International Journal of Advances in Scientific Research
ISSN: 2395-3616 (Online)
Journal DOI: https://doi.org/10.7439/ijasr **Research Article**

Comparison and evaluation of ambient air quality at different nearby locations of LCL plant, 2014

Shahid Raza*, Jalil Ahmad and Ayesha Ameen

Department of Biological Sciences, University of South Asia, Lahore Pakistan

QR Code

***Correspondence Info:**
Dr. Shahid Raza
Department of Biological sciences,
University of South Asia, Lahore Pakistan

***Article History:**
Received: 16/05/2017
Accepted: 21/05/2017
DOI: https://doi.org/10.7439/ijasr.v3i5.4166

Abstract

The monitoring of ambient air quality is very important to evaluate the effect of running industry on environment. The Lahore compost Pvt. Ltd. has its own composting plant that utilizes tons of municipal solid waste to make organic bio fertilizer. The tons of organic waste are transported to landfill site. This study was designed to check the effect of composting plant on nearby village, nearby roads and LCL site. The evaluated parameters for ambient air quality were PM 10, CO, TSP and VOC. The results were compared and it was concluded from this study that composting plant do not effect nearby locations. The results were according to the WHO standards.

Keywords: VOC, LCL, Organic Waste, Environment.

1. Introduction

The purpose of air monitoring is to identify and quantify airborne contaminants in order to determine the level of worker protection needed [1]. Air monitoring is an important parameter to evaluate the ambient air quality of the area where process of composting takes place. There are many species of bacteria and fungi present in the organic waste windrow which take active part in degradation of waste in to components. This microflora could be pathogenic. Some fungal and bacterial species are highly pathogenic and able to cause different diseases in plants and pollute environment. In order to accelerate and control the aerobic composting a specially formulated biological inoculum is used to treat the organic waste, which is the key element in aerobic composting. The properties of microbes can be used as an indicator for composting process, besides the characteristics of control the composting process through physiochemical activities [2]. Since air can play a central role as a reservoir for microorganisms, in controlled environments such as operating theatres regular microbial monitoring is useful to measure air quality and identify critical situations [3].

The Lahore Compost (LCL) is a part of the Saif Group of Companies. This company is working by utilizing organic waste and produce organic bio fertilizer which can be used as a soil conditioner. They have operational composting plant. The municipal solid waste components are transported and collected to the land fill side near Mahmood Booti, ring road Lahore. The composting facility has been developed under the exclusive concession awarded by the City District Government Lahore. 8,000 tons waste is collected daily and transported in Lahore to landfill side. This company adapted windrow aerobic composting. These windrows are prepared on rectangular platform. Proper mixing is provided to ensure the availability of oxygen. Lahore compost Pvt Ltd is conducting different tests e.g. air monitoring and water quality to ensure any type of damage and harm to the nearby community [4].

2. Methodology

2.1 Study area

Lahore Compost Company (Pvt) at Mehmood Booti dumping site was selected as a study area. The rational for selecting this site was that it is only legal and official dumpsite of Lahore which is owned by CDGL and is operated since 1995. This site, being the oldest and active would be the best representative of the waste disposal site

in Lahore and the area around, whereas other sites are small, private, illegal or any combination of these three.

2.2 Collection of samples

Samples for particulate matter, Carbon monoxide, noise, microbial emissions and VOC were collected:

a) At site where workers do their duty
b) Ring Road
c) Nearby village

2.3 Study period

A risk assessment study was conducted at Lahore Compost near Mahmood Booti solid waste disposal site from September 2015-2016. This period of study has been selected to establish the latest/most current environmental status and condition of the health of workers.

