PRÉLÈVEMENT DE L'AIR PAR TECHNOLOGIE CYCLONIQUE : OUTIL EXISTANT ET ÉTUDE DE CAS

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BERTIN TECHNOLOGIES IN LIFE SCIENCES

▷ Precellys® Homogenizers for biological sample preparation

- A full range of systems and consumables to prepare any type of sample in less than 1 min with high reproducibility

▷ Coriolis® bio air samplers for indoor and outdoor controls

- Bio air samplers based on airborne particles transfer into a liquid to go beyond traditional methods

▷ Sterilwave® medical waste management solution

- Based on microwave validated technology, on-site solution for bio-hazardous waste sterilization without effluent

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10 YEARS OF WET CYCLONE TECHNOLOGY IMPLEMENTATION

▷ MonaLisa project – 2006-2009

- Validation of a new method for pollen and allergen detection

monalisa

▷ French army project – since 2006

- Portable air sampler for airborne pathogens detection.

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

▷ Lab equipment – since 2009

- Microbial air sampler for indoor and outdoor air bio-contamination.

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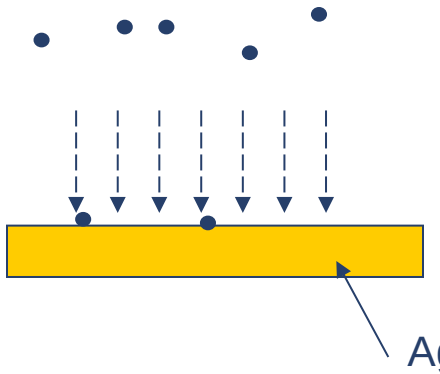
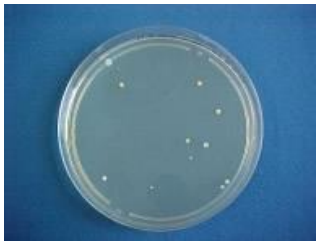
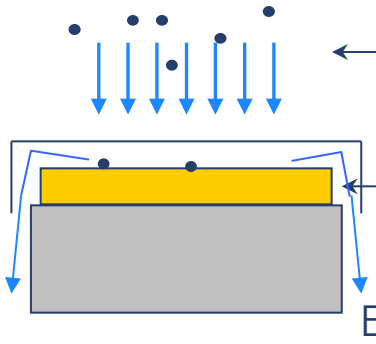
CURRENT AIRBORNE CONTAMINATION CONTROL

▷ Passive: Settle plate exposed max 4h





▷ Active: Impaction is the reference



▷ Limitation of traditional technologies

- Information only on cultivable flora (what can grow on the nutritive agar)
- Long time to results (incubation step for growth) = several days (2 to 14)
- Limited volume of air collected (1m^3)
- Short collection time (10 min)
- Air flow rate limited (to avoid the stress of the microorganisms) (~100 L/min)
- Saturation of the collection media in case of charged environments

