

Rapid Monitoring of Bioaerosols from Industrial, Rural and Urban environments

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Introduction

Exposure to bioaerosols is linked to infectious bacteria and viruses and can cause deleterious health effects.

Bioaerosol components are difficult to quantify in real time and results between different researchers are not comparable due to the lack of a standardised sampling methodology. A robust quantification of bioaerosols is important in order to evaluate risk exposure.

As an alternative to cell culturing, chemical fingerprint analysis of microbial biomarkers such as microbial volatile organic compounds (MVOCs) can be done in order to quantify bioaerosols.

Material and methods

Air has been collected from urban, rural and industrial areas with TD-tubes at different flow rates and sampling times. Schematic working procedure is shown in Figure 1.

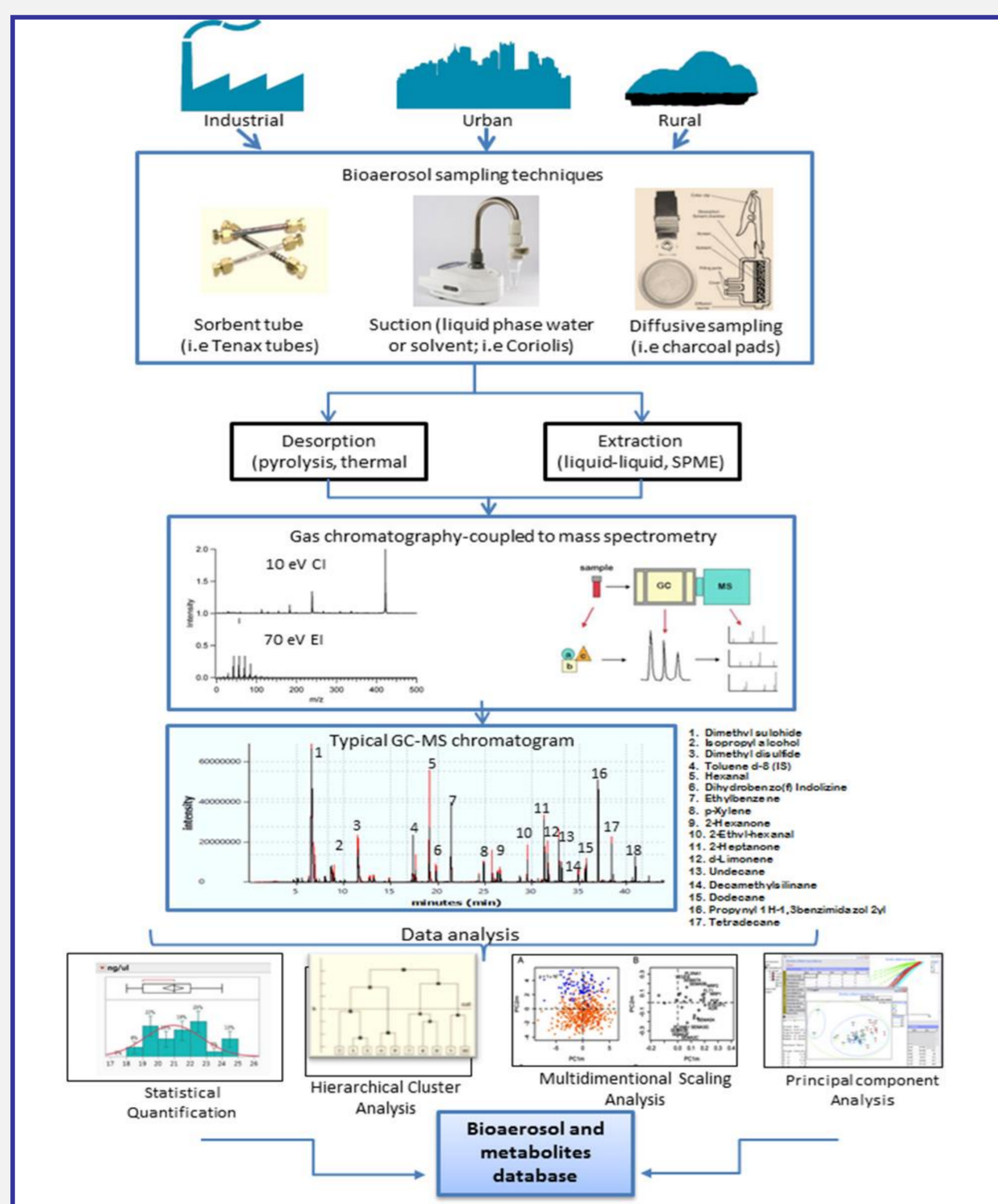


Figure 1. Schematic representation of different sampling techniques depending on the downstream analysis required.

Results

Total VOCs, MVOCs and concentration of MVOCs (ng m^{-3}) detected and quantified in a wastewater treatment plant and a farm at different flow rate and sampling time regimes are shown in Table 1 and Figure 2.

Table 1. Sampling conditions and number of VOCs, MVOCs and concentration of MVOCs (ng m^{-3}) at a waste water treatment plant and farm.