2.4 Description of the compost sites

Lahore has been administratively divided into nine towns, which are further divided into 150 union councils. The nine towns of Lahore, with their population, area and estimated waste generation is per capita range from 0.5–0.65 kg day. Schematic summary of composting process is as follow:

2.4.1 Site A

Site A is a place where the workers are performing main activities of waste management. The site uses an open-air windrow system. On site activities therefore include green waste shredding, compost turning and screening. At the start of the process, shredding of waste is done externally on a concrete pad. Typically, one new windrow per week is created on site, which is then turned on a weekly basis to aerate the compost and maintain optimum composting conditions. Windrows are turned by mechanical tool, this involves lifting the compost to maximum height of the mechanical tool and then dropping it with a shaking motion, to form a new windrow. At the time of sampling, which was typical of site activity, they had 19 windrows ranging in age from 4 days to 19 weeks. As composting progresses, microbiological activity declines as the compost enters a maturation phase leading to the final fully composted product. (Bioerosoles emissions 2010)

2.4.2 Site B

Site B is the residential area near this composting plant. As this site is very near to the composting plant so, the noise of the plant can be heard there. Sampling for bioaerosols was done there.

2.4.3 Site C

The third site chosen was the ring road. This road is passes near by the Lahore compost company.

2.5 Bioaerosol monitoring and analysis

Air samples for bioaerosols were collected during various activities at the compost sites. Air quality was measured for the significant air pollutants which are particulate matter (PM), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), relative humidity, wind speed and heavy metals (Ni, Cu, Pb, Cd, Cr and Mn) present in the atmosphere and level of noise was also measured.

2.6 SIBATA high volume air sampler

For the collection of the particulate matter, High volume air sampler (SIBATA) model HV-1000F was used. On the compost sites, the sampler was positioned as close to the work task as possible without risk of damage to equipment. This limited the distance to the task to between 10 and 50m. The samplers were run simultaneously in the described positions for half an hour dependent on the length of task monitored. The filters were equilibrated for 24 hours before weighing. For the elemental analysis of copper, lead and chromium in particulate matter the filter paper containing Particulate matter was digested in the HNO_3. The filter papers containing particulate matter were digested in 50 ml of 4:1(v/v) HNO_3/ H_2O_2 mixture until the original volume reduced to one-third. After that the digested material was concentrated on a hot plate, filtered and washed with distilled deionized water three times. The blank solutions were also prepared to run in the Atomic absorption spectrophotometer as standard solution. Then the samples were run through the AAS and the readings were recorded. (Horang et al., 2006)

2.7 Analysis of samples

Samples of particulate matter will be analyzed by using Ambient Air Quality sampler and Samples of CO by Lamotte AM-62, VOC with VOC Meter TOXI Pro-PID, and noise with Noise Level Meter AR4. Sampling of air for microbial emissions will be conducted with the help of Petri Plate Method.

2.7.1 VOC meter: Volatile Organic Compounds (VOCs) were detected with the help of VOC meter TOXI Pro-PID.

2.7.2 Noise meter: Noise level was detected with the help of noise level meter AR4.

2.7.3 SO_x meter: SOX_x like SO, SO_2 were detected with the help of SO, SO_2meter.

2.7.4 NO_x meter: NOX_x like NO, NO_2 were detected with the help of NO, NO_2 meter

2.7.5 CO meter: Carbon monoxide was detected with the help of CO meter

2.7.6 Hygrometer TH02: Hygrometer was used to detect the relative humidity.

2.8 Air sampling

Air samples were collected at three sites at Lahore Compost**.** Temperature ranged between 28.4^{o}C-31.1^{o}C with mean value 29.7^{o}C. A total of 9 samples were collected in sterilized petri dishes, containing sterilized potato dextrose agar (PDA) media for fungi and LB agar for bacteria

(reference-PDA) (references petri)These samples were collected at the height of 1 meter.

Those petri dishes were immediately sent to GCU laboratory for incubation. Fungal plates were incubated at 37°C for 7 days and bacterial plates were incubated at 37°C for 48 hours. After incubation colonies of both samples were detected on media. The resultant colonies were counted and studied using macroscopic and microscopic features indicated in the literature to identify their species. (Fungi and some mycotoxins)

2.9 Health Assessment on the basis of questionnaire

A questionnaire was conducted in Lahore Compost Site to assess the impact of activities of waste handling on potential targets/receptors i.e. workers. The source populations for this study were workers in Lahore Compost. Various workers were reluctant to give interviews due to illiteracy. The used method was qualitative and for data collection in-depth interviews were conducted. Questionnaire consisted of the perception about solid waste, drinking water quality, and health problems facing from dumpsite to gather relevant information. Health parameters such as respiratory problems, skin problems, nausea, vomiting, physical injuries like strain, back pain, cuts on hands due moving conveyer belt and some accidental deaths of the workers etc were considered in the study as shown in figure.

