cultural patrimony in urban centers. Major components of air pollutants are dust and gases. The suspended dust in air is known as suspended particulate matter (SPM) and consists of solid and liquid particles emitted from numerous natural and manmade sources. About six thousands premature deaths annually were recorded alone in India due to polluted air (Kanwade *et.al*., 2020). As India is a developing country, the population density is higher, which contributes to higher intake fractions of PM (Apte *et.al*., 2012). In India, the dust pollutants contribute around 40% of total air pollution problems (Chauhan and Sanjeev 2008). Some workers have observed higher concentration of SO2 in the ambient air as compared to present investigation (Mukhopadhyay and Mukherjee 2013, Nandanwar *et.al*. 2014). Various researches have been carried out by Rani *et.al*., 2011; Chakrabarti and Mitra, 2014; Richhariya, 2015; Simbi *et.al*, 2017; Dwivedi and Tripathi, 2018 to evaluate the ambient air pollutants (SO2, NOx and SPM). Hasan *et.al*., (2018) observed that Nitrogen oxides has an important role in the formation of ozone in the atmosphere and sulphur dioxide is a highly reactive gas which affects the environment. Roadside dust by vehicular exhausts and various other anthropogenic activities contain considerable concentrations of particulates and gaseous pollutants. Present research work was undertaken to monitor the ambient air quality of Rewa city (M.P.).

Materials And Methods

Study Area: The present research work was undertaken in Rewa city, which is situated on the north-eastern part of Madhya Pradeshstate, central part of India.It lies between 24°18' and 25°12' north lattitute and 81°2' and 62°18' east longitudes. Rewa has a humid subtropical climate, with cold, misty winter, a hot summer and a humid monsoon season. The average temperature being around 30°C (86°F).The geographical area of Rewa district is 6,314 kilometers. Rewa district is bounded on east and south-east by Sidhi , on the south- east by Sidhi, on the south by Shahdol and on the west by Satna district, Rewa city is lies about 450 KM north-east of state capital Bhopal and 130 KM south of

Prayagraj city. Nearby Rewa city there mega cement plants and some small scale industries present, including a few stone crushers.

Sampling and Monitoring: Sampling and Monitoring of ambient air quality was carried out at three locations in Rewa city. These stations are residential, commercial and industrial area respectively. According to CPCB (Central Pollution Control Board) the method prescribed for the pollutant gases and the particulate pollutants are very sensitive ones yet percentage of errors are very less. Sampling was carried out at three different locations using Respirable Dust Sampler (Envirotech model APM 460 BL-411) for 8 hours in a day at an average flow rate of 1.5 LPM as per the standards of Central Pollution Control Board (India). Monitoring is carried out covering a period of six months from February 2024 to July 2024. Suspended particulate matters (SPM) and respirable suspended particulate matters (RSPM) were collected on the dust cup and glass fabric filter paper respectively. Samples for determination of gaseous pollutants (SO2 and NOx) were collected by bubbling air samples in Sodium tetra chloromercurate and Sodium hydroxide- Sodium arsenate absorbent solutions respectively in impingers at flow rate of 1.5 LPM. These samples were analyzed foe SO2 and NOx spectrophotometrically.

Result And Discussion

The detailed result of air quality monitoring are presented in Table 1 and 2.

The concentration of Respirable Suspended Particulate Matter (RSPM) in residential area (Niralanagar) was in the range of 68.18 to 98.32 µg/m^3. The concentratin of RSPM in commercial area (Shilpi Plaza) and industrial area (Naubasta) were observed in the range of 61.71 to 113.59 µg/m^3 and 78.89 to 115.83 µg/m^3 respectively. All the values were under the prescribed by National Ambient Air Quality Standards (NAAQS) of 100 µg/m^3 for residential/ commercial and industrial area respectively. (Fig.1).Similar study of seasonal variation in ambient particulate of Durg city was studied by Sharma and Parvej (2003) in six sampling sites. As well as Kushwaha *et.al*.,(2008), Salve *et.al*., (2006), Muneeswaran *et.al.,* (2003). The concentration of SO_2 in residential area (Niralanagar) was in the range of 21.02 – 23.55 µg/m^3. The concentration of SO_2 in commercial area (Shilpi Plaza) and Industrial Area (Naubasta) were found in the range of 22.32 to 24.92 µg/m^3 and 25.31 to 26.31 µg/m^3 respectively. All the values of SO_2 are within the prescribed limit of the NAAQS of 80 µg/ m^3 for residential, commercial and industrial area (Fig.1). Maurya (2005), Mondal *et.al*., (2007). The concentration of of NOx in residential area (Niralanagar) was found in the range of 34.19 to 35.13 µg/m^3. The concentrations of NOx in commercial area (Shilpi Plaza) and industrial area (Naubasta) were found in the range of 35.03 to 37.76 µg/ m^3 and 37.01 to 39.81 µg/m^3 respectively. All the values of NOX were within the prescribed standard by NAAQS of 80 µg/m^3 for residential, commercial and industrial area. Kushwaha (2008), Chaurasia and Kumar (2014).

