



Triggered Bioaerosol Sampling onto Dry Electret Filters; Wanted: Dead or Alive

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Presentation Outline

(20 Slides)

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Detect-Collect-Identify for Tactical Use and Building Environments Infection Control

LIF Detection with Threat Signatures and Network

Dry Filter Collection with Wet Foam Elution

Direct Concentration for Identification

Current Efforts

Bioaerosol Transmission of Pathogens

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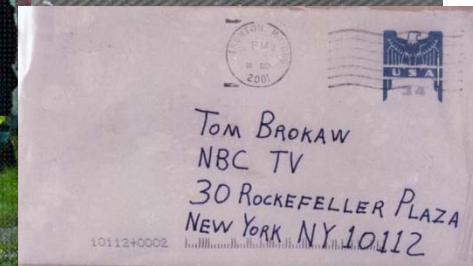
Unintentional releases
Releases despite
attempts at control
Intentional releases

Detect to Warn
scenario is key

- ▣ Nat. Academies
report, 2005

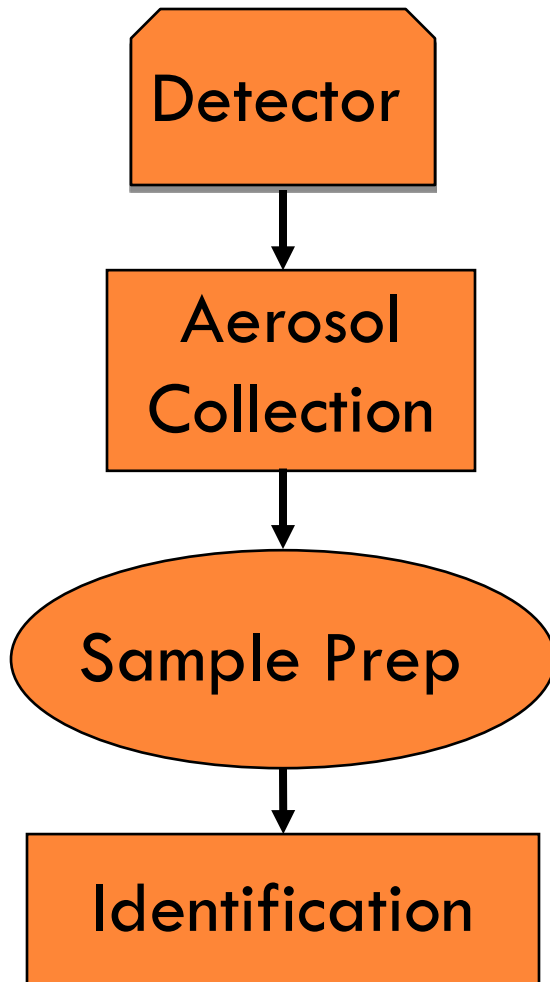


Aerobiology,
AAAS 1942;
Terrorismfiles.org,
2011



Detect-Collect-Identify Solution

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DETECTOR: Areté's LIF detector engine

COLLECTION: InnovaPrep's dry-collection/wet-elution system

SAMPLE PREP: InnovaPrep's HSC-40 Hydrosol Concentration System

IDENTIFICATION: Immunoassays, PCR, RMMs

Areté TRAP Detection System

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Key Threat Reduction Advancement Processor
(Detector) Subsystems:

Laser Induced Fluorescence Detector

Laser Source

Receiver

Integrated Flow Module

Aerosol Inlet with an Optional Scalping Module

System Electronics/Programming

Battery

The system is a point detection sensor that provides single particle detection and analysis.

**Patents Pending*

InnovaPrep Bobcat (ACD-200)

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Lightweight

No liquids

Eluting captured particles is quick & easy

Sample is ready for analysis in less than one minute

Operator can wear gloves

Single electrical port allows for remote triggering, data acquisition, and external power



**Patents Pending*

Integrated Detect-Collect System

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By integrating and repackaging the TRAP and Bobcat collector, a networkable detect-collect module has been developed.