3. Results and Discussion

The results were taken for air quality (PM 10, TSP, CO, VOC). These results were satisfactory and according to the standards of WHO. The Reading for PM 10 was recorded 86.6 in LCL site and the baseline of WHO standard is 632. The reading for TSP was recorded 161.8 and the standard value for it by WHO is 679. The reading for CO was recorded 0.81 and the baseline for it is 0.

3.1 Ambient Air quality

Table 1: LCL Site/ Near Sieving Machine

Sr. #	Parameter	Baseline	Result
1	PM 10	632	86.6
2	TSP	679	161.8
3	CO	1.7	1.6
4	VOC	0	0.81
5	Noise	66	73.06, 71.65, 74.52,70.65

The Reading for PM 10 was recorded 72.9 near ring road area and the baseline of WHO standard is 735. The reading for TSP was recorded 189.8 and the standard value for it by WHO is 781. The reading for CO was recorded 1.7 and the baseline for it is 0.0.

Table 2: Near Village

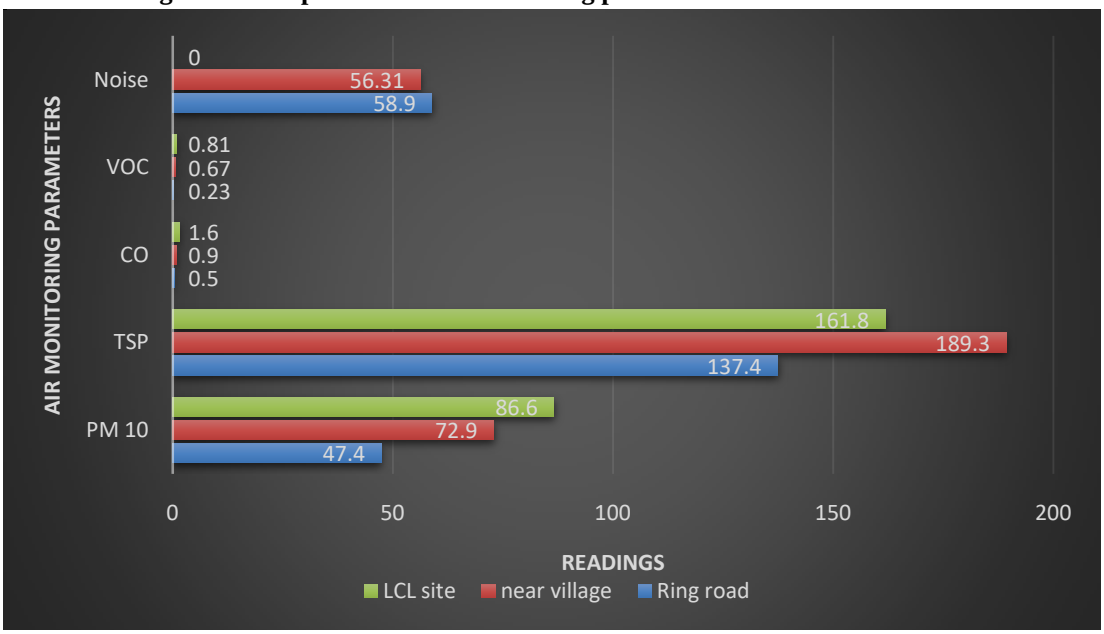
Sr. #	Parameter	Baseline	Result
1	PM 10	735	72.9
2	TSP	781	189.3
3	CO	1.7	0.9
4	VOC	0	0.67
5	Noise	63	56.31, 58.54, 59.98, 61.98

The Reading for PM 10 was recorded 47.4near ring road area and the baseline of WHO standard is 1381. The reading for TSP was recorded 1492 and the standard value for it by WHO is 137.4. The reading for CO was recorded 1.0 and the baseline for it is 0.5.

