The Secret Lives of Airborne Microbes

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INTRODUCTION

The atmosphere has been described as one of the last frontiers of biological exploration on Earth. Despite our intimate relationship with the air around us, the composition of microbial communities in the atmosphere is still poorly defined, and our knowledge about the functional potential of airborne microbes (both beneficial and pathogenic) is scant. Only recently, it has been discovered that airborne microbes are more than just passive inhabitants of the atmosphere: they are metabolically active and well adapted to the harsh atmospheric conditions. In this project, airborne microbes are studied in relation to particulate matter (PM) of polluted air in the region of Antwerp (Belgium) and surroundings. PM is thought to act as a vector for bacteria and their endotoxins, subsequently resulting in inflammation.

IMPLICATIONS OF AIRBORNE MICROBES

- General Health
- Climate Research
- Agriculture
- National Security
- Biotechnological Applications

SAMPLES

- 16S rDNA pyrosequencing
- Concentration endotoxins
- Concentration transition metals & reactive gases
- Pro-inflammatory capacity

AIM

- What bacterial communities are present in the polluted air of Belgium?
- Can we monitor spatiotemporal concentrations of microbial endotoxins in relation to other PM pollutants such as transition metals and organic pollutants?
- What is the relative pro-inflammatory capacity of microbial endotoxins in relation to other pollutants?
- Can airborne microbes be used for biomonitoring and bioremediation purposes?

MATERIALS AND METHODS

Endotoxin concentrations

- Coriolis®µ sampler
- Limulus Amoebocyte Lysate (LAL) bioassay for LPS

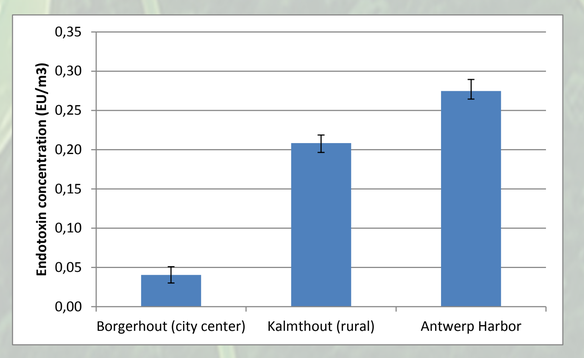

Figure 2 : Results of the LAL test, which was used to determine the concentration of LPS. Samples were taken in Antwerp and surroundings at sites where the VMM monitors PM10 (and PM2.5) concentrations.

Part I: Spatiotemporal monitoring of microbial endotoxins in relation to other PM pollutants

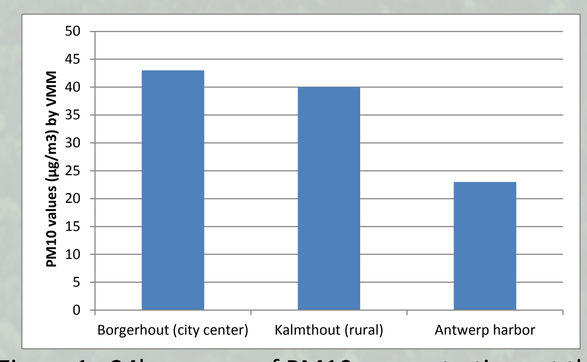

Figure 1 : 24h average of PM10 concentrations at the studied locations (Source: VMM).

Part II: Relative pro-inflammatory capacity of microbial endotoxins in cell lines

THP-1 Cell line

- Macrophage cell line
- Relative expression of TNF-α and IL-8 used as inflammation markers
- Determined by qPCR

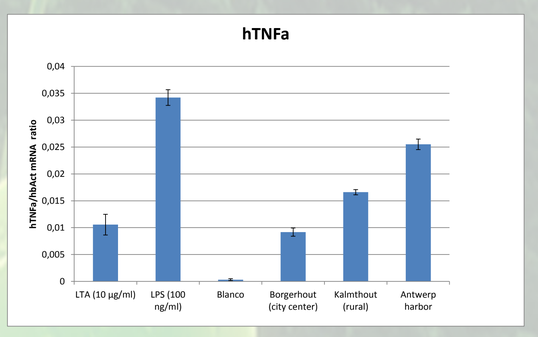

Figure 3: Expression of TNF-α by the positive and negative controls, and the different samples. The same samples as discussed in Figure 1 from Antwerp and surroundings were monitored. Similar results were obtained for IL-8 (data not shown).

RESULTS & DISCUSSION

Preliminary results indicate that the presence of endotoxins and the pro-inflammatory capacity of the airborne samples do not necessarily correlate with the measured PM10 concentrations at these sites (VMM). This highlights that it is important to monitor not only the PM concentrations and size, but also the pro-inflammatory capacity of the components

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References on request