AMERICAN JOURNAL OF PREVENTIVE MEDICINE AND PUBLIC HEALTH, 2018
VOL 2, NO. 1: PAGES 1–7
10.5455/ajpmph.20171030080402

eJManager

ORIGINAL ARTICLE

Open Access

Assessment of ambient air quality resulting from anthropogenic emissions

Adamu Yunusa Ugya[1], Tijjani Sabiu Imam[2]

[1]Department of Biology, Ahmadu bello University Zaria, Kaduna, Nigeria, [2]Biological Sciences Department, Bayero University, Kano, Kano, Nigeria

ABSTRACT

Introduction: Rapid urbanization and industrialization in developing countries like Nigeria has resulted in loss of greenhouse effect which is causing an imbalance in nature.
Aim: This research is aimed at monitoring and evaluating pollution of ambient air resulting from anthropogenic emissions.
Methods: Particular matter samples were collected for 24h at four different sites daily using a high volume air sampler for the period of two years (March 2015-March, 2017). The determination of SO_2 and CO in the sample was done using spectrophotometric method.
Result: The obtained result shows higher CO Concentration of 7000µg/m in 2015/2016 and 8000µg/m in 2016/2017. The result also shows higher SO_2 of 140µg/m in 2015/2016 and 180µg/m in 2016/2017.
Conclusion: The concentration of SO_2 and CO obtain are above the recommended limit by World Health Organization (WHO). The high concentration of SO_2 and CO could be attributed to the anthropogenic activities of the study area. It is thereby recommended that government should imposed Carbon tax and provides adequate social amenities to discourage the use of generators and private vehicles, incessant falling of trees etc.

ARTICLE HISTORY

Received August 18, 2017
Accepted December 3, 2017
Published December 30, 2017

KEYWORDS

Air Pollution; Particulate matter; Afforestation; Industrial processes

Introduction

Environmental pollution is a major hazard facing the world today and there is an increasing awareness of the fact that a clean environment is necessary for smooth living and the better health of human beings [1]. The ecological equilibrium of the earth is endangered by the chemical process industries as most industries continue to spew chemical toxicants into the environment [2–4].

The quality of air quality is compromised by day to day anthropogenic activities resulting from human activities such as indiscriminate use of chemical based substance and this is of a great concern not only in mega cities but developing cities because these chemicals are passed on from one organism to another through all the links can ultimately be accumulated in the fat of human body and can increase in lungs or cardiopulmonary injuries [5–7]. Pollution of air by anthropogenic activities is known for quite a longtime now, some of which have been reported to be harmful to human being and other flora and fauna. Air pollution in urban areas is gradually becoming a great challenge. Rapid urbanization and industrialization in developing countries like Nigeria has resulted to exposure of large part of the earth to green house effects [8–10]. The city (Chikun local government) is located in Kaduna State of Nigeria (Figure 1) and is the home of over five hundred thousand inhabitants. The city is most crowded with traffic moving at slow pace in most of its road. The city also lies at the intersection with national roadways with an estimated 1000 trucks passing via it. The major industrial activities in the area include refining of crude oil, Pulp and Paper industrial activities, food processing and Allied industrial activities, Foundry industrial activities, Glass making industrial activities etc. [11]. Even though there is significant effort in trying to cope air pollution arising from these

Contact Yunusa Adamu Ugya ugya88@yahoo.com Department of Biology, Ahmadu Bello University Zaria, Kaduna State, Nigeria.

