

Fluorescence based detection of bioaerosols to improve emissions characterization from environmental sources

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Introduction

Bioaerosols are ubiquitous in ambient air but there have been increasing concerns about their human exposure and to health impact due to ever increasing environmental emissions from sources such as biowaste and intensive agriculture facilities (Borlée et al. 2015). However, the knowledge on their risk of exposure to the public is limited mainly due to a lack of emission characterisation, in part due to the limitation of conventional methods for the detection and characterisation of ambient bioaerosols. Among emerging techniques, fluorescence spectroscopy has shown promise in detecting and broadly classifying bioaerosols (Pan et al. 2015). This paper provides the preliminary results of a study that aims to demonstrate the potential of a fluorescence based bioaerosol sensor unit to detect and quantify these in real time with a view to developing and advancing bioaerosol exposure assessment methodologies to various environmental sources.

Methods

Continuous real time measurements were carried out to monitor the number size distribution of bioaerosols by using Spectral Intensity Bioaerosol Sensor (Droplet Measurement Technologies, USA) under five different environmental scenarios: Urban background I (Low combustion sources), Urban background II (Moderate combustion sources), Urban background III (Agricultural), Environmental Source I (Waste water treat plat) and Environmental source II (Composting). Measurements were made over a period of 7 hours (different days) under each scenario.

Results

The results presented in Figure 1 show that concentration of bioaerosols under different scenarios can vary greatly.)

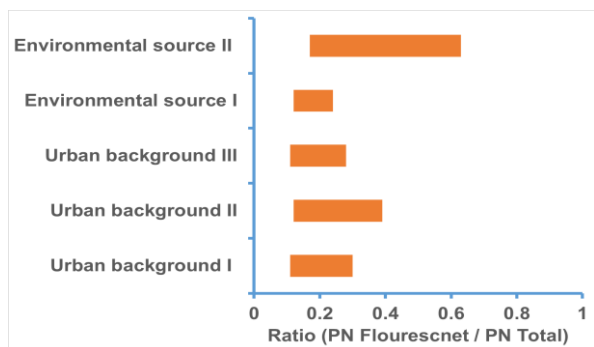


Figure 1. Ratio of Particle Number Fluorescent / Particle Number Total under different environmental scenarios.

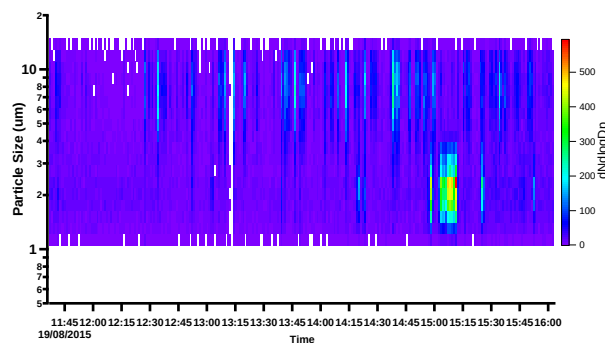


Figure 2. Representative number size distribution of fluorescent particles at a composting site

Higher concentrations of bioaerosols were found at composting site in comparison to other sites. However, a significant proportion of these at composting site was in coarse size fraction (Figure 2). This trend offers evidence to the notion that majority of bioaerosols at composting site disperse as agglomerates or attached to other non-biological matrixes rather than single cells.

Conclusions

The study suggest that fluorescence based real time measurement of bioaerosols can inform emission characteristics from different environmental sources. There is a potential to use these not only as detect to alarm tools and to develop methodologies to estimate risk of community exposure to bioaerosols from different environmental sources but also to reduce human vulnerability to growing bio threat from range of sources beyond that of biowaste and intensive agriculture facilities

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References

Borlée, F., Yzermans, C. J., van Dijk, C. E., Heederik, D., & Smit, L. A. (2015). Increased respiratory symptoms in COPD patients living in the vicinity of livestock farms. *European Respiratory Journal*, DOI: 10.1183/13993003.00265-2015.

Pan, Y. L. (2015). Detection and characterization of biological and other organic-carbon aerosol particles in atmosphere using fluorescence. *Journal of Quantitative Spectroscopy and Radiative Transfer*, 150, 12-35.



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