Sampling location	Waste Water Treatment Plant									Farm		
	Site	Site	Site	Upwind	Upwind	Upwind	Downwind	Downwind	Downwind	Site	Site	Site
Flow rate (ml min^{-1})	100	100	100	100	100	100	100	100	100	100	500	1000
Sampling time (min)	30	20	10	30	20	10	30	20	10	30	10	10
Sample volume (L)	3	2	1	3	2	1	3	2	1	3	5	10
Total VOCs	43	69	75	60	50	71	69	61	62	39	62	60
MVOCs	23	36	41	35	25	35	38	34	34	18	26	27
Σ MVOCs (ng m^{-3})	88787	67646	183916	79723	20875	270614	72745	43356	47275	14783	18432	10748

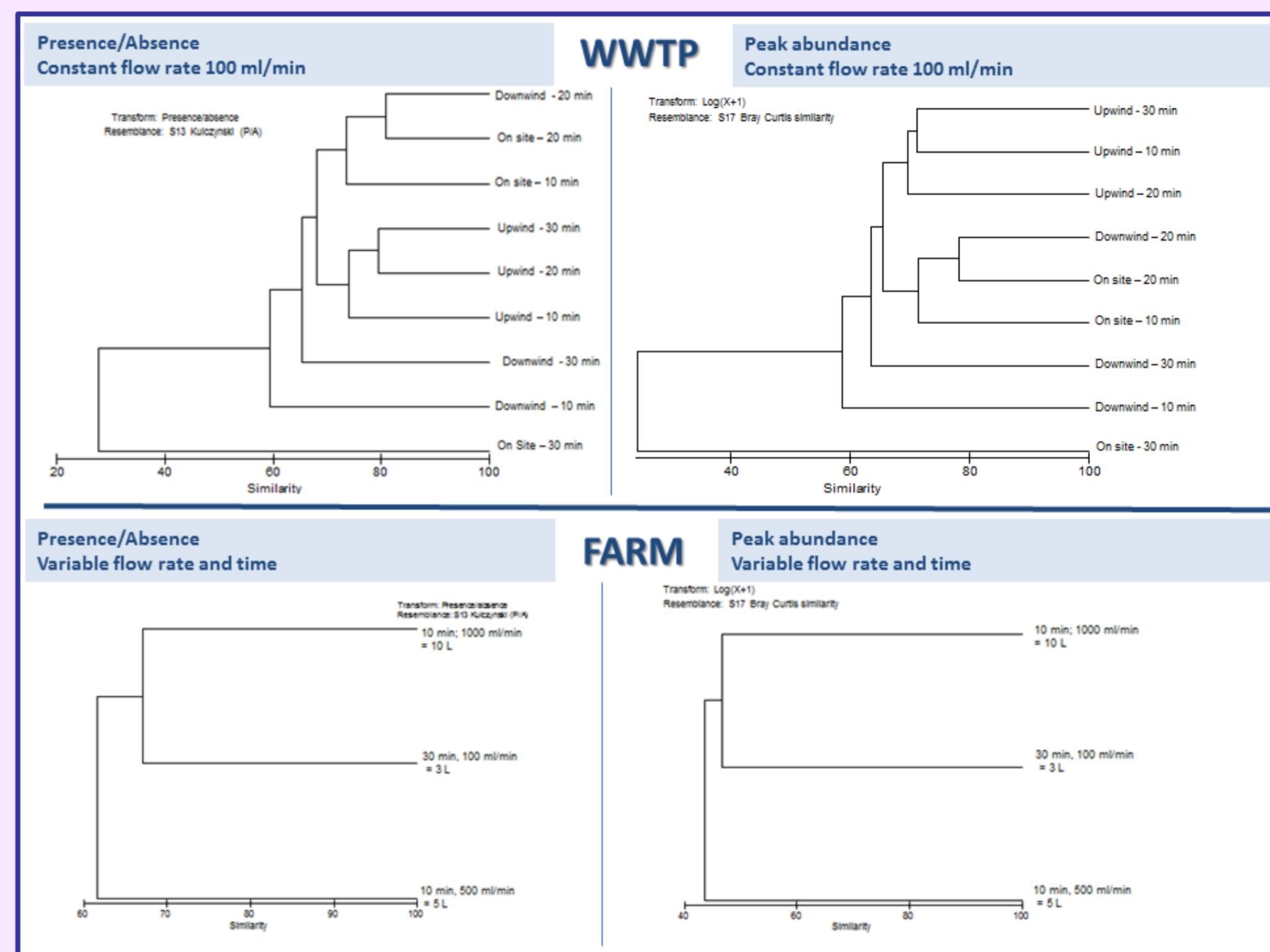


Figure 2. Comparison of MVOC profile at a waste water treatment plant and a farm based on presence/absence and peak abundance at different sampling flow rate and time.

Conclusions

- Sampling at constant flow rate and varying sampling time:
 - Does not affect in presence/absence of MVOCs (70% similarity)
 - There is large difference in abundance (ng.m^{-3}), (20% similarity).
- Sampling at different flow rates and varying sampling time affects both peak detection and concentration.

Future Work

Air samples from industrial, rural and urban environments will be collected with TD-tubes. VOCs and MVOCs will be identified by GC-MS. Chemometric analysis will be performed and specific MVOCs from each site will be identified. Data will be correlated with MVOCs database to determine the microbial species.

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