

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 3, March 2018

Ambient Air Quality Status of Belagavi City, Karnataka State, India

Gokavi .N.B*, B.N.Sunkad

Associate Professor, Dept. of Chemistry, K.L.E.Society's R.L.Science Institute Belagavi, Karnataka, India*

ABSTRACT: Clean air is basic requirement of living organisms. But now a day, due to the unplanned growth, development and vehicular boom, air becomes polluted. Pollutants of major public health concern include particulate matter, carbon monoxide, ozone, nitrogen dioxide and sulfur dioxide and that can pose a serious threat to human health. In the present study, prime air pollutants (PM₁₀, PM_{2.5}, SO₂ and NO₂) were estimated in some areas of Belagavi city of Karnataka. In the present study an attempt has been made to express the ambient air quality of Belagavi city in the form of air quality index (AQI). The sampling of 24 hrs was carried out to evaluate Respirable suspended particulate matter (RSPM), Sulphur dioxide (SO₂), Nitrogen dioxide (NO₂), AQI values in our study were calculated and, are categorized as good to moderate level by CPCB. Concentration of all pollutants were within the permissible limit.

KEYWORDS: Air quality, , AQI, RSPM, SPM , NO₂, SO₂.

I.INTRODUCTION

In addition to land and water, air is the prime resource for sustenance of life. For better human health and wellbeing of the humanity, clean air is one of the main basic requirements. Clean air become polluted by variety of sources, out of them household combustion devices, motor vehicles, industrial facilities and forest fires are common sources of air pollution that change the composition of atmosphere and affect the biotic environment. The concentration of air pollutants depend not only on the quantities that are emitted from air pollution sources but also on the ability of the atmosphere to either absorb or disperse these emissions. The relationships between the occurrence of respiratory and cardiovascular diseases and cardiopulmonary mortality with exposure to air pollutants are well documented in the literature [1] Major source responsible for higher level of SPM, RSPM, SO₂, NO_x and other organic and inorganic pollutants in environment was motor vehicle emission [2],[3] and [4] and 60 to 70% of the pollution found in the urban environment is also due to vehicle emission[5],[6].

The advent of technological and scientific innovations in various fields and diverse activities of human race for its sophistication have put extra load on the atmosphere by way of releasing air pollutants [7]. The magnitude of effect estimate varies across cities and countries [8].

The unplanned growth, development and vehicular boom have deteriorated the ambient air quality. Pollutants of major public health concern include particulate matter, carbon monoxide, ozone, nitrogen dioxide and sulfur dioxide and that can pose a serious threat to human health if it exceeds the permissible limit [9]. More than two million premature deaths per year can be attributed to the effects of urban (outdoor /indoor) air pollution that is mainly caused by burning of solid fuels [10]. More than half of the air pollution driven disease burden is borne by the population of developing countries. Air pollution is a common problem in both developed and developing countries [11]. Air pollution is one of serious problem faced by city dwellers globally, due to vehicles [12]. Sulphurdioxide ,nitrogendioxide and SPM are regarded as major air pollutants in India.Urban air pollution is a matter of concern today because of exposure of large number of people to it [4].

In development countries, air quality crisis in cities is attributed to vehicular emissions which contributes to 40- 80% of total air pollution [11]. Every city has its own characteristics which becomes the pull factor for its growth and developments. Air pollution is a significant risk to the environment, quality of life and health of the population. Ambient air quality monitoring in long term on regular basis is still not systematic in Indian cities. Moreover, ambient air quality standards have not yet been established and implemented properly. All the available information is based on random and short-term sampling conducted to assess the concentrations of various pollutants.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 3, March 2018

Both National and State authorities have taken up necessary regulatory steps and introduced interventions to curb emissions and reduce ambient air pollution, however lack of rational policy as well as unplanned growth across various developmental sectors (construction, transport, industry) has caused hindrance in the efforts. The polluted air has to be accepted as inevitable part of city has become intolerable. The ambient air may contain a high number of pollutants depending upon natural and anthropogenic activities.