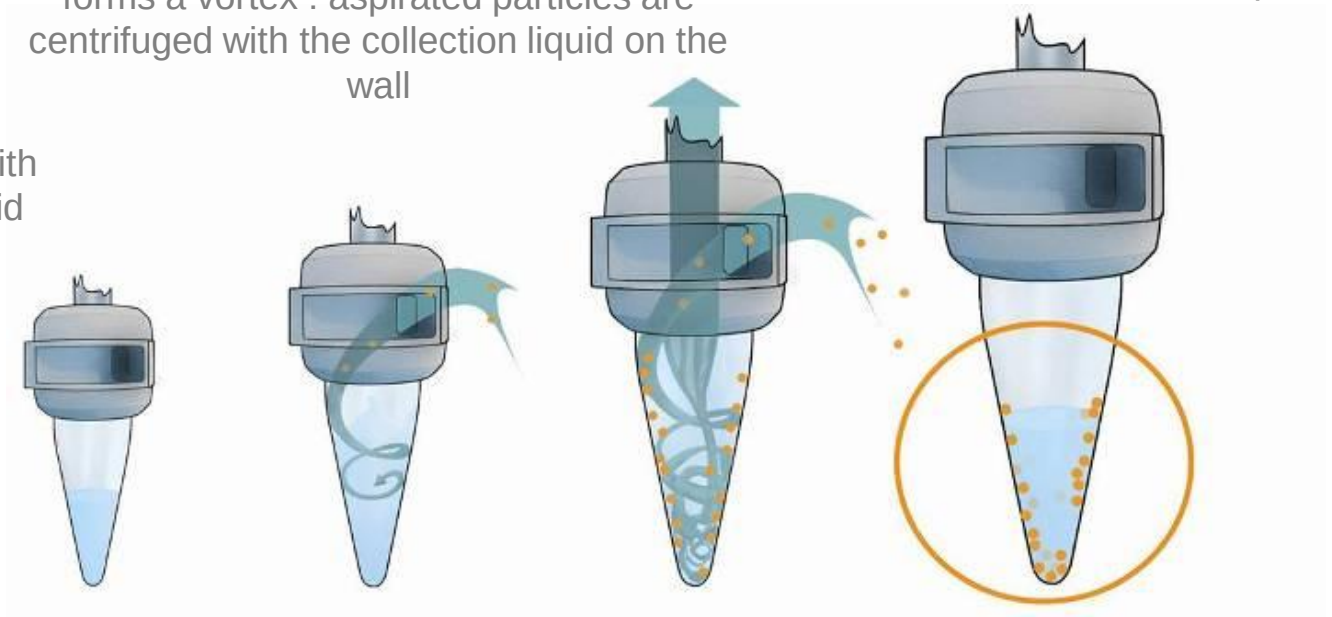
ALTERNATIVE SOLUTION: CORIOLIS® TECHNOLOGY

- Patented cyclonic technology concentrating particles from 0.5 to 20µm into a sterile liquid collection media
- Captures and concentrates all airborne particles (bacteria, fungi, spores, viruses, pollens, allergens, endotoxins…)

1-
Pre-filled sterile cone with adapted collection liquid

2-
Air & particles enters in the cone and forms a vortex : aspirated particles are centrifuged with the collection liquid on the wall

3-
Particles are concentrated into the collection liquid



Wet cyclone collection Advantages

High flow rate

- Representative air sampling (10 lpm vs 300 lpm)

Liquid sample output (10 mL)

- No saturation of the liquid sample
- Compatible with **qPCR**
- Compatible with **ELISA**
- Compatible with **Titration**

The Coriolis® micro gives access to more information than traditional methods

Long time monitoring (up to 6 hours)

- Concentration of the target in the collection liquid (generally sampling of 30 min)
- Unpredictable pollution event (for area monitoring)

CORIOLIS® MICRO PRODUCT

www.coriolis-airsampler.com

▷ Designed for clean rooms, hospital and indoor air control

- High air flow rate: 100 to 300 L/min
- Light: 3 kg
- Collect viable, non cultivable and total flora, pollens, viruses…
- Easy decontamination (single use consumable, H202 decontamination)
- Battery operated
- Long time monitoring option (up to 6 hours)

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CASE STUDY: IMPLEMENTATION OF BIOLOGICAL BEACONS

▷ Topic:

- ALBEDO Project 2012-2015
- Evaluation of sampling device with field biological analysis incorporated
- Target: aspergillus fumigatus

▷ Sampling site

- Outside composition site

▷ Analysis:

- magnetic beads magnisense

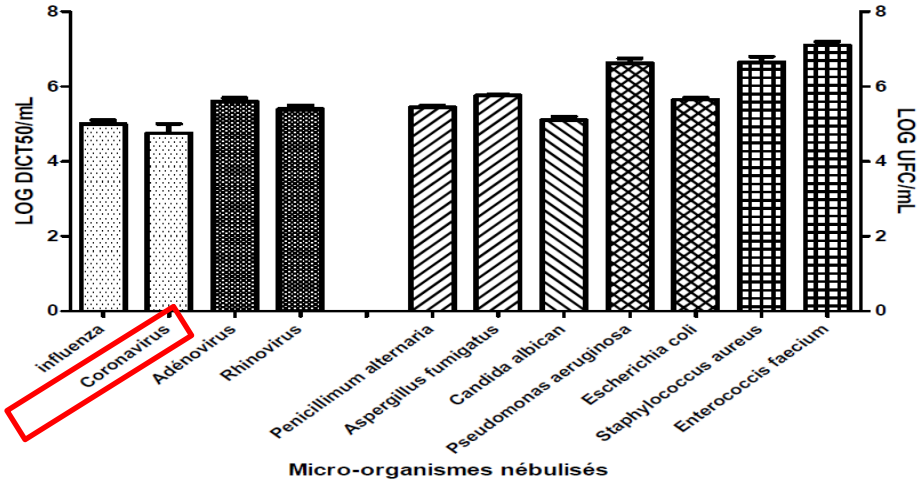
▷ Conclusion

- Translating manual to automatic analysis requires development
- Define the pathogen target