The average concentration of RSPM, SO_2 and NOx in residential area (Niralanagar) was found in the range of 81.38, 21.76 & 35.12 µg/m^3 respectively. The average concentration of RSPM, SO_2 and NOx in commercial area (Shilpi Plaza) was observed in the range of 89.54, 22.79 & 36.11 µg/m^3 respectively. The average concentration of RSPM, SO_2 and NOx in industrial area (Naubasta) was found in the range of 92.77, 25.43 and 37.71 µg/m^3 respectively.

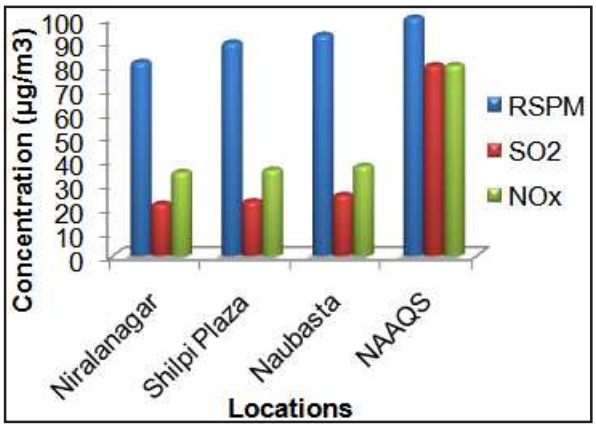
Table 1:- Concentration (µg/m^3) of RSPM, SO2 and NOx in different areas of Rewa city during the month of February – July, 2024).

Location	Month	RSPM	SO_2	NOx
	February	98.32	23.55	34.19
	March	89.39	22.5	35.49
Niralanagar (Residential Area)	April	86.62	21.28	35.32
	May	73.49	21.15	35.38
	June	72.29	21.09	35.22
	July	68.18	21.02	35.13
Average Concentration		81.38	21.76	35.12
Shilpi Plaza (Commercial Area)	February	113.59	24.92	37.76
	March	99.56	22.8	36.42
	April	93.45	22.33	36.12
	May	86.64	22.19	36.23
	June	82.31	22.23	35.11
	July	61.7	22.32	35.03
Average Concentration		89.54	22.79	36.11
Naubasta (Industrial Area)	February	115.83	26.31	39.81
	March	97.79	25.62	38.89
	April	94.18	25.22	36.32
	May	85.32	25.11	37.1
	June	84.63	25.04	37.09
	July	78.89	25.31	37.01
Average Concentration		92.77	25.43	37.70
NAAQS		100.00	80.00	80.00

Table 2 :- Average Concentration (µg/m^3) of RSPM, SO2 and NOx in different areas of Rewa city during month of February – July, 2024 and compared with prescribed National Ambient Air Quality Standards (NAAQS).

Location	Locations	RSPM	SO2	NOx
Residential	Niralanagar	81.38	21.76	35.12
Commercial	Shilpi Plaza	89.54	22.79	36.11
Industrial	Naubasta	92.77	25.43	37.7
	NAAQS	100.00	80.00	80.00

Fig 1:- Average Concentration (µg/m^3) of RSPM, SO2 and NOx in different areas of Rewa city during month of February – July, 2024 and compared with prescribed National Ambient Air Quality Standards (NAAQS).



Result of the study of the Rewa city is similar with research for other cities of India as the concentration of particulate matter is also high in other cities. High particulate concentration is due to heavy transport activity in study area, apart from industrial emission, dust from paved roads, garbage burning in open, population density, congestion, weather, type of fuel and vehicle used, topography of a region and other domestic purposes. The study revealed that concentration of the pollutants in residential, commercial and industrial area showed little variations indicates that pollutants are well dispersed within the urban area. The major concern is the particulate matter which affects the human health. The effect of pollutant especially the particulate matter in urban area depends on several factors like number of concentration, size composition, time of exposure, and lastly the receptor (in case of humans these factors depend on age , health conditions etc.) thus is necessary to monitor the air quality as well as the health effects on regular interval strategic locations. All pollutants were observed to be high in concentration during winters as compared to summer and monsoon, due to slow dispersion and dilution of pollutants.

Conclusions: Monitoring of air pollutants such as RSPM, SO2 and NOx at 3 locations during six month of 2024 revealed that the concentrationof RSPM, SO2 and NOx at all the monitoring locations of residential, commercial and industrial were within the prescribed NAAQS at all the locations. It can be summarized that air pollution at the study site is primarily because of vehicular emissions by heavy traffic.

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