II. RELATED WORK

India is the one of the largest developing country and its economic expansion over the past decades has been one of the strongest in the world history. Nature has the long contaminated air with sand and dust particles. The magnitude of air pollution increased immensely with industrialization and urbanization. The pollutants let out by industries and automobiles have suppressed the nature. In India, ambient air quality have progressively deteriorated due to anthropogenic sources like rapid urbanization, industrialization, uncontrolled increase of vehicles on poor road conditions, construction debris, garbage burning, lack of public awareness, domestic cooking/heating and seasonal causes such as dust storms. Various workers studied on air quality status. Similar study was reported by [12] in Jaipur city. [13] studied an ambient air quality using AQI of Vapi city, [2] studied air quality in Indore city. [14] studied air quality of Dahej area of Gujarat. [20] studied ambient air quality of Karnool city, they found city was moderately polluted category. [21] studied on ambient quality of Kolhapur city of Maharashtra, they observed RSPM and SPM concentration was high. [17] studied air quality status of Jaipur city and observed $RSPM > SPM > NO_2 > SO_2$. High AQI due to automobiles. [15] studied assessment of ambient air quality status by using AQI of Bhopal city (MP), they found RSPM and SPM concentration was beyond permissible limit. [19] studied impact of vehicular exhaust on ambient quality of Rohtak city.

It is need of the hour for the awareness of common people especially in the urban area regarding vehicular pollution and industrial pollution. In view of the above facts, the level of SPM, RSPM, SO_2 and NO_2 was measured in Autonagar and Shrinagar of Belagavi city of Karnataka for one year from May 2009 to April 2010.

III. MATERIALS AND METHODS

Study Area: Belagavi is popularly known as "Chotamahabaleshwar" as it has pleasant climate, population is around 6 lakh and is located in Northwest part of Karnataka state. Belagavi city lies on the geographical coordinates $15^{\circ} 53' 4''$ North latitude and $74^{\circ} 32' 2''$ East longitude. Belagavi city is situated in the eastern region of Western Ghat which observes heavy to moderate rain fall, temperature ranges from max $38^{\circ}C$ to $8^{\circ}C$.

Samples of pollutants was collected at Autonagar and Shrinagar of Belagavi city and recorded continuously for 24 hrs on last Saturday of every month for one year. Gravimetric method is used to determine the concentration of SPM. The ambient air was passed through glass microfiber filter paper. The SPM present in the air deposited on the surface of filter paper. The filter paper was reweighed after sampling, which gives the amount of SPM for the known period and this concentration of the particulate matter in ambient air was then computed on the net mass collected. For the gaseous pollutants (SO_2 & NO_2), sample was done at interval of 8 hours. SO_2 concentration was analyzed by modified West and Geake (1956) para rosaniline method. In this method SO_2 was absorbed in absorbing solution potassium tetrachloromercurate solution, it forms a stable dichlorosulphitomercurate. The amount of SO_2 is then estimated by the colour produced when the p-rosaniline added. The colour is estimated by a reading from spectrophotometer for which calibration curve has already prepared. NO_2 is estimated by Jacob and Hochheiser method. NO_2 are collected by bubbling air through a sodium hydroxide solution to form stable solution of sodium nitrate. The nitrate ion determined colorimetrically (540 nm) by selecting the exposed absorbing reagent with phosphoric acid, sulphanilamide and N (1-naphthyl) ethylene diaminedihydrochloride.

Air quality index: AQI is an interpretative technique which transforms measured concentrations of individual air pollutants into a single set of numbers in order to make the data more understandable. The following formula is used. Air quality index (AQI) = $100 \times \frac{\text{Observed mean concentration of a pollutant}}{\text{Standard for the respective pollutant}}$

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 3, March 2018

IV. RESULTS AND DISCUSSION

Monthly average concentrations of air pollutants namely SO₂, NO₂, RSPM and SPM are depicted in Table 1 & 2 . SO₂: According to the data presented in Table 1 (Autonagar) and Table 2 (Shrinagar). Values of SO₂ concentration at Autonagar was below the detectable limit and in Shrinagar it was ranged between 6.98 and 12.22 µg/m³. Highest concentration in Shrinagar was obtained in the month of November (12.22 µg/m³) and lowest concentration was observed in the month of October (6.98 µg/m³). Highest seasonal variation was found in winter (10.62 µg/m³) and minimum was in monsoon (9.99 µg/m³). Maximum in winter and minimum in monsoon season was observed in Jaipur city of Rajasthan [17]. Similar observations recorded by [18], [19],[20] in Karnool city of Andra Pradesh. Maximum concentration values was recorded in winter season[21].

NO₂: Concentration values are presented in Table 1&2. In Autonagar area NO₂ concentration ranged between 9.26 µg/m³ and 24.6 µg/m³. Maximum concentration was observed in August and minimum concentration was observed in November. Seasonally minimum values of NO₂ concentration was observed in winter and maximum was in summer season presented in Table 4. But [17] reported that NO₂ concentration in Jaipur city of Rajasthan was maximum in winter and minimum was in monsoon. The present study coincides with the results of study of Rohtak city[19] and [22]. In Shrinagar NO₂ concentration was between 36.24 µg/m³ and 52.86 µg/m³ , minimum was in monsoon and maximum was in summer season, where high traffic density was found. In summer photochemical activity are again presumed to be the primary cause of increasing the NO₂ concentration. At such high temperatures, more nitrogen from the air compresses and reacts with oxygen in the combustion chamber of CNG driven vehicles in comparison to petrol driven vehicle and thus produces more NO_x. In both the study area values were below the permissible limit. Air quality index as per CPCB categorized as good to satisfactory[23].