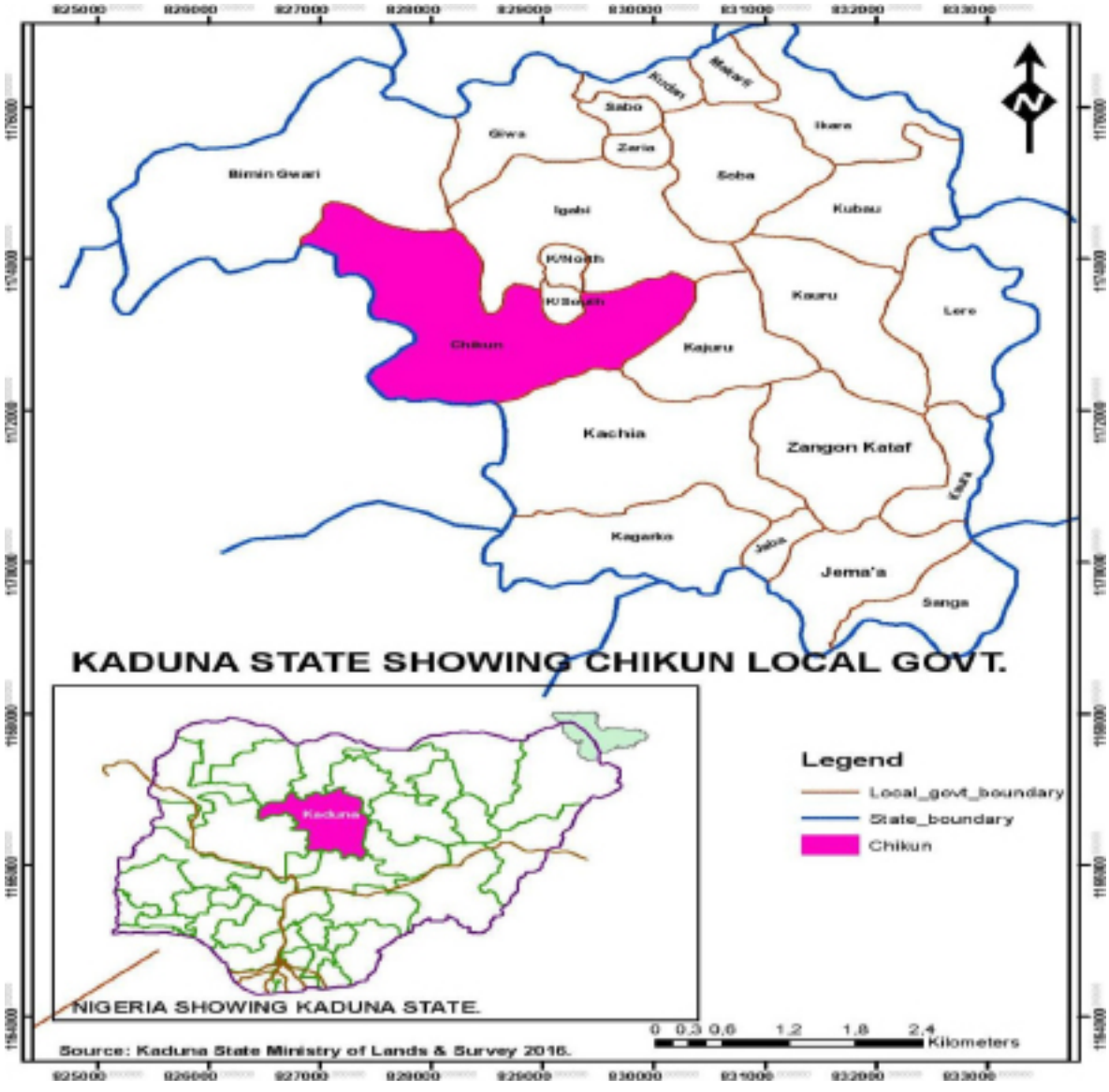

Figure 1. Map of Kaduna State Showing Chikun Local Government.

industrial activities, there are still other sources of air pollution in the area including thousand of uncontrolled vehicles and petrol or diesel emergency generators [12]. These generators are prolific due to severe power shortage is the area, this pollutants are not dispersed properly and remain in surrounding ambient air for longer durations [12–15]. Removal of such pollutants would have been easy by natural process but the incessant cutting down of trees in the study area in the name of getting of shelter is another problem contributing to air pollution in the area [16–18]. As a result there is a direct link between air pollution and lack of developed infrastructures. This condition is causing an imbalance in nature. Cumulative exposure to several pollutants enhances toxicity of the air [19,20]. It is thereby needful to monitor and evaluate the air pollution limit of the study area with the view of creating awareness to wake up the government of Kaduna state to take measure so as to reduce the adverse health impacts that may be resulting from long term exposure to air pollutants at the same time improving the local urban ecology. This research is aimed at monitoring and evaluating pollution of ambient air resulting from anthropogenic emissions.