The two systems were integrated within an envelope the approximate size of the current Areté system

The power supply is shared, allowing the use of single power/battery sourcing for the two systems

Single user interface



Patents Pending

Networked Detection

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Areté Threat Reduction Advancement Network (TRAN) connects all sensors to central node for processing and analysis

Network signal processed in real time; triggers samplers to collect sample for identification



Hand Held Extraction (HHE) System

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InnovaPrep Developed
HHE

Cartridge Holds
Carbonated Elution Fluids

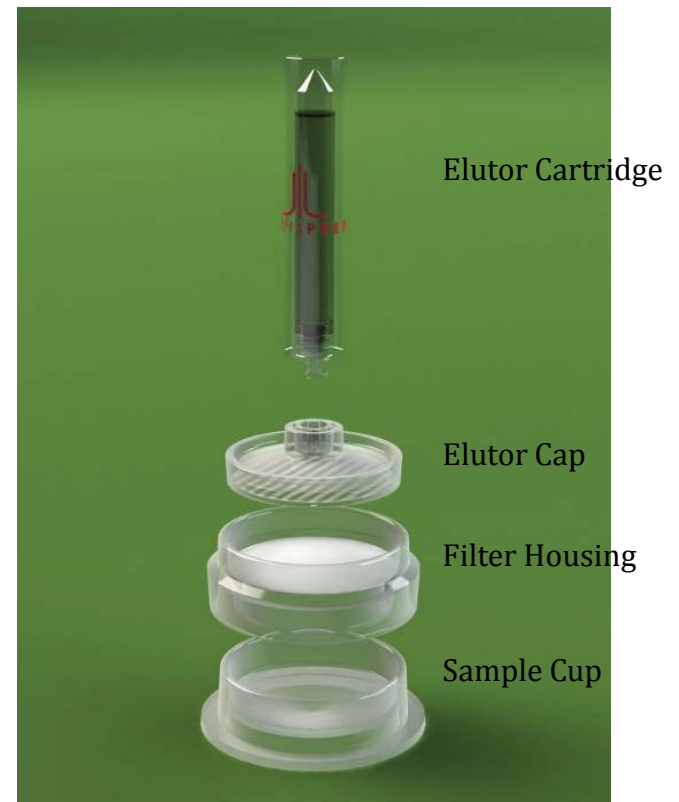
Elutor Cap

Fits Directly on Filter

Housing Used in Collector

Directs the Wet Foam Evenly
Through the Filter

Filter Housing



**Patents Pending*

Wet Foam Elution

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Fast

Losses are minimal

Process is effective for all particles depending on membrane selection, including small particles like viruses

Quickly Breaks Down into a Liquid

Maintains Sample Viability in buffer or appropriate matrix



**Patents Pending*

Centrifugation

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Time-consuming,
exacting procedure

Losses occur in
centrifuge tubes

Process is uneven
due to physical
constraints

Increasingly difficult
to centrifuge small
particles

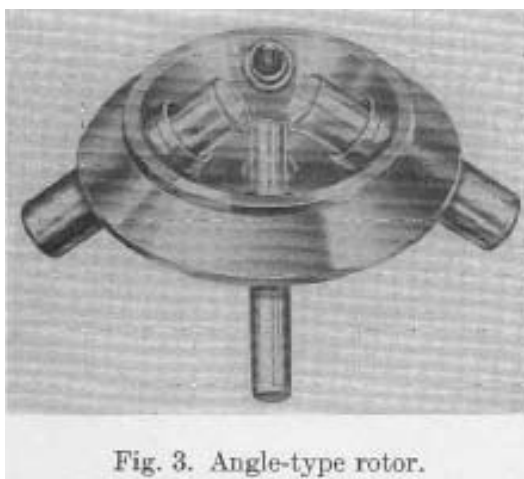


Fig. 3. Angle-type rotor.

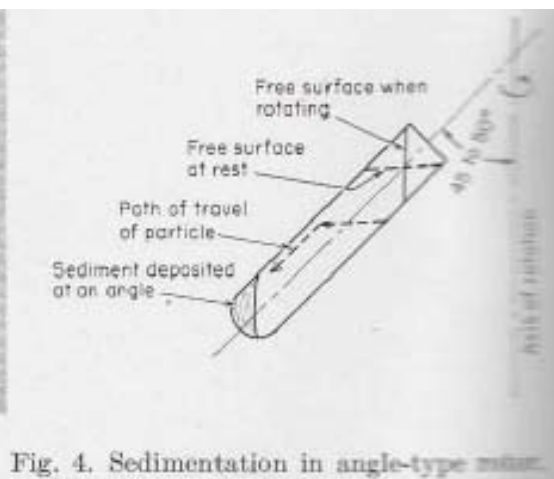


Fig. 4. Sedimentation in angle-type rotor.

