

AMUG 2012

EMD Millipore Product Overview

Celia Landers/ AMUG / April 26

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Introduction

Celia Landers, Technology Manager

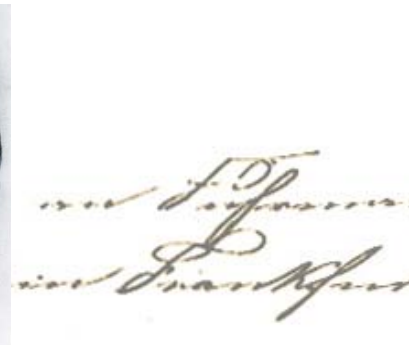


Company Overview

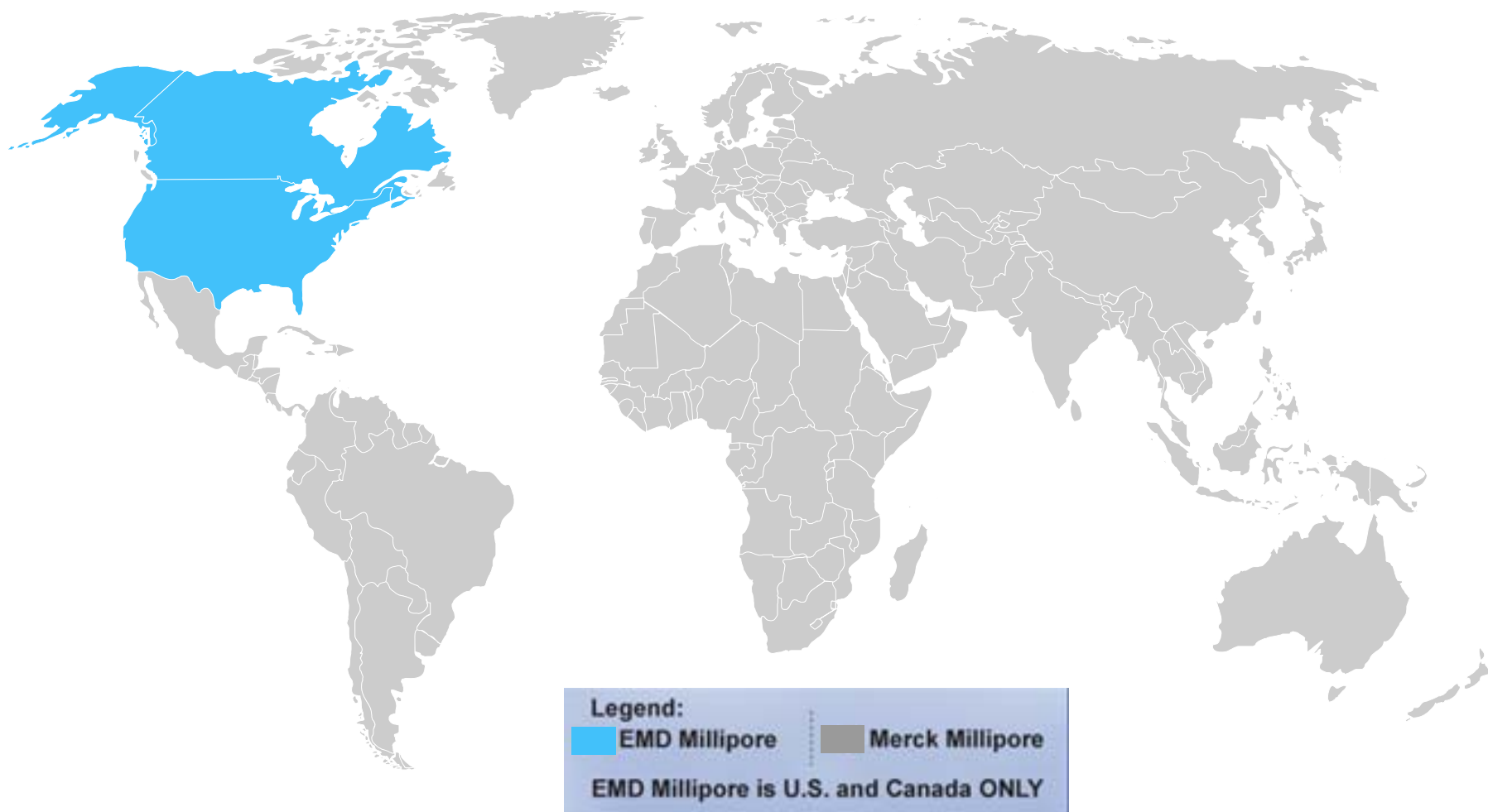


Merck KGaA: Long Tradition in Pharma & Chemicals