Material and Methods

The air samples were collected from five sites daily for the period of 24 month (March, 2015 to March 2017). The samples were collected for 24h at five different sites daily using a high volume air sampler (Envirotech APM 410-411) according to the method employed by Bhaita, [21]. Point A was Sabo

Tasha market which is characterizing by combustion of substances belonging to stationary and mobile categories. Point B was Rido community; this sampling point is selected due to the presence of Kaduna refining and petrochemical company. Point C was Abuja Junction, this sampling point is selected because it is a point of heavy vehicular and trucks movement, and it is also a place of vast with industries. Point D was Mararaban Rido which is a place of tense activities and vehicular movement and sometimes traffic. Point E was Television garage which is characterize by high vehicular movement and intense location of industries. Analysis of SO_2 and CO was done by spectrophotometric method according to NAAQS and CPCB [22].

Results

The obtained results reveal important aspects of the concentration of SO_2 in the study area and it monthly variation across the sampling points (Figures 2 and 3). In the year 2015/2016 the mean concentration of SO_2 was higher in point E compare to any other points whereas in 2016/2017. The mean concentration of SO_2 was higher in point B. CO show spatial variation at different study points (Figures 4 and 5). The average concentration of CO in ambient air was found maximum at point E. Minimum of SO_2 and CO concentration levels of particulates as well as gases pollutants were found during April to June and this could be maximum mixing height, high temperature, high wind erosion and moderate stability.

Discussion

This higher concentration of SO_2 in point E in 2015/2016 but higher in point B in 2016/2017 could be attributed to the high industrial activities in point E during 2015/2016 compare to point B since in 2015/2016 Kaduna Refining and Petrochemical company is not in production and the reverse is the reason why the concentration is higher in point B compare to point E in 2016/2017. Another reason of high concentration of SO_2 in point E in 2015/2016 was due to high vehicular movement in this area. Lower concentration of SO_2 was noticed in point C which later shoots up in the month of December and January of 2015/2016 and 2016/2017. This was attributed to the fact that vehicular pollution plays the key role in polluting the environment since it is low in other months but higher in January and December. The value obtained for SO_2 in most of the sampling points, clearly indicate pollution and could be detrimental to the inhabitants of the area since the value obtained is greater than the tolerant limit specify by World Health Organisation [20,23] as such can be detrimental to human health and environment as a whole [24–26].

The high CO recorded in point E could be attributed to the fact that point E is situated in an industrial area comprising of large concentration of industries and high vehicular movement [27–29]. Many studies have reveal that CO is resulted from burning of fuels in cars and other combustion engines and can also be resulted due to industrial processes [29–31]. The values obtained for CO in all the sampling points could be detrimental to the health and also the environment since it is beyond the recommended limit by WHO in almost all the sampling points [32]. The high concentration of the pollutants recorded in these studies could be blamed on the government of Nigeria at all level for not discharging it duty of regulation to save the life of the future generation as such most industries spew air pollutants into the environment without the fear of the impact on the inhabitants of the area. The lack of provision of stable electricity in the country has also attributed to the high pollutant in this area since people now solely depend on generators for source of electricity also the lack of proper housing provision by the government has also contributed immensely to the level of pollutant in the air since most people now cut down trees with the view of building of houses [33–35].

