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Spatial and seasonal assessment of bioaerosols associated with municipal solid wastes in yenagoa metropolis

Abstract

The proliferation of microbes in dumpsites includes putrefying bioaerosols fouling the air quality. This study assessed the bioaerosols of 6 Municipal solid wastes dumpsites, with regard to microbes suspended in the air using the sedimentation or settle plate method. Aseptically prepared Nutrient agar, Sabouraud Dextrose agar and MacConkey agar were partially opened and suspended in platforms of the dumpsite for 30 minutes. Afterward the samples were incubated in-situ. Results for total heterotrophic bacteria ranged from 49-73cfu/30 minutes for dry season, and 44-51cfu/30 minute for wet season. Total fungi ranged from 24-37 and 17-37cfu/30 minutes for dry and wet seasons respectively. Meanwhile the levels of enterobacteriaceae ranged from 22-43 and 20-31 cfu/30 minutes in dry and wet seasons respectively. The control station indicated the lowest level of microbes compared to all assessed stations. The two stations in the central dumpsite indicated the highest levels of microbial densities. Notwithstanding, bacteria densities were relatively higher in dry season was compared to wet season, but the reversed was the case for fungal densities. Result confirmed that the proliferation of bioaerosol due to anthropogenic activities associated to putrifying bacteria from unsanitary disposal of waste streams.

Keywords: bioaerosols, microbes, waste stream, anthropogenic activities

Volume 4 Issue 5 - 2018

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Received: October 16, 2018 | **Published:** October 31, 2018

Introduction

The problems posed by poor handling of municipal solid waste have become a global threat to biodiversity and key resources of the ecosystem. In most developing nations, policies put in place to regulate the reduction, reuse and recycling waste streams are ineffective.[1] Due to urbanization and industrialization the magnitude of waste stream in most metropolis have become worrisome.[2,3] For instance, in Nigeria, the daily magnitude of waste stream is estimated to be in the range of 0.44-0.66 kg/capital/day, culminating to of 25 million tons per anum.[4] In addition, the desire for contemporary technologies may have incurred some toxic waste that find their way to the ecosystem.[5]

Piles of unattended waste stream undergo physical, chemical and biological transformation that emits toxic aerosol that infringes on ambient air quality. For instance, foul odour is produce when biomass are acted upon by putre-fying bacteria.[6] As documented in literature, due to atmospheric mobility the dispersal and the transmission of pathogenic bioaerosols to the ecosystem have become inevitable.[7] Dumpsite bioaerosol of microbial origin have been reported as a major source of air pollution.[8] This research therefore seeks to assess the spatial and seasonal level of bioaerosol associated with municipal solid waste dumpsites in Yenagoa metropolis.

Materials and method

Media preparation technique

The microbial enumeration of the dumpsite aerosol was carried out based on standard protocol,[9,10] using the settle plate culture or sedimentation technique as describe by Ambrose et al.[8] The total of aerobic microbial count was determined using Nutrient Agar for bacterial, Saboraud dextrose agar for fungi and Mc Conkey agar for enterobacteriaceae. The nutrient agar was fortified with 50µg/ml of Ketoconazole, while the Saboraud dextrose agar was fortified with 100µg/ml tetracycline.

Sampling technique and laboratory analysis

Aseptically prepared media in Petri dishes containing 20ml of the aforementioned culture media (in triplicates), were suspended on a pegged makeshift 4ft wooden platforms and exposed for 30 minutes. The sampling was carried out in 7 sampling stations (LA-LF), and a control station (LX). The petri dishes were closed after duration of exposure, and transported to the laboratory for incubation. The bacteria and coliforms were incubated at 37ºC for 24hours, while fungi were incubated at 28±2ºC for 72 hours. The enumeration of the microbial species were carried out with the aid of a Quebec colony counter, and expressed as cfu/30 minutes.

Result and discussion

Figure 1 presents results of the spatial and seasonal distribution of bacterial aerosols. Results showed that bacterial bioaerosols ranged from 40–73cfu/30 minutes, with lowest values in the control station (LX). Based on seasonal variation, higher bacterial counts were reported in dry season compared to wet season. Furthermore, lowest bacterial count was reported in the month of May at station LD, highest bacterial count was reported in the month of November at station LF (Figure 1).