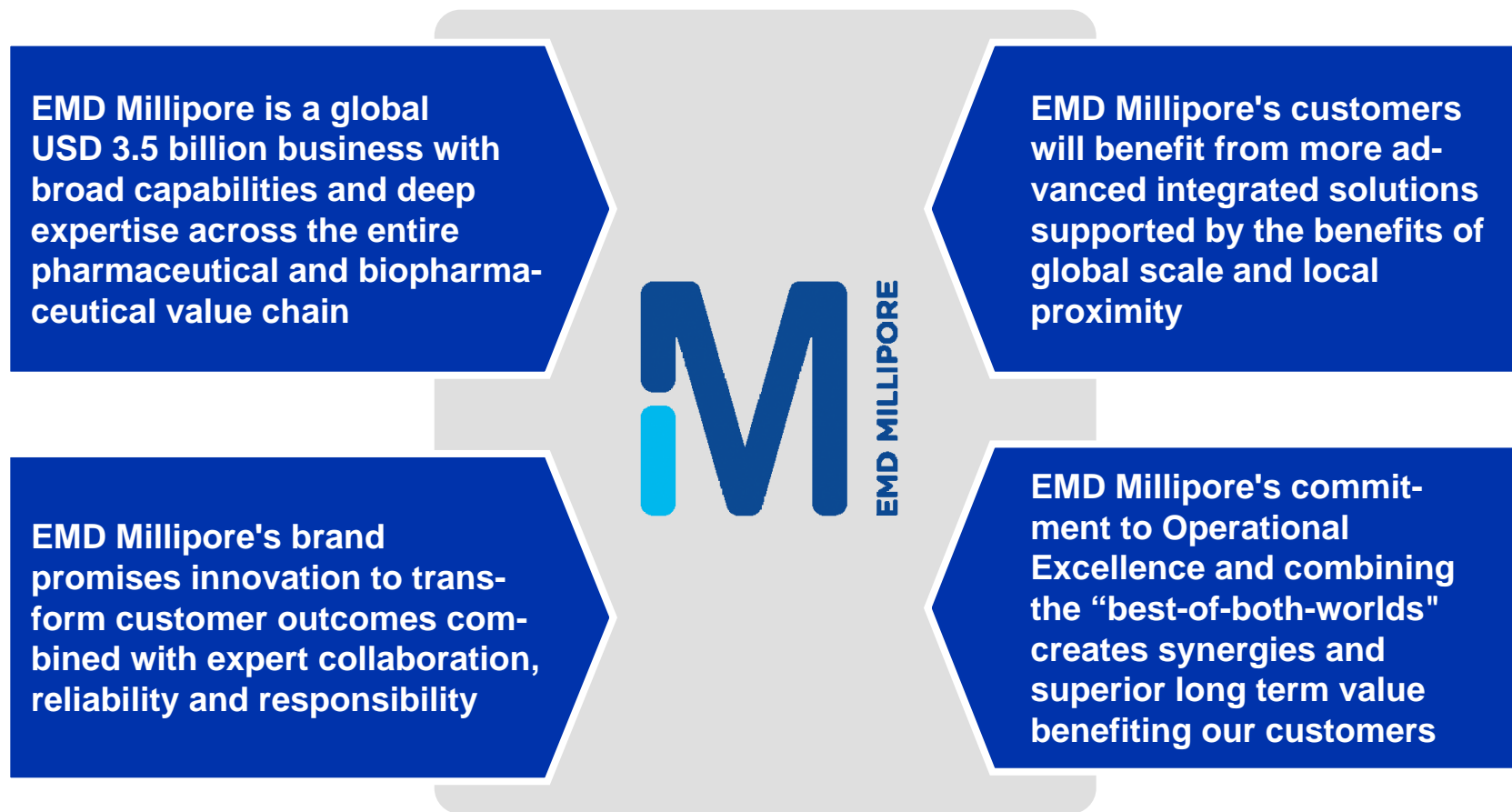
- Oldest pharma and chemicals company in the world – since 1668
- Diversification in pharma and chemicals to spread risk
- ~70% family ownership; ~30% public ownership by shares
- Broad global presence with more than 40,000 employees worldwide
- Expropriation of the US subsidiary after World War I (→ Merck & Co.)