Conclusion

The result obtained by this research shows high air pollution in the city since both SO_2 and CO were found to be more than the recommended limit by WHO. The concentration of the pollution shows high pollution which is hazardous to human health. It is thereby recommended that the government needs to intervene in the following area:

1. Carbon tax should be imposed to discourage the use of generators and private vehicles.
2. Social amenities should be provide to the people to prevent incessant building of houses at the expense of trees.
3. Strong regulation should be created and implement so that industries must treat their air pollutants before discharge and must control burning.
4. Electricity must be standardize to prevent both individuals and industries from using generators

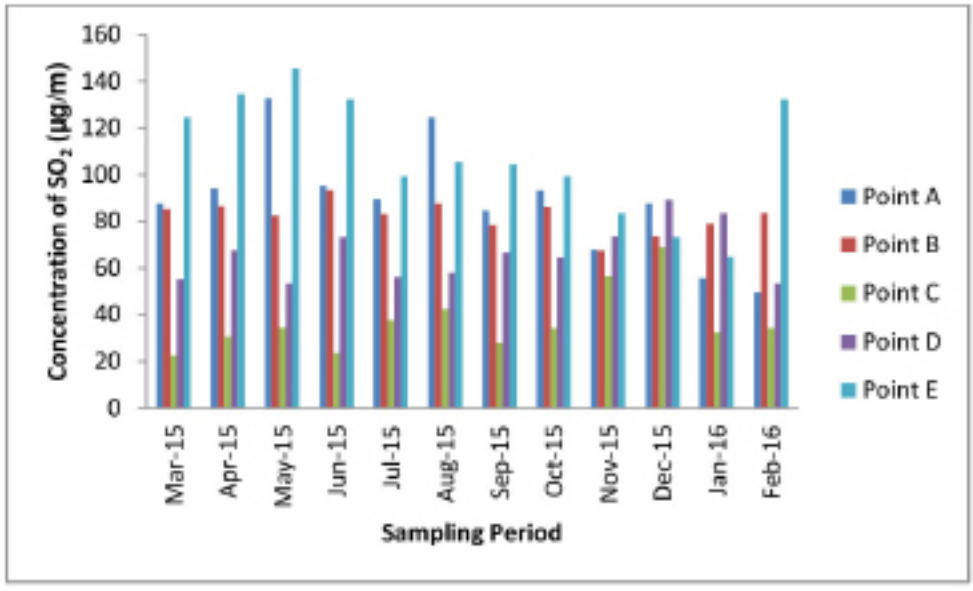

Figure 2. Concentration of SO_2 in the sampling point during 2015/2016.

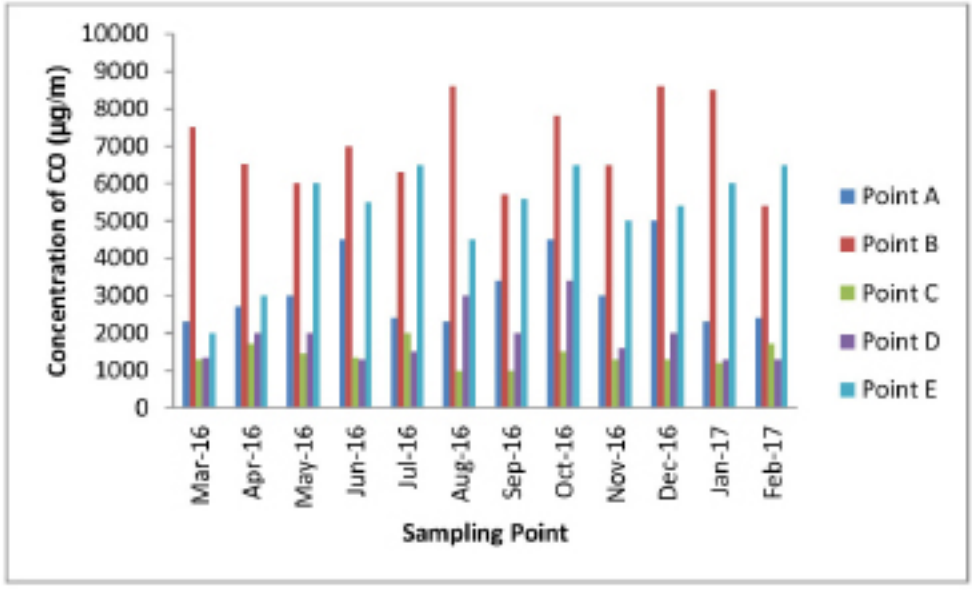

Figure 3. Concentration of SO_2 in the sampling point during 2016/2017.

