

SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

Action number: ECOST-STSM-Request-CA17136-44187

STSM title: Pilot study on human sources and sinks of volatile organic compounds

STSM start and end date: 26/04/2019 to 30/04/2019

Grantee name: Dr Pawel K Misztal

PURPOSE OF THE STSM:

(max.200 words)

The purpose of this short-term scientific mission was to:

- 1) Enhance the synergy between the ongoing SLOAN-funded measurements campaign on human volatile organic compound (VOC) emission and the COST Action's WP1 research questions.
- 2) Brainstorm the ideas for the future collaborations at the DTU environmental chamber
- 3) Inspire and perform a pilot study to enhance further understanding of human breath and dermal VOC fluxes.
- 4) Explore the DTU dataset collaboratively to look for human microbial VOC (mVOC) signatures.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

(max.500 words)

Dr Pawel Misztal spent 5 days in Denmark working with the host, Dr Gabriel Beko (WP1 leader), DTU staff, and international community taking part in the ongoing measurement campaign. This was an excellent opportunity to discuss the important research questions relevant for the COST Action. In the first step we performed brainstorming of experiments to understand human VOC fluxes, their sources and sinks, their reactivities and microbial aspect of VOC emission. These ideas have been noted down for inclusion to the long list of experiments at DTU. The main ideas interrogated the variability of human body VOC emission spatially (VOC body map). Another idea contributed was the question of human microbiome and its VOC activity. We also discussed how human VOC might change during sleep and how to properly test it. Finally, the novel hypothesis was the humans not only emit but also take up pollutant through the lungs and skin. Due to a relatively short period of the visit we decided to focus on the last question and performed the dedicated experiment to test this hypothesis. The chamber was cleaned according to the protocol and the stable ozone concentration representative of a polluted environment was obtained. Two subjects (Dr Misztal and Dr Beko) sat in chamber 1 exhaling breath through the special masks to the chamber 2 so that to separate breath and dermal VOCs. After about an hour, 3 other subjects went to chamber 2, and started breathing in and out the air from chamber 1 via tubes. When the experiment ended the data of VOCs from PTRTOFMS have been saved and Dr. Misztal and Ms Nijing Wang started analyzing the complex data. Further analysis was agreed to be contributed by Dr Misztal using a complementary data processing approach which looks at hundreds of VOCs at the same time.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

Despite the short visit, the results obtained from the pilot experiment were impressively thorough. The data are currently being further analysed but the initial preliminary exploration indicated that indeed there are VOCs which are selectively taken up by the lungs. It appears that this phenomenon is related to the gradients of VOCs. For those compounds which humans are a strong source (e.g. acetone) the uptake was not observed but some of the taken up compounds possibly point to 4-OPA and non-human associated benzenoid pollutants. This needs to be further confirmed in the full analysis but the study already inspired to treat humans not just as the emitters of volatile organics to the indoor environment but also as the sink for ozone and specifically of certain but not all pollutants. The ozone sink to skin and clothing was uncomparably larger than to lungs. This is likely because skin and clothing surfaces are covered with highly reactive squalenoids and microbes emitting reactive mVOCs.

FUTURE COLLABORATIONS (if applicable)

Future collaborations will continue with Dr Beko, Dr Wargocki, Prof Glenn Morrison, and other collaborators who were met at DTU. Additional networking has been made with the PTRTOF team at Max Planck Institute. The remaining ideas are expected to be tested at DTU and we are thinking about the story for a collaborative high-impact paper.