Figure 2 presents the spatial and seasonal variation of fungal count. Results showed that the spatial variation of fungal count which ranged from 23–47cfu/30 minutes, with the control station having the lowest value. Based on seasonal variation, higher fungi count was reported in wet season compared to dry season. This was in contrast compared the trend of bacterial count (Figure 1). Notwithstanding, highest and lowest fungi count was reported in the months of July and January respectively. Results of the seasonal and spatial variation of enteriobacteriaceae associated with the dumpsite is presented in Figure 3. Result showed that the spatial distribution of enteriobacteria count ranged from 20–43cfu/30 minutes, with lowest count in the control station. In addition, higher enteric bacteria count were reported in dry season compared to wet season. Highest and lowest enteric bacteria count was reported in the months of March and July respectively (Figure 3).

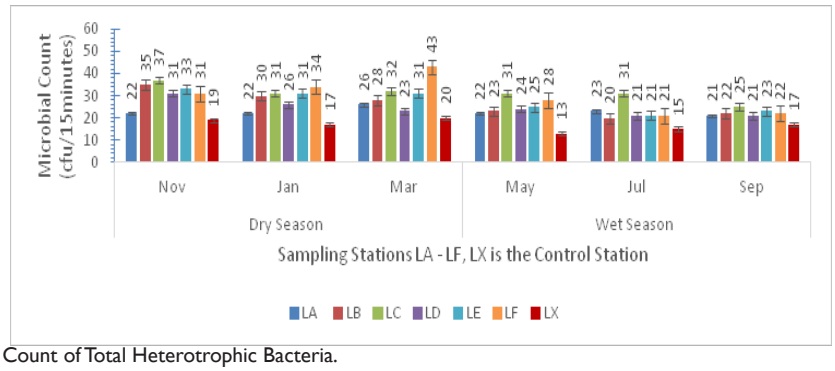

Figure 1 Spatial and Seasonal Count of Total Heterotrophic Bacteria.

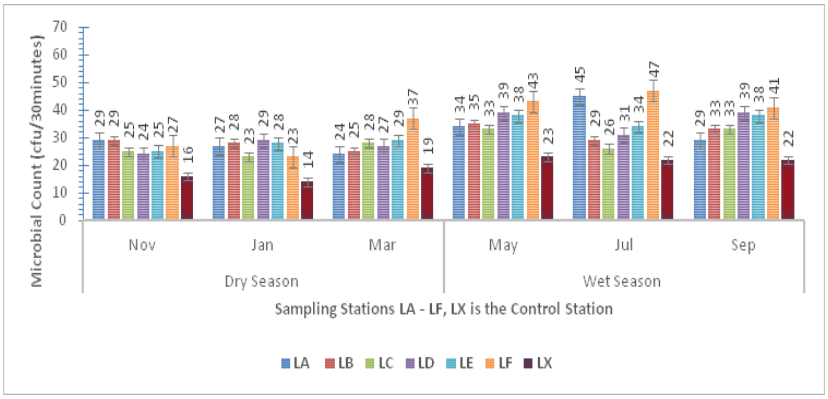

Figure 2 Spatial and Seasonal Count of Total Fungi.

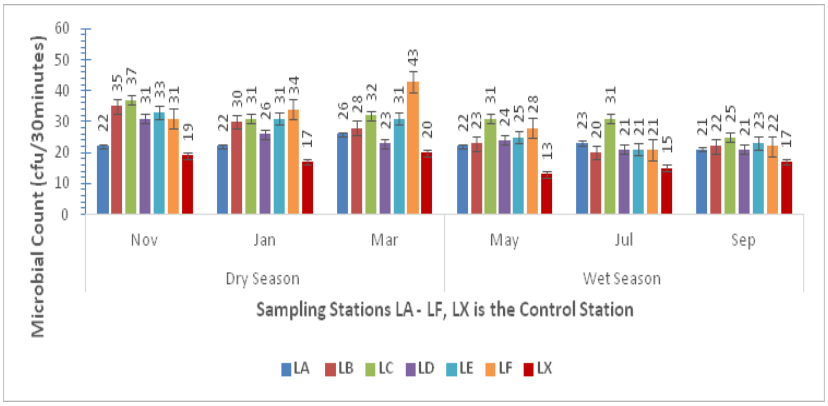

Figure 3 Spatial and Seasonal Count of Enteriobacteriaceae.