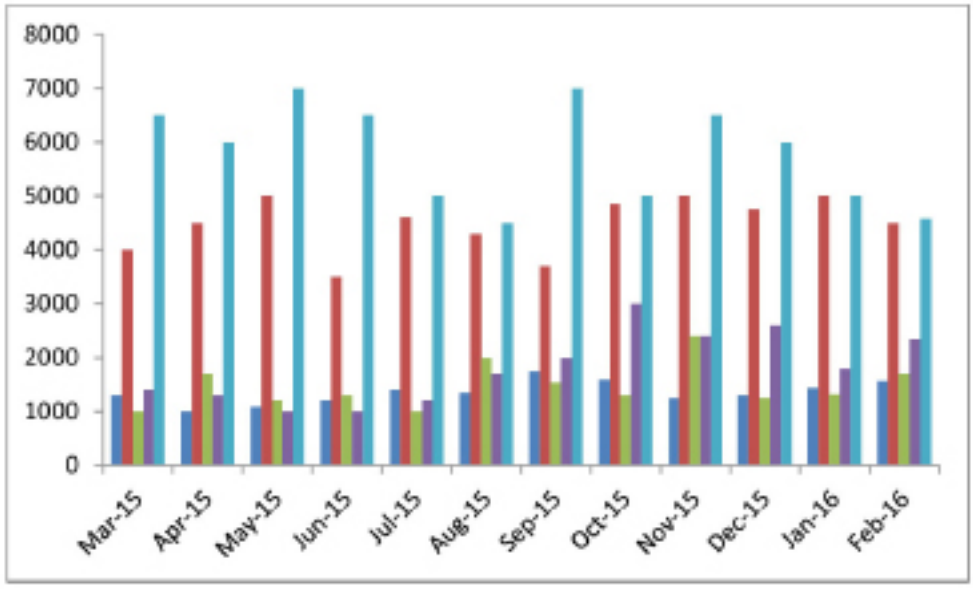

Figure 4. Concentration of CO in the sampling point during 2015/2016.

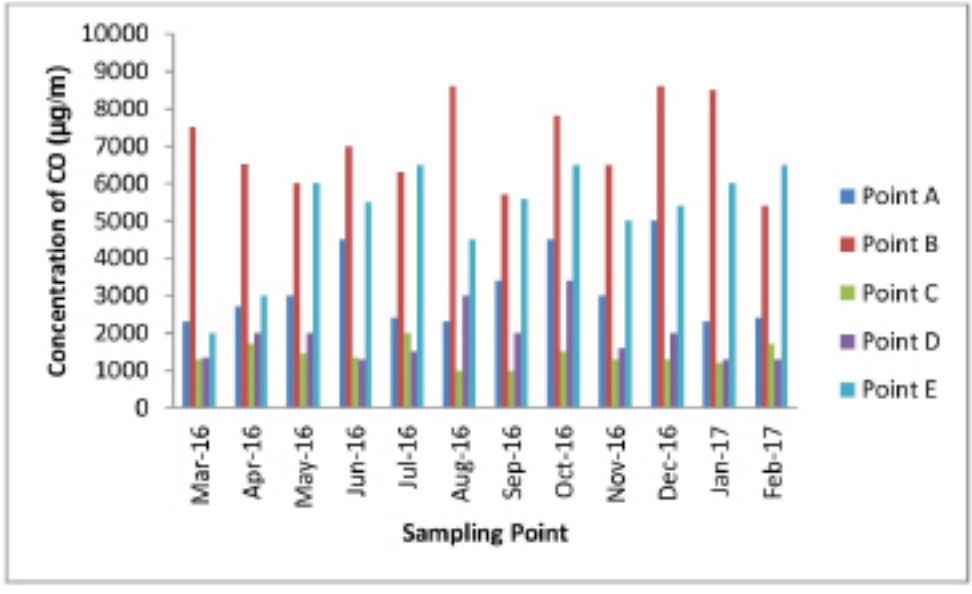

Figure 5. Concentration of CO in the sampling point during 2016/2017.