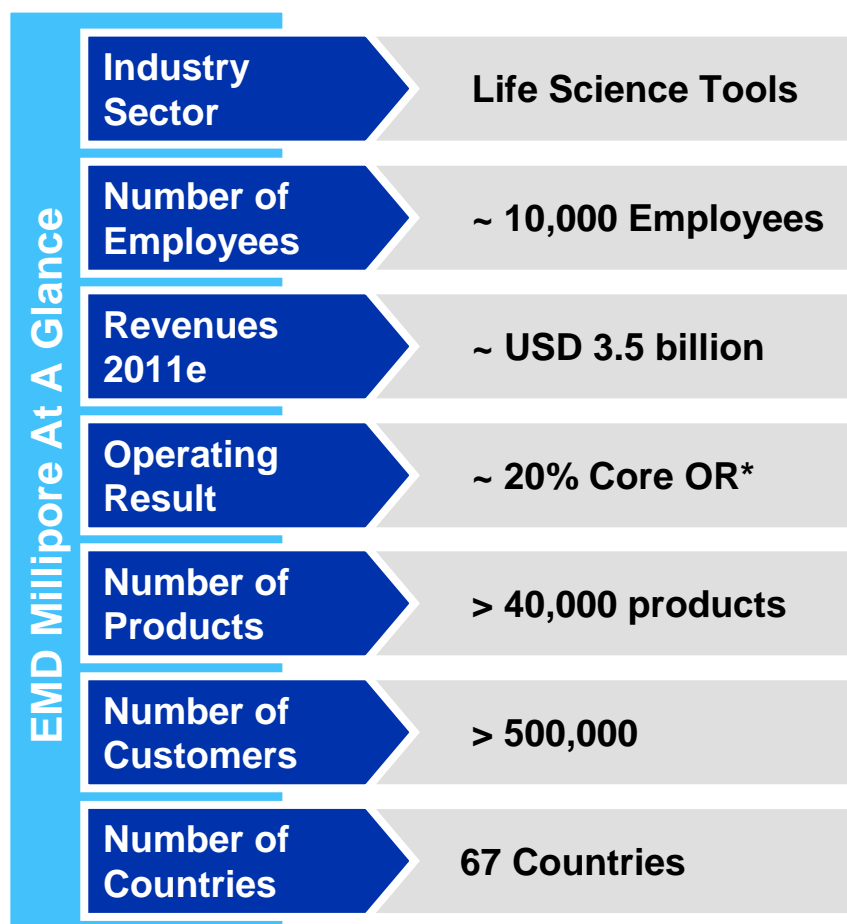
Merck Millipore vs. EMD Millipore



Which benefits our Customers

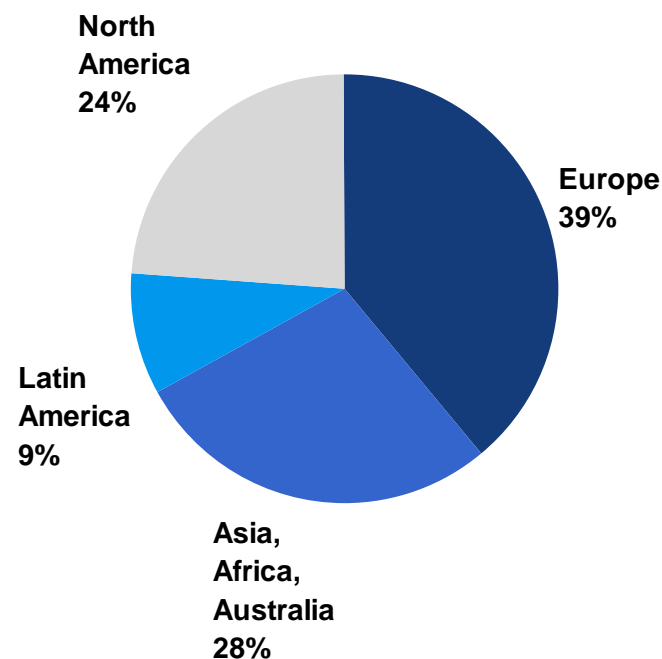


EMD Millipore: Global scale and competitive horsepower



* Core Operating Result = OR less costs related to Millipore purchase

Sales by Region



EMD Millipore operates via 3 Business Units

Bioscience

Products used by specialized life science laboratories



20%

Lab Solutions