Comparatively, the studies of Ambrose et al.[8] in Uyo Metropolis, reported bacterial count ranging from 16 - 64cfu/15minutes, 1 - 39cfu/15minutes for coliforms and; 13-77cfu/15minutes fungi. A recent study on microbial assessment of soil isolated from dumpsite in Yenagoa Metropolis by Angaye et al. (2018), showed the following microbial ranges; for bacteria (9.30-20.5 X10^{6}cfu/g in dry season, and 5.43-13.41 X 10^{6}cfu/g in wet season), fungi (16.63 - 28.56 and 10.51-20.70 X10^{4}cfu/g), and enterobacteriaceae (14.27- 27.90 dry season and 10.30 – 21.40 X 10^{4}cfu/g in wet season). They reported higher bacterial count in dry season, which was in contrast to higher fungal in wet season. Furthermore, predominant bacterial species were; *Bacillus spp. E. coli Pseudomonas spp* and *Staphylococcus spp*; while fungal isolates includes *Aspergillus spp*., *Penicillium spp*., *Rhizopus spp.*, and *Saccharomyces spp*.

Conclusion

This research investigated the spatial and seasonal diversities bioaerosols associated with MSWs dumpsites in Yenagoa metropolis. Results showed that there are pathogenic microbes fouling air quality and public health. Consequently, aseptic disposal and containment of waste stream have become necessary, in order to mitigate adverse health effects that may arise from poor handling of waste. In addition, dumping or sighting of waste dumpsite close to public places, and effective legislations and polices should be enacted to reduce, reuse and recycle waste stream.

Acknowledgements

None.

Conflict of interest

The authors declare that there is no conflict of interest.

References

1. Angaye TCN, Abowei JFN. Review on the Environmental Impacts of

Municipal Solid Waste in Nigeria: Challenges and Prospects. *Greener Journal of Environmental Management and Public Safety*. 2017;6(2):18–33.

2. Schwarz Herion O, Omran A, Rapp HP. A Case Study on Successful Municipal Solid Waste Management in Industrialized Countries by the example of Karlsruhe City, Germany. *Journal of Eng Annals*. 2008;6(3):266–273.
3. Amuda OS, Adebisi SA, Jimoda LA, et al. Challenges and Possible Panacea to the Municipal Solid Wastes Management in Nigeria. *Journal of Sustainable Development Studies*. 2014;6(1):64–70.
4. Ogwueleka TC. Municipal solid waste characteristics and management in Nigeria. *Iranian Journal of Environmental Health Science and Engneering*. 2009;6(3):173–180.
5. Adejobi OS, Olorunnimbe RO. Challenges of Waste Management and Climate Change in Nigeria: Lagos State Metropolis Experience. *African J Sci Res*. 2012;7(1):346–362.
6. Odeyemi AT. Antibiogram Status of Bacterial Isolates from Air around Dumpsite of Ekiti State Destitute Centre at Ilokun, Ado-Ekiti, Nigeria. *Journal of Microbiology Research*. 2012;2(2):12–18.
7. Stetzenbach LD, Buttner MP, Cruz P. Detection and Enemeration of Airborne Biocontaminants. *Curr Opin Biotechnol*. 2004;15:170–174.
8. Ambrose I, Braid W, Essien JP. Assessment of Air Quality (Bioaerosols) of the Municipal Waste Dumpsite in Uyo Urban, Akwa Ibom State, Nigeria. *International Journal of Scientific and Research Publications*. 2015;5(9):1–6.
9. APHA. Standard Methods for the Examination of water and waste water. 20th ed. Washington: American Public Health Association (APHA); 1998.
10. Benson HJ. Microbiological Applications: Laboratory Manual in General Microbiology/complete version, 5th ed. New York: McGaraw-Hill; 2002.

Citation: Angaye TCN, Zige DV, Mieseigha TA. Spatial and seasonal assessment of bioaerosols associated with municipal solid wastes in yenagoa metropolis. *MOJ Toxicol.* 2018;4(5):361–363. DOI: 10.15406/mojt.2018.04.00128