RSPM (PM₁₀): Concentration of RSPM in Autonagar was ranged between 16.03 µg/m³ (August) to 53.3 µg/m³ (Feb). Maximum concentration value was observed in summer followed by winter. Lowest value was found in monsoon due to intermittent precipitation. Similar observation was reported by [24] in some areas of Telangana. RSPM (PM₁₀) disperse long distance and reduce the lung

Table 1: Monthly average and air quality index of pollutants in Autonagar

Month	SO ₂		NO ₂		RSPM		SPM	
	Monthly value	AQI	Monthly value	AQI	Monthly value	AQI	Monthly value	AQI
May	1	2.62	14.5	18.12	31.93	31.93	105.2	52.6
June	1	2.62	12.5	15.62	16.75	16.75	31.2	15.6
Jul	1	2.62	11.9	14.87	16.74	16.74	41.16	20.58
Aug	1	2.62	24.6	30.75	16.03	16.03	27.43	13.71
Sept	1	2.62	13.39	16.73	19.56	19.56	32.6	16.3
Oct	1	2.62	9.63	12.03	37.13	37.13	58.2	29.1
Nov	1	2.62	9.26	11.6	42.93	42.93	95.76	47.88
Dec	1	2.62	15.25	19.06	43.33	43.33	75.23	37.61
Jan	1	2.62	17	21.25	42.16	42.16	92	46
Feb	1	2.62	20.95	26.18	53.3	53.3	120.33	60.16
Mar	1	2.62	18.55	23.18	42.8	42.8	113.23	56.61
April	1	2.62	17.5	21.87	49	49	106	53

All values are expressed in µg/m³ capacity in human[11]. Concentration of RSPM was in Shrinagar ranged between 118.2 µg/m³ (Nov) to 186 µg/m³ (May). Seasonally concentration was more in summer and minimum in monsoon. AQI level categorized as satisfactory to moderate in respective study area (Table 4). Motor vehicles generate particulate matter of different particle size from dust produced by vehicles. The present values are less than the concentrations observed in Jhansi city, Dehradun and in Kakinada city [17].

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 3, March 2018

Table 2: Monthly average and air quality index of pollutants in Shrinagar

Month	SO ₂		NO ₂		RSPM		SPM	
	Monthly value	AQI	Monthly value	AQI	Monthly value	AQI	Monthly value	AQI
May	10.24	12.8	48.22	60.27	186	186	104.8	52.4
June	10.2	12.75	46.76	58.45	128.34	128.34	46.4	23.2
Jul	8.8	11	42.26	52.82	126.6	126.6	43.4	21.7
Aug	9.62	12.02	52.8	66	136.8	136.8	38.8	19.4
Sept	11.34	14.15	40	50	120.4	120.4	42.4	21.2
Oct	6.98	8.72	38.94	48.67	126.8	126.8	60.2	30.1
Nov	12.22	15.27	36.24	45.3	118.2	118.2	78.8	39.4
Dec	11.48	14.35	52.2	65.25	145.6	145.6	68.2	34.1
Jan	10.36	12.92	58	72.5	122.4	122.4	88	44
Feb	9.44	11.42	44.34	55.42	162.4	162.4	120.1	60.05
Mar	10.2	12.75	52.86	66.07	148.8	148.8	116.3	58.15
April	8.6	12.44	48.66	60.82	166.4	166.4	102	51

All values are expressed in $\mu\text{g}/\text{m}^3$

SPM (PM_{2.5}): Concentration of SPM in Autonagar ranged between $31.2 \mu\text{g}/\text{m}^3$ (June) and $120.3 \mu\text{g}/\text{m}^3$ (Feb). Maximum values in winter and minimum was in monsoon. In Shrinagar area values are ranged between $38.8 \mu\text{g}/\text{m}^3$ and $120.1 \mu\text{g}/\text{m}^3$ which is presented in Table 1&2.