CASE STUDY: CHARACTERIZATION OF BIOLOGICAL FILTER EFFICIENCY

VirNext VirPath

Contact : Vincent Moulès



▷ Topic:

- Efficiency evaluation of indoor air decontamination system
- Nebulization chamber in BSL3 laboratory to simulate different in situ conditions

▷ Sampling site

- Air chamber : Suction of total volume of chamber with the Coriolis® micro with different conditions according to nature of micro-organisms (collection media and time/flow rate)

▷ Analysis: Titration, culture, RT-qPCR etc.

▷ Conclusion

- Collection of various pathogens
- Enable efficiency results of MERS
- Quantify respiratory viruses in air samples with specific RT-qPCR molecular procedures

Case Study: gluten in the air in a food processing

Sampling parameters	[Gluten] (mg of gluten/kg of liquid collection)	[Gluten] (mg of gluten/m^3 of air)	Results
Control (distilled water)	<5 ppm	-	OK
A1-300L/min-20 min Machines stopped	**<5 ppm**	< 0,075 mg de gluten/6000L of air < 12,5 µg de gluten/m3 of air	Low gluten contamination
A1-300L/min-10 min Machines stopped	**<5 ppm**	< 0,075 mg de gluten/3000L of air < 25 µg de gluten/m3 d'air	
A1-300L/min-20 min Production time	**<5 ppm**	< 0,075 mg de gluten/6000L of air < 12,5 µg de gluten/m3 of air	Low gluten contamination
A1-300L/min-10 min Production time	**8 ppm**	0,12 mg de gluten/3000L of air 40 µg de gluten/m3 of air	Increase of the level of gluten during the production

Sampling parameters	[Gluten] (mg of gluten/kg of liquid collection)	[Gluten] (mg of gluten/m^3 of air)	Results
A2-300L/min-20 min Production time	**35 ppm**	0,525 mg de gluten/6000L of air 87,5 µg de gluten/m3 of air	Detection of gluten at a high concentration -> the production of gluten-free products close to this area is not possible
A2-300L/min-10 min Production time	**54 ppm**	0,81 mg de gluten/3000L of air 270 µg de gluten/m3 of air	
	44 ppm	0,66 mg de gluten/3000L of air 220 µg de gluten/m3 of air	
A2-200L/min-5 min Production time	**18 ppm**	270 µg de gluten/m3 d'air	

▷ Topic:

- Threat of contamination of gluten-free food by air (FDA regulation: 20ppm in food)

▷ Sampling sites

- A1: This area has been emptied out of all products containing gluten
- A2: Raw materials containing gluten are continuously used in this area.

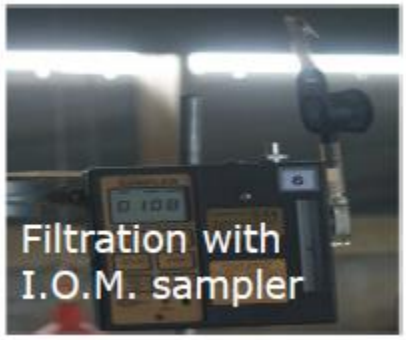
▷ Analysis: ELISA (R5-Mendez)

▷ Conclusion

- Thanks to its high flow rate, Coriolis Micro is a valuable tool for the collection of gluten even in a low contaminated environment.