References

[1] Pandey M, Pandey AK, Mishra A, Tripathi, B.D. Assessment of the bioaccumulation of selected metals in Channa punctatus and Rita rita and exposure evaluation in humans. Regional Studies in Marine Science 11. 2017;1–8.

[2] Vailshery LS, Jaganmohan M, Nagendra H. Effect of street trees onmicroclimate and air pollution in a tropical city. Urban Forestry & Urban Greening, 2013;12:3, 408–415.

[3] Lave LB, Seskin EP. (2013). Air pollution and human health (Vol. 6) Routledge.

[4] Chaudhary S, Kumar N. Qualitative and Quantitative Analysis of Aerosols in Sonepat—A National Capital Region of India. Open Journal of Air Pollution, 2017; 6:65-75.

[5] Cancio JL, Castellano AV, Hernández MC, Bethencourt RG, Ortega EM. Metallic Species in Atmospheric Particulate Matter in Las Palmas de Gran Canaria. Journal of Hazardous Materials, 2008; 160, 521-528.

[6] Srivastava KP, Singh VK. Impact of Air Pollution on pH of Soil of Sa-ran, Bihar, India. Research Journal Recent Science, 2012; 1, 9-13.

[7] McDonald BC, Dallmann TR, Martin EW, Harley RA. Long-termtrends in nitrogen oxide emissions from motor vehicles at national, state, andair basin scales. J Geophys Res 2012; 117: D00V18.

[8] Gharge S, Menon GS. Air pollution tolerance index (APTI) of certainherbs from the site around Ambernath MIDC. Asian Journal of Experimental Biological Sciences, 2012; 3:3, 543–547.

[9] Vaseem H, Banerjee TK. Contamination of metals in different tissues of Rohu (Labeo rohita, Cyprinidae) collected from the Indian River Ganga. Bull. Environ. Contam. Toxicol. 2013; 91, 36–41.

[10] Rai P, Panda LS. Dust capturing potential and air pollution tolerance index (APTI) of some road side tree vegetation in Aizawl, Mizoram, India: an Indo-Burma hotspotregion. Air Qual. Atmos. Health 2014; 7,93–101.

[11] Ugya AY, Imam TS. Efficiency of the Decomposition Process of Agaricus bisporus in the Mycoremediation of Refinery Wastewater : Romi Stream Case Study. World J Pharm Sci 2017; 6: 200-211.

[12] Ugya AY, Agamuthu P. Phytoremediation of Landfill Leachates Using Pistia Stratiotes: A Case Study of Kinkinau U/Ma'azu Kaduna, Nigeria. Journal of Chemical, Environmental and Biological Engineering . 2016; 1:1, 7-10.

[13] Agbaire P. (2009). Air pollution tolerance indices (APTI) of some plants around Erhoike-Kokori oil exploration site of Delta State, Nigeria. International Journal of Physical Sciences, 2009; 4:6, 366–368.

[14] Gu ZL, Zhang YW, Cheng Y, Lee SC. Effect of uneven building layout on air flow and pollutant dispersion in non-uniform street canyons. Building and Environment, 2011; 46:12, 2657–2665.

[15] Shukla UK, Srivastava P, Singh IB. Migration of the Ganga River and development of cliffs in the Varanasi region, India during the late Quaternary: Role of active tectonics. Geomorphology 2012; 171–172, 101–113.

[16] Ran MJ, Sivaraj A. Adverse effects of chromium on amino acid levels in freshwater fish Clarias batrachus (Linn.). Toxicol. Environ. Chem. 2010; 92:10,1879–1888.