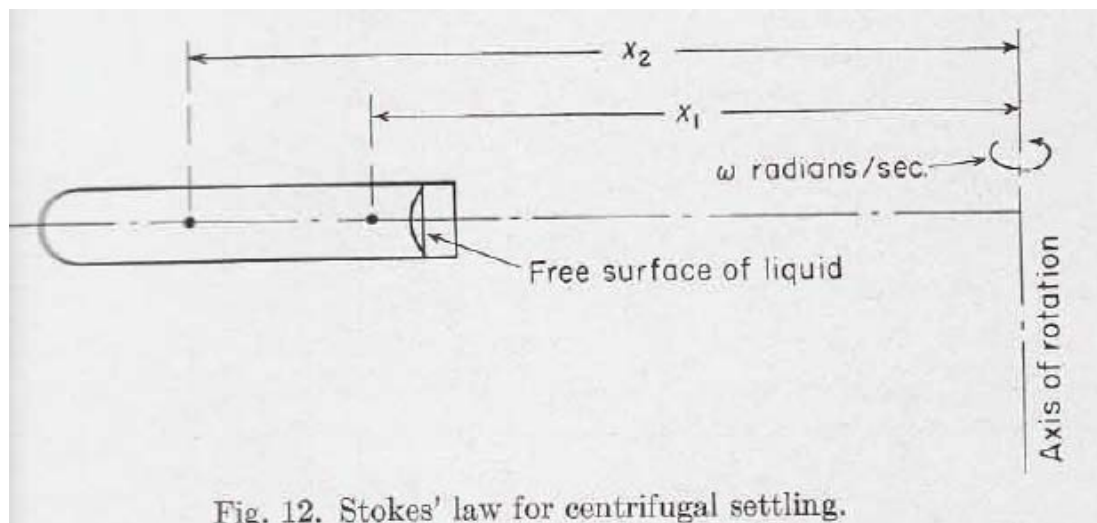


Fig. 12. Stokes' law for centrifugal settling.

Technique of Organic Chemistry, Vol. III, 1950

Liquid to Liquid Concentration

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Dead-end hollow fiber
membrane filtration
Automated process
Wet Foam Elution of
captured particles
routinely into volumes as
small as 80 μL (volumes as
low as 4 μL have been
demonstrated)



Patents Pending

InnovaPrep's Concentration Process

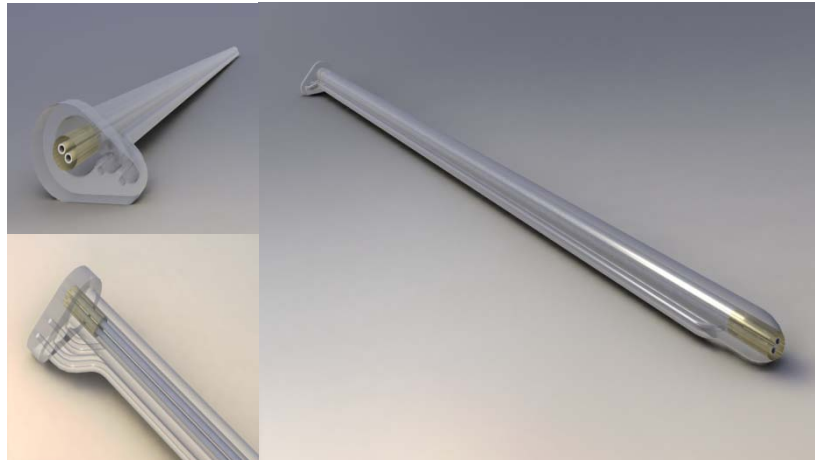
13

Physical Size-based Separation technology

Buffer exchange

Final volumes are settable by user

“Particles” as small as 1-10 kD



CPT base station instrument and Concentrating Pipette Tips (CPT, center). Actual prototype tips as tested (right). *Patents Pending*