Table 3: Ring Road

Sr. #	Parameter	Baseline	Result
1	PM 10	1381	47.4
2	TSP	1492	137.4
3	CO	1.0	0.5
4	VOC	0	0.23
5	Noise	75	58.98, 64.31, 62.17, 65.48

Figure 1: Comparison of Air monitoring parameters at different location



The composition of PM 10 is a combination of primary and secondary particles. These particles have long lifetime in the atmosphere and it can travel to long distances. Nitrate, sulphate, trace elements, ammonium and organic carbon and water are the main constituents of PM 10. Primary particles are emitted directly in to the atmosphere. The main constituents of these primary particles are soil related carbon from combustion of fossil fuel [5]. The combustion also release many trace metals. The main type of secondary particles or aerosols are nitrate and ammonium sulphate. These aerosols are formed from emission of NOX and SO2 when they react with ammonia. While the inorganic precursor gas relationships are more predictable, the extent to which VOCs contribute to PM2.5 formation is not well understood and additional measurement data are needed to quantitatively link specific source types to ambient PM2.5 concentrations. The coarse inhalable particle size fraction, PM10-2.5, consists of more localized fugitive dust which usually travels lesser distances than finer particle sizes and represents an important urban air quality parameter. Periodic natural events (e.g., dust storms, forest fires) can also contribute to elevated background levels [6]. The municipal solid waste also contains components of primary particles from soil and these particles can be incorporated in to PM 10. The composting plant could have effect on the PM 10 [7]. The results are below baseline set by the WHO, and shows that the composting plant do not effect much on the PM 10 quality [8].

Carbon monoxide is an important component in oxidant photochemistry and ground-level ozone formation. In urban areas, CO measurements provide an index of anthropogenic emissions and, when linked with NOX and VOC measurements, can provide important information related to emissions verification and the efficiency of emissions controls, especially as they relate to the transportation sector [9]. In rural settings, CO provides an index of the level of anthropogenic influence on air mass chemistry and, to some degree, the age of the air mass [10].

References

[1]. NIOSH. 1985. Certified Equipment List as of October 1, 1984. DHHS (NIOSH) No. 85- 101. National Institute for Occupational Safety and Health, Cincinnati, OH. Updated annually

[2]. Cadena, E., Colón, J., Artola, A., Sánchez, A., & Font, X. Environmental impact of two aerobic composting technologies using life cycle assessment. *The International Journal of Life Cycle Assessment*, 2009; 14(5): 401-410.

[3]. Napoli, C., Marcotrigiano, V., & Montagna, M. T. Air sampling procedures to evaluate microbial contamination: a comparison between active and passive methods in operating theatres. *BMC Public Health*, 2012; 12(1): 1.

[4]. Environmental impact assessment (2011), Lahore compost Pvt.Ltd

[5]. Morgan, G. B. (1977). Ambient air quality monitoring. In Methods and Standards for Environmental Measurement: Proceedings of the 8th Materials Research Symposium Held at the National Bureau of Standards, Gaithersburg, Maryland, September 20-24, 1976 (Vol. 464, p. 381). US Department of Commerce, National Bureau of Standards.

[6]. Environment Canada (EC) 2009b. Method for the Operation of TEOM Samplers for PM2.5 Monitoring in the NAPS Network. Environment Canada, Ambient Air Quality Section. No. 8.05/1.3/M. December 29, 2009. December 29, 2009. Environment Canada (EC) 2009c.

[7]. Modak, P. M., & Lohani, B. N. Optimization of ambient air quality monitoring networks. *Environmental monitoring and assessment*, 1985; 5(1): 1-19.

[8]. Chow, J. C., Watson, J. G., Lu, Z., Lowenthal, D. H., Frazier, C. A., Solomon, P. A. & Magliano, K. Descriptive analysis of PM 2.5 and PM 10 at regionally representative locations during SJVAQS/AUSPEX. *Atmospheric Environment*, 1996; 30(12): 2079-2112.

[9]. Kao, J. J., & Huang, S. S. Forecasts using neural network versus Box-Jenkins methodology for ambient air quality monitoring data. *Journal of the Air & Waste Management Association*, 2000; 50(2): 219-226.

[10]. Operating Procedures for BAM-1020 PM2.5 Monitors in the NAPS Network. Environment Canada, Ambient Air Quality Section. No. 8.04/1.3/M. December 29, 2009. December 29, 2009.