[17] Baik JJ, Kwak KH, Park SB, Ryu YH. Effects of building roof greening on air quality in street canyons. Atmospheric Environment, 2012; 61:0,48–55.

[18] Krishnaveni M. Air Pollution Tolerance Index Andantioxidant Activity of Parthenium hysterophorus. J. Pharm. Res. 2013; 7,296–298.

[19] Leghari SK, Zaidi MA, Ahmed M, Nazim K. Air pollution toleranceindex (Apti) of various plant species growing in quetta city, Pakistan. FUUAST Journal of Biology, 2011;81.

[20] Lee A, Maheswaran R.The health benefits of urban green spaces: a review of the evidence. J. Public Health 2011; 33, 212–222.

[21] National Ambient Air Quality Standards (NAAQS), Central Pollution Control Board (CPCB), New Delhi. Notification, 18th Nov, 2009.

[22] Bhaita SC. "Environmental Pollution and Control in Chemical Process Industries". 2nd Edition, Kanna Publishers India 2011; pp. 1273.

[23] Gallardo L, Escribano J, Dawidowski L, Rojas N, de Fátima Andrade M, Osses M. Evaluation of vehicle emission inventories for carbon monoxide andnitrogen oxides for Bogotá, Buenos Aires, Santiago, and São Paulo. Atmospheric Environment, 2012; 47, 12–19.

[24] Asgarzadeh M, Vahdati K, Lotfi M, Arab M, Babaei A, Naderi F, et al. Plant selection method for urban landscapes of semi-arid cities (a case study of-Tehran). Urban Forestry & Urban Greening, 2014; 13:3, 450–458.

[25] Cheung K, Daher N, Kam W, Shafer MM, Ning Z, Schauer JJ, Sioutas C. Spatial and Temporal Variation of Chemical Composition and Mass Closure of Ambient Coarse Particulate Matter (PM 10-2.5) in the Los Angeles Area. Atmospheric Environment, 2011: 45, 2651-2662.

[26] Kim KH, Kabir E, Kabir S. (2015). A Review on the Human Health Impact of Airborne Particulate Matter. Environment International, 2015; 74:0,136–143.

[27] Guttikunda SK, Goel R, Pant P. Nature of air pollution, emissionsources, and management in the Indian cities. Atmospheric Environment, 2014; 95:501–510.

[28] Islam MN, Rahman KS, Bahar MM, Habib MA, Ando K, Hattori N. Pollution attenuation by roadside greenbelt in and around urban areas.Urban Forestry & Urban Greening, 2012; 11:4, 460–464.

[29] Jyothi SJ, Jaya D. Evaluation of Air Pollution Tolerance Index of Selected Plant species Along Road Sides in Thiruvanthapuram, Kerla. J. Environ. Biol. 2010; 31, 379–386.

[30] Choi IH, Jo WK. Application of stack emissions data fromtele-monitoring systems for characterization of industrial emissions of airpollutants. Aerosol and Air Quality Resarch, 2011; 11:4, 412–418.

[31] Xu YH, Wu JH, Feng YC, Dai L, Bi XH, Li X, Zhu T, Tang SB, Chen MF, Source Characterization and Apportionment of PM10 in Panzhi-hua, China. Aerosol and Air Quality Research, 2010; 10:367-377.

[32] WHO. WHO air quality guidelines for particulate matter, ozone, nitrogendioxide and sulfur dioxide: Global update 2005: Summary of risk assessment. 2006.

[33] Kumar M, Mukherjee N, Sharma G, Raghubanshi AS. Land use patterns and ur banization in the holy city of Varanasi, India: A sc enario . Environmental Monitoring and Assessment, 2010, 167(1–4): 417–422.

[34] Reddy MS, Venkataraman C. Inventory of aero- sol and sulphur dioxideemissions from India. I: Fossil fuel combustion. Atmospheric Environment, 2002; 36:4, 677–697.

[35] Yang J, Yu Q, Gong P. Quantifying air pollution removal by green roofsin Chicago. Atmospheric Environment, 2008; 42:31, 7266–7273.