Table 3: Ambient air quality standards in $\mu\text{g}/\text{m}^3$

Area	SO ₂	NO ₂	RSPM	SPM
Industrial	120	120	150	500
Residential/rural	80	80	100	200
Sensitive area	30	30	75	100

Overall annual air quality index in Autonagar and in Shrinagar AQI was categorized as good as per the ambient air quality standards presented in Table 3. Seasonally concentration was maximum in summer and minimum was recorded in monsoon depicted in Table 4.

Table 4: Seasonal variation in pollutants

pollutants	Monsoon		Winter		Summer	
	Autonagar	Shrinagar	Autonagar	Shrinagar	Autonagar	Shrinagar
SO ₂	2.62	9.99	2.62	10.26	2.62	9.62
NO ₂	15.59	45.45	12.78	46.34	17.87	48.52
RSPM	17.27	128.03	41.38	128.25	44.25	165.9
SPM	33.09	42.75	80.29	73.8	55.59	110.75

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 3, March 2018

Table 5 -Break Points of Various Pollutants (National Air Quality Index, CPCB, October 2014)
(Units: $\mu\text{g}/\text{m}^3$)

AQI Category Range	PM10 (24hr)	PM _{2.5} (24hr)	SO ₂ (24hr)	NO ₂ (24hr)
Good (0-50)	00-50	0-30	0-40	0-40
Satisfactory (51– 100)	51-100	31-60	41-80	41-80
Moderately Polluted (101–200)	101-250	61-90	81-380	81-180
Poor (201-300)	251-350	91-120	381-800	181-280
Very Poor (301-400)	351- 430	121-250	801-1600	281-400
Severe (401-500)	>430	>250	>1600	>400

V.CONCLUSION

Air pollution measured in the form of Air Quality Index can be used to provide a meaningful assessment of air pollution in the common man's perception [25]. The present study shows all parameters are well below the permissible limit. SPM and RSPM concentration were little high but well below the permissible limit. Air Quality Index shows that the air quality falls under fairly (good) clean category.

Hence, proper pollution control measures must be taken by the pollution control board in order to reduce the air pollution in these areas, otherwise the air quality may become more deteriorated, polluted or severely polluted in the future.

V. ACKNOWLEDGEMENT

Author* is thankful to UGC, Bangalore for awarding a minor research project. He is also grateful to the Principal and staff of chemistry Department and HOD of Zoology department for their continuous encouragements throughout the study period.

REFERENCES

- [1]. Koken P.J., Piver W.T., Ye F., Elixhauser A., Olsen L.M. and Portier C.J. "Temperature, air pollution and hospitalization for cardiovascular diseases among elderly people in Denver". *Environ. Health Perspect.*, 111: 1312–1317, 2003.
- [2]. Sharma, K., Singh, R., Barman, S.C., Mishra, D., Kumar, R., Negi, M.P.S., Mandal, S.K., Kisku, G.C., Khan, A.H., Kidwai, M.M. and Bhargava, S.K. "Comparison of trace metals concentration in PM10 of different locations of Lucknow city". *Bullet Environ. Contam. Toxicol.* 77: 419-426. 2006.
- [3]. Jayaraman, G.N. "Air quality and respiratory health in Delhi.". *Environ. Monit. Assess.* DOI 10.1007/s 10661-007-9651-0. 2007.
- [4]. Barman, S.C., Kumar, N. and Singh, R.: "Assessment of urban air pollution and its probable health impact". *Journal of Environmental Biolog.* 31(6): 913-920. 2010.
- [5]. Panday, P.K., K.S. Patel and P. Subart. "Trace element composition of atmospheric composition of atmospheric particulate at Bhillai in central east India". *Science of total environment*, 21 pp 123 - 134. 1988.
- [6]. Singh, N., Yonus, M., Srivastav, K., Singh, S.M., and Panday, V.: "Monitoring of auto exhaust pollution by road side plant". *Environ. Monitor. Asses.* 34, pp. 1325. 1995.
- [7]. Panda, B.K. and C.R. Panda: "Estimation of Ambient Air Quality Status in Kalinga Nagar Industrial Complex in the District of Jajpur of Odisha". *International Journal of Environmental Sciences*, 3(2): 767. 2012.
- [8]. Bhuyan, P.K., Samantray, P. and S.P. Rout. "Ambient Air Quality Status in Choudwar Area of Cuttack District." *International Journal of Environmental Sciences*, 1(3): 343. 2010.
- [9]. World Health Organization (WHO): "Air Quality Guidelines for Europe," 2nd ed., 2000.
- [10]. World Health Organization WHO: "Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide." Global update 2005, Summary of risk assessment, WHO/SDE/PHE/OEH/06.02, 2005.
- [11]. Ghose, M.K., Paul, R. and R.K. Banerjee: "Assessment of the Status of Urban Air Pollution and Its Impact on Human Health in the City of Kolkata." *Environmental Monitoring and Assessment*, 108: 159. 2005.
- [12]. Agarwal, Sheetal, B.L. Swami and A.B. Gupta: "Interpretation of ambient air quality and air quality parameters in Jaipur city- A case study." *Nature Environment and Pollution Technology*. Vol.7(4). 573-578. 2008.
- [13]. GowthamSarella and Khambete, A.K: "Ambient Air Quality Analysis using Air Quality Index – A Case Study of Vapi." – *International Journal for Innovative Research in Science & Technology*. Vol 1 (10). 68-71. 2015.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 3, March 2018