InnovaPrep's Concentration Process Is Not:

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Not an affinity-based technology

Not magnetic or bead based

Not centrifugal

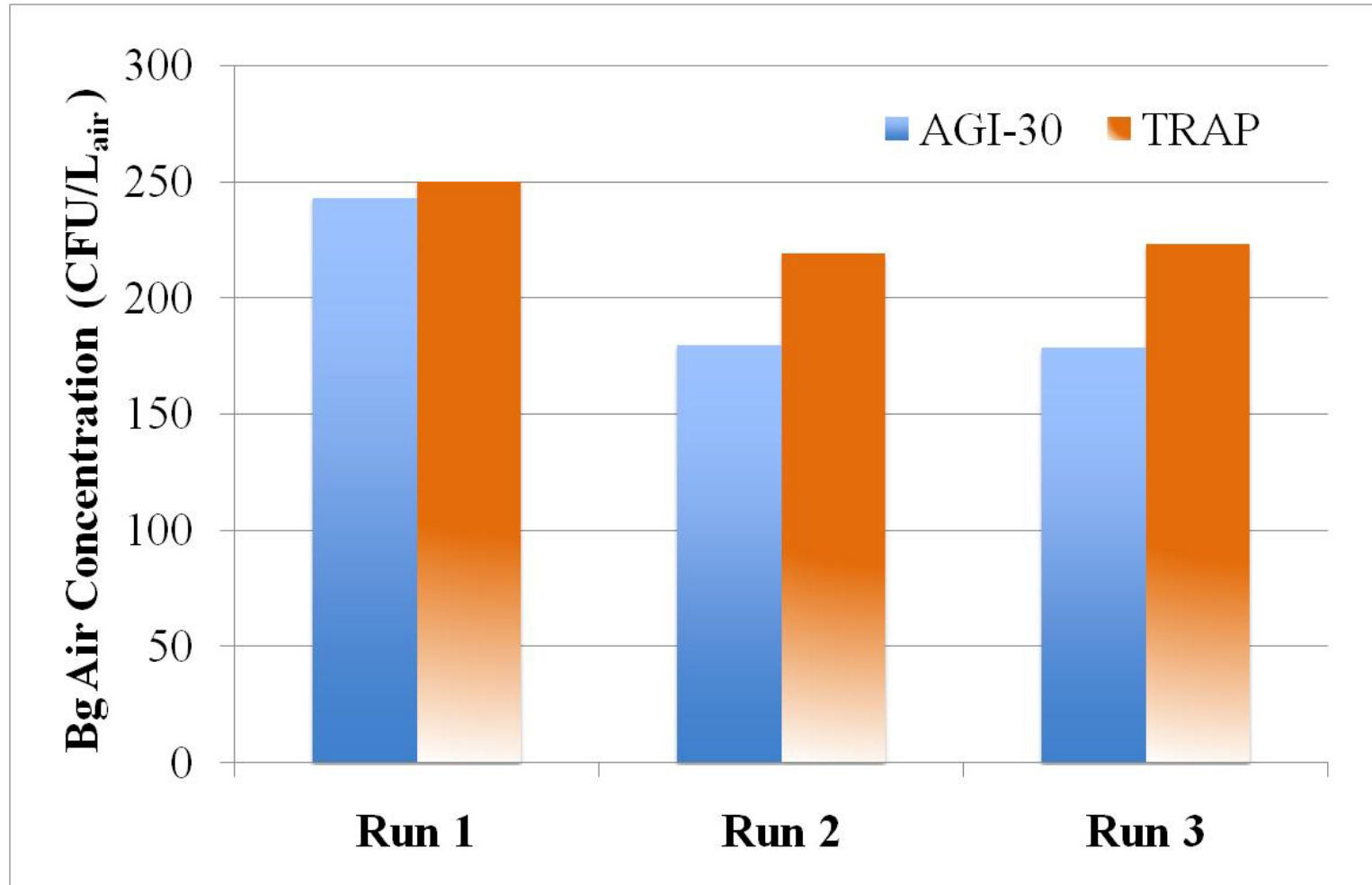
Not recirculating

Some but not all analytical interferences can be removed through exchange from sample fluid to extraction fluid (i.e., soluble bivalent metal ions)