CASE STUDY: STUDIES ABOUT THE DETECTION AND QUANTIFICATION OF BIOAEROSOLS WITHIN AND IN THE VICINITY OF PIG AND POULTRY BARNS

Contact : Jochen Schulz



Ahmed, Schulz, Hartung (2013): Air samplings in a Campylobacter jejuni positive laying hen flock. Annals of Agricultural and Environmental Medicine 20: 16-20

Topic:

- The air of laying hen houses can contain high concentrations of airborne bacteria including zoonotic pathogens.
- The numbers of these bacteria can be influenced by the efficiency of the chosen sampling method.
- sampling aerobic mesophilic bacteria in a Campylobacter jejuni (airborne C. jejuni is suggested to be a potential health risk when it is swallowed, Wilson 2004)

▷ Sampling methods

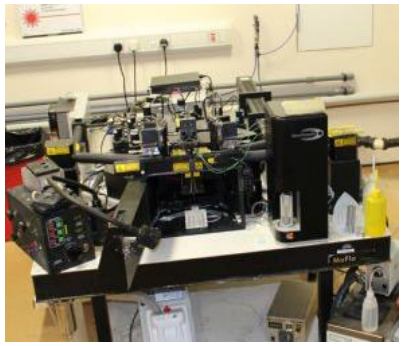
- AGI-30 Impinger and the Coriolis®µ

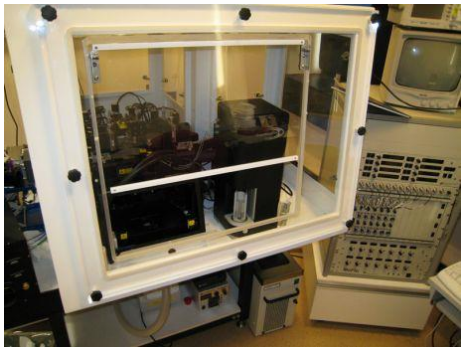
▷ Conclusions

- The Coriolis µ Air Sampler showed higher bacteria concentrations than the AGI-30 impinger. The differences were highly significant

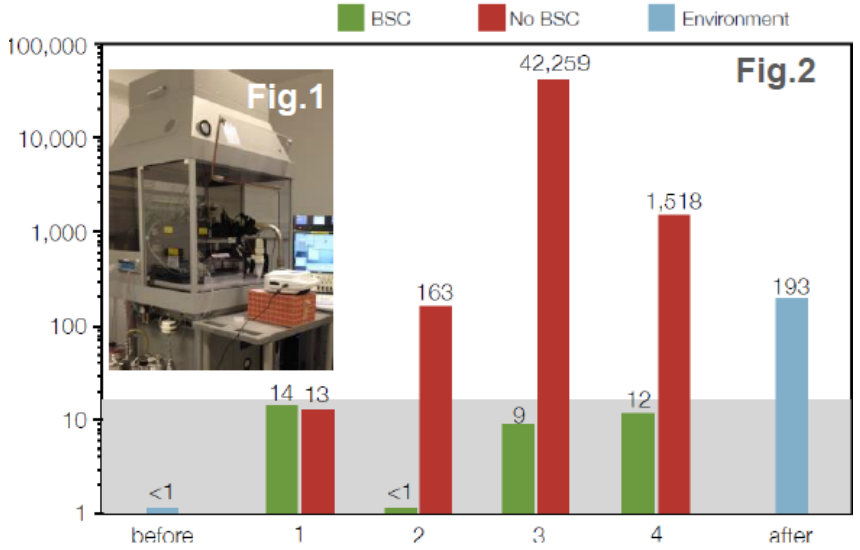
CASE STUDY: POTENTIAL AIR CONTAMINATION FROM CYTOMETERS

Contact : Jan Baier





Cytometers without and with Bio Safety Cabinet (BSC)



Bead concentration (beads per m3) in "operator safety zone" under different operation conditions,

▷ Topic:

- Operator protection from aerosols, potentially carrying bio hazardous sample constituents (e.g. HIV), generated during cell sorting experiments
- In failure mode, high amounts of aerosol are produced because of (partial) obstruction of the "nozzle" of the cytometers

▷ Sampling site: in front of the cytometer

- Exp. 1: no operation (= background)
- Exp. 2: normal operation
- Exp. 3: failure mode
- Exp. 4: 30 seconds after failure mode
- Exp. 5: 2 meters away from cytometer

▷ Analysis: fluorescent micro beads.

▷ Conclusions

- The results of this preliminary study clearly indicate the efficiency of providing operator safety by running jet-in-air flow cytometric cell sorters inside a BSC.

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