- [14]. Patel, J.A., Prajapati B. I. and Panchal Viralben. "Assessment of Ambient Air Quality and Air Quality Index (AQI) in Dahej Area, Gujarat, India." *Int. J. Curr. Microbiol. App. Sci.* (2017) 6(6): 2714-2719.
- [15]. Chaurasia, Sadhana, Dwivedi. Pragya, Ravindra Singh and Gupta. AnandDev. "Assessment of ambient air quality status and air quality index of Bhopal city (Madhya Pradesh), India." *Int. J. Curr. Sci.* 9: E 96-101. 2013
- [16]. Nagdeve, D.A. "Urban air pollution and its influence on health in India. IIPS, Mumbai," *ENVIS Center*, 01 (03), 2004.
- [17]. Sharma Sanjeev Kumar and Sharma Kriti. "Ambient Air Quality Status of Jaipur City, Rajasthan, India," *International Research Journal of Environmental Sciences* Vol. 5(1), 43-48. 2016.
- [18]. Yadav, S., Kumar, V. and Singh, M. M. "Assessment of Ambient Air Quality Status in Urban Residential Areas of Jhansi City and Rural Residential Areas of Adjoining Villages of Jhansi City," *International Journal of Advanced Engineering Technology*, 3(1): 280-85. 2012.
- [19]. Shukla, V., Dalal, D., and Chaudhry, D. "Impact of vehicular exhaust on ambient air quality of Rohtak city, India." *Journal of Environmental Biology.*, 31(6), 929-932. 2010.
- [20]. Mohammed Waaiz, Krishna Reddy, K. and Punyaseshudu, D. "Ambient air quality analysis of Kurnool city, India". *International Journal of Current Research* Vol. 9, Issue, 02, pp.46597-46601, February, 2017.
- [21]. Pande, Vijayant and Dohare Devendra 2016. "Assessment of Present Ambient Air Quality of Indore City using Indian Air Quality Index – A Case Study." *International Journal of Science Technology & Engineering* | Volume 3 | Issue 06 | December 2016.
- [22]. Ali, M. and M. Athar. "Air pollution due to traffic, air quality monitoring along three sections of National Highway N-5, Pakistan." *Environ Monit Assess*, 136: 220. 2008.
- [23]. CPCB, National Air Quality Index, 2014, (<http://cpcb.nic.in/AQI-FINAL-BOOK.pdf>)
- [24]. Mangalekar, S.B., Jadhav, A.S. and Raut, P.D. "Studies on Ambient Air Quality Status of Kolhapur City, Maharashtra, India during Year." *Asian Journal of Water, Environment and Pollution*, Vol. 12, No. 3 (2015), pp. 15-22. 2013.
- [25]. Pradeepta K. Bhuyan, Pradyusa Samantra, Swoyam P Rout. "Ambient Air Quality Status in Choudwar Area of Cuttack District," *International Journal of Environmental Sciences*, Volume 1, No 3. 2010.

BIOGRAPHY



N.B. Gokavi is serving as an Associate professor in the Department of Chemistry, K.L.E Society's R.L. Science Institute, Belagavi. He has completed his graduation and post graduation from Karnatak University, Dharwad. He has 31 years of teaching experience and completed minor research projects, funded by UGC. Published research paper.



Dr. B.N. Sunkad: He has served as an Associate Professor and Head of the Department of Zoology, in K.L.E Society's R.L. Science Institute, Belagavi. He has completed his B.Sc., M.Sc., M.Phil and Ph.D. from Karnataka University, Dharwad. He has guided three students for M.Phil degree. He has published 20 research papers and presented a research paper in Thai Society of Higher Education Institutes on Environment of Bangkok, Thailand. He worked as a Principal at J.T. College, Gadag. Served as a Deputy Registrar at Rani Channamma University, Belagavi and as Director, Rani Channamma University PG Centre, Bijapur. He has completed two minor research and one major research project funded by University Grants Commission (UGC).