Lab products and equipment for applications in life science and industrial markets



40%

Process Solutions

Products used in the production of pharmaceutical and biopharmaceutical drugs



40%

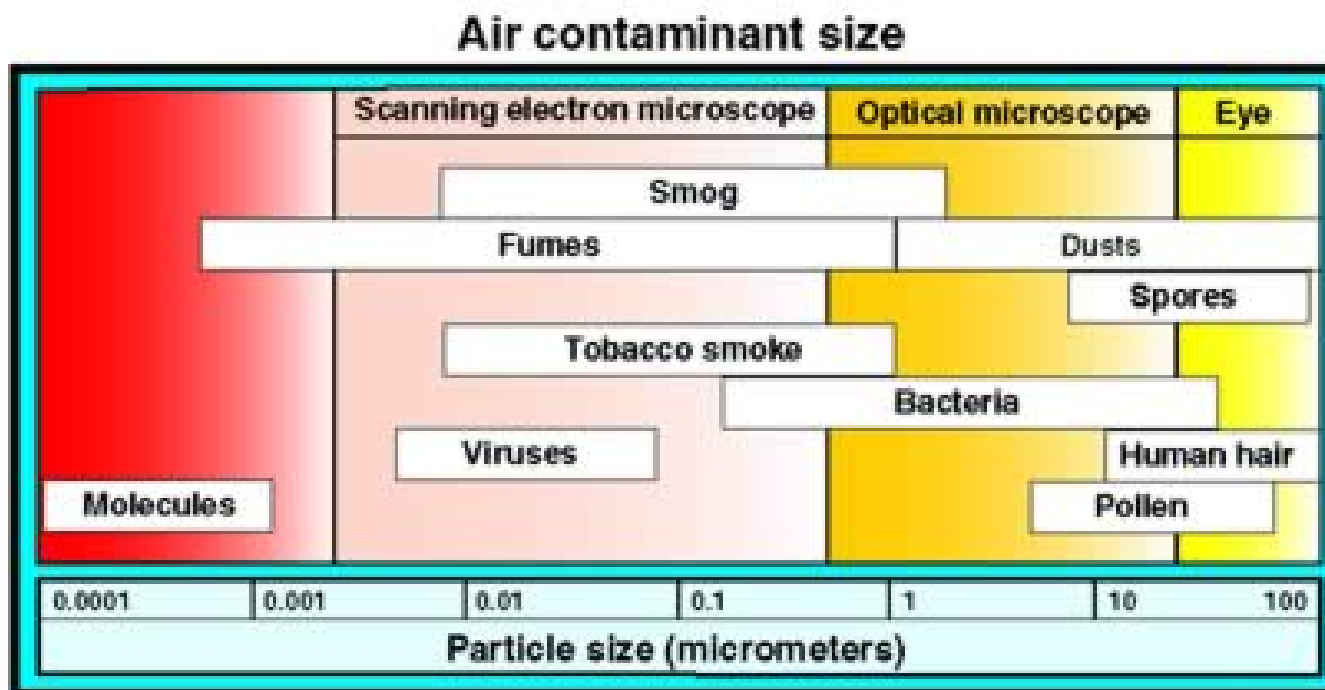
Contribution to divisional sales for EMD Millipore

Membrane Technology Overview

An abstract graphic consisting of several overlapping, curved, blue shapes that resemble liquid droplets or membrane folds, positioned in the lower right quadrant of the slide.

Background

- Millipore was founded in 1954, first commercially available filter (MF- mixed cellulose ester)
- 1970- Clean Air Act introduced, 1971 National Ambient Air Quality Standard for Total Suspended Particles. Millipore sends scientists to Washington to help draft some of the first methods for particle/contamination monitoring for air/water/soil testing

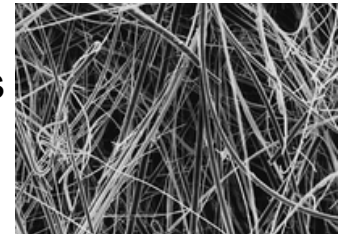


Courtesy of www.cdc.gov

Filter Types

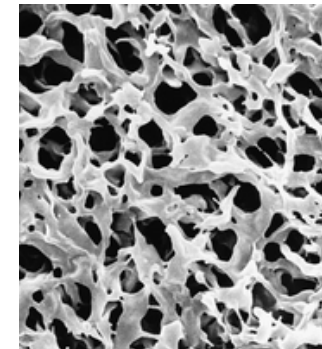
Depth Filters

- Matrix of randomly oriented fibers pressed together to form flow channels
- Nominally rated, no exact pore size
- Large particle loading capacity, excellent flow rates
- Glass fiber, polypropylene



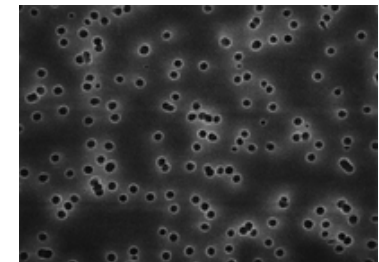
Screen Filters

- “Absolute” pore size ratings, surface retention
- Rigid, uniform mesh of material
- PTFE, PVDF, MCE



Track Etched Filters

- Pores are generated by the film exposure to a beam of accelerated Cr^{6+} ions, then placed in a bath of NaOH
- Clean, cylindrical pores of a uniform diameter
- Smooth surface



Filter materials and applications

MF (mixed cellulose ester)

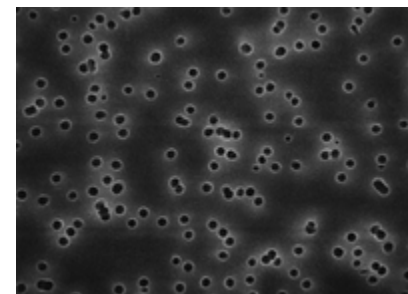
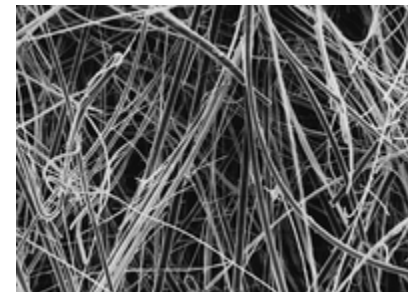
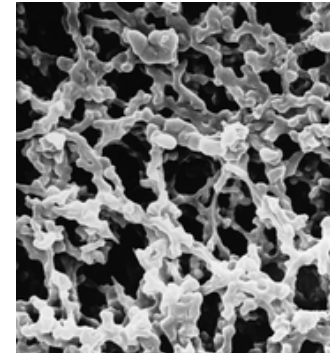
- First filter to market
- Used extensively for microorganism collection
- Can be dissolved for analytical purposes
- Clean room/garment monitoring
- Microbiological monitoring
- Asbestos testing
- Metals

Glass fiber (borosilicate microfiber)

- Large particle load
- Able to be ashed for volatiles
- Carbon free

Polycarbonate

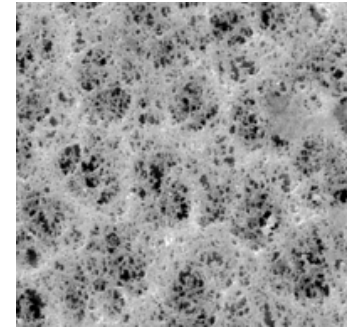
- Transparent filter for microscopy
- Smallest pore size distribution of any filter
- Track etched membrane



Filter Materials and Applications

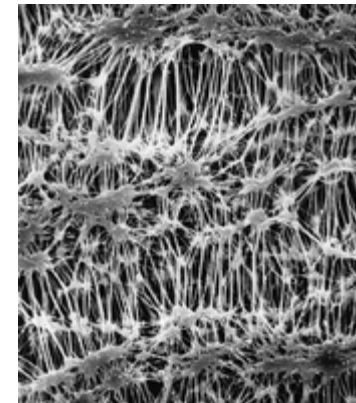
PVC

- Medical grade
- Silica, carbon black, quartz
- Zinc, lead, etc.



PTFE (Fluoropore, Mitex)

- Hydrophobic membrane
- Very low extractables, inert
- Alpha particle monitoring
- Benzene, sulfides, alkalines



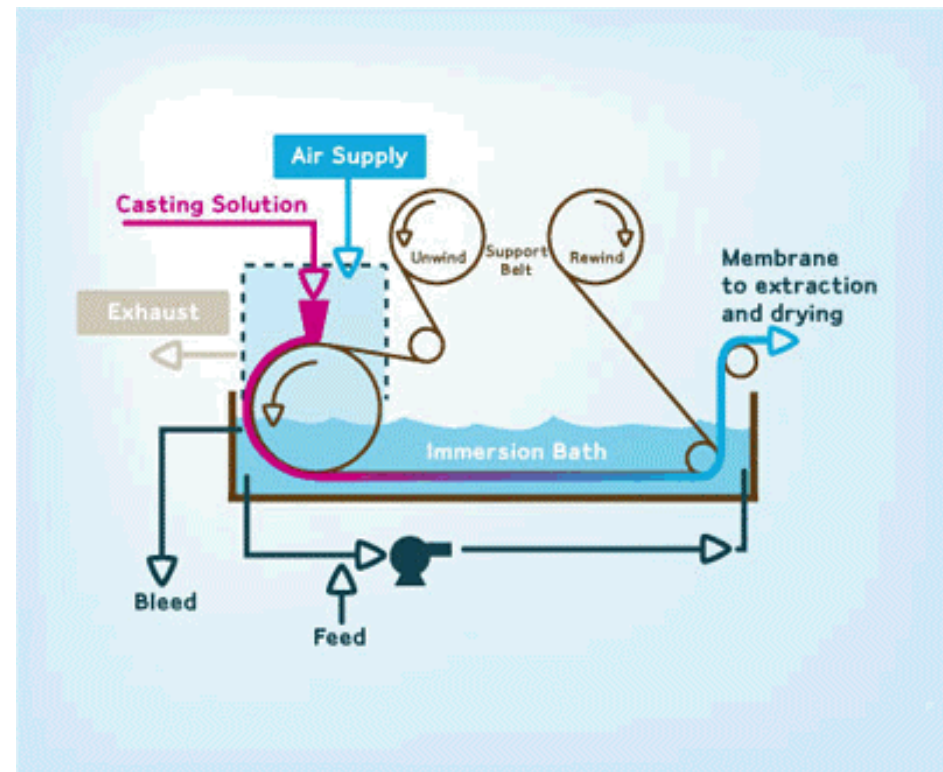
Other materials available: Polycarbonate, silver, nylon, PVC, quartz

Millipore can also supply materials in rolls or special cut sizes

Membrane Manufacturing: Controlled Precipitation

Solvent or emersion casting:

The dissolved polymer is spread onto a moving belt and run through a bath of liquid; the liquid in the bath exchanges with the solvent in the lacquer and causes the formation of the pores.



How is Pore Size Measured?

- **Bubble Point**

Bubble point is based on the fact that liquid is held in the pores of the filter by surface tension and capillary forces. The minimum pressure required to force liquid out of the pores is a measure of the pore diameter

Bubble point formula:
$$P = \frac{4k \cos \theta}{d} \sigma$$

where:

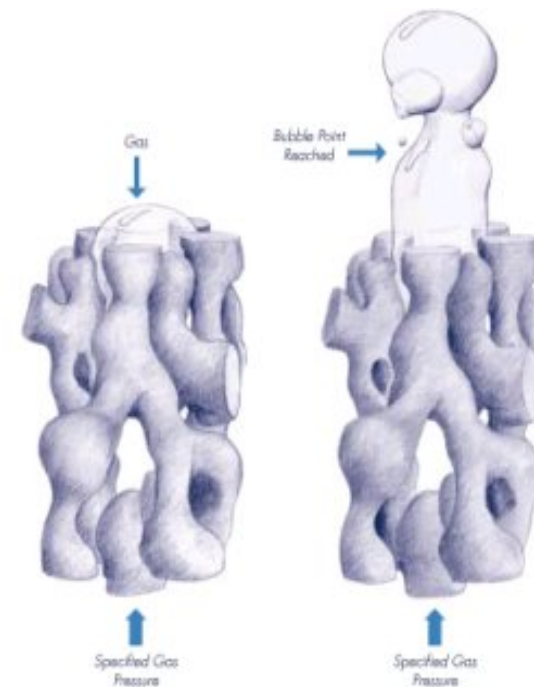
P = bubble point pressure

d = pore diameter

k = shape correction factor

cos = liquid-solid contact angle

σ = surface tension



Air vs Liquid filtration

Pore sizes of filters are measure in liquid. Ratings for air are usually described in retention sizes, ie DOP >99%

Liquid filtration is affected by the buffer system

- pH, salt concentration, biological components, particle size dispersion, filter compatibility

Air filtration is much more complex due to electrostatic effects

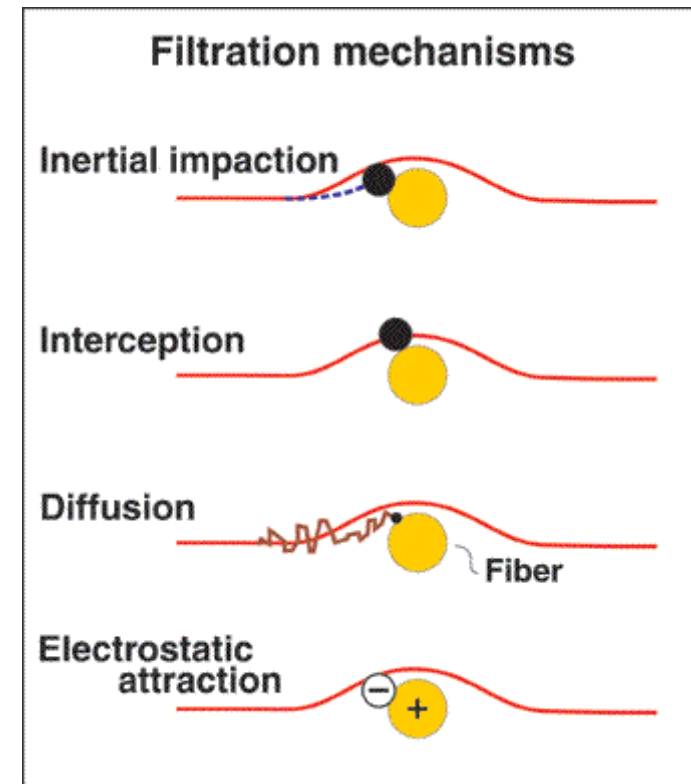
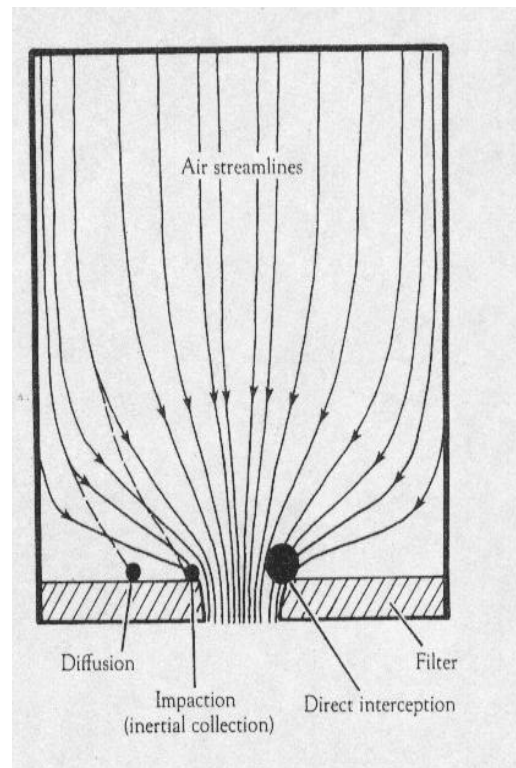
- Any filter can be used with air but the results can vary depending on the material of construction and sampling conditions