Some interferences may be concentrated if they are like the target particles (i.e., some humic acids have properties similar to DNA)

Viable Bg Spores, TRAP-Collect

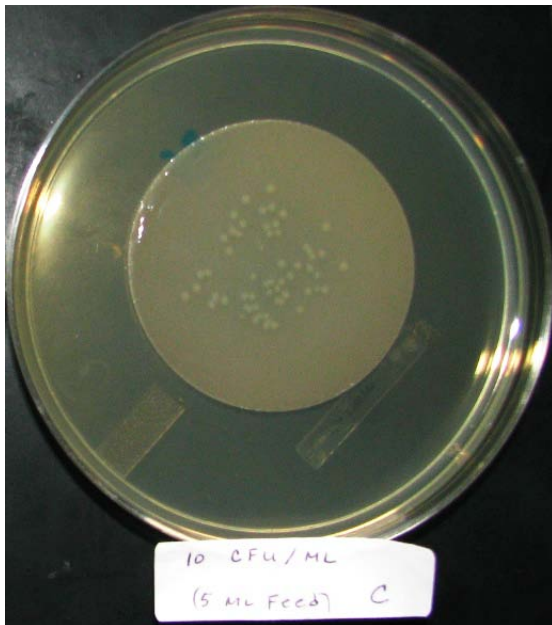
15



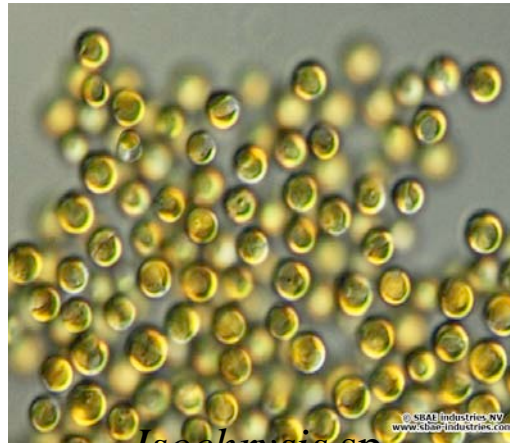
Sample Viability Maintained

16

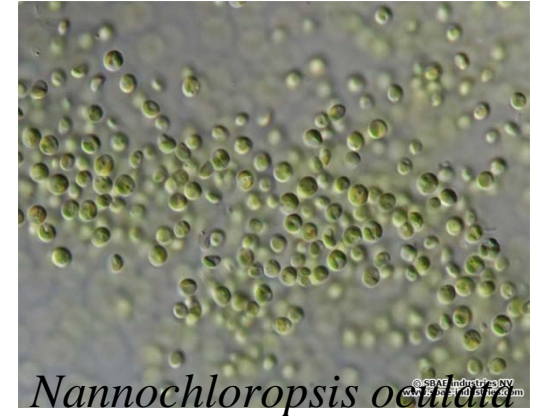
Tomato wash on TSA
Unconcentrated
Concentrated
E. coli on Petrifilm®



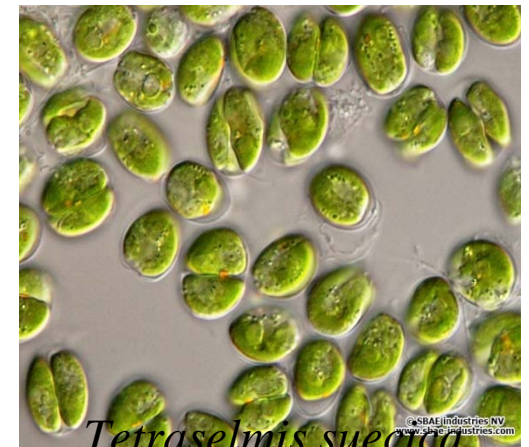
PhytoPlex



Isochrysis sp.



Nannochloropsis oculata



Tetraselmis suecica

PhytoPlex Concentration Testing (Flat Filter)

Dilute 300 μL of concentrated PhytoPlex to 50 mL with water
~4.5 minutes process to concentrate into 350 μL

Undiluted PhytoPlex



Dilution



Concentrated by
HSC-40