There is no true correlation between air filtration and liquid filtration, each must be quantified independently, even if you are looking for the same contaminant

Mechanisms of Air Filtration

Particle retention in air is affected by several factors unlike liquid which tends to rely heavily on pore size for capture efficiency

Impaction- Particles (especially around 1 μm) do not flow precisely with the air stream, and will tend to move in straight lines when the air streams bend, impacting the surface of the filter

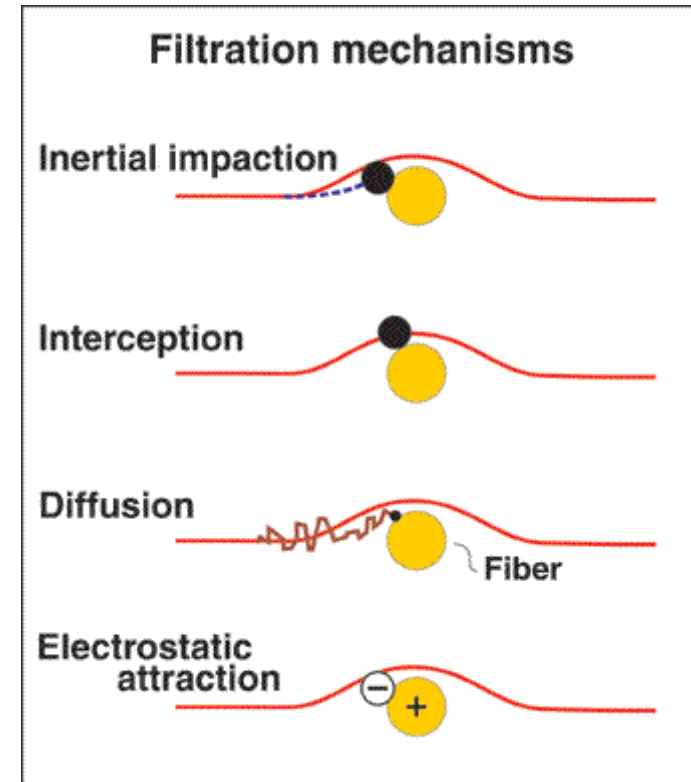


Courtesy of www.cdc.gov

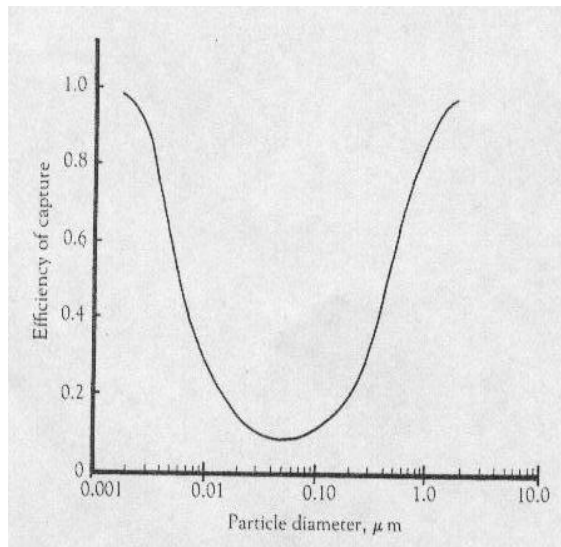
Direct Interception- (as with liquid)

- Particles larger than the pore size of the filter are removed
- Particles with a radius which is an appreciable fraction of the pore size radius get removed- this is because particles of this size moving with the air stream have a large probability of touching the filter surface.

Diffusion- particles exhibit Brownian movement and diffuse in response to concentration gradients. Since at the surface of the filter the concentration of particles is initially zero, a concentration gradient is set up leading to the movement of particles out of the air stream and onto the filter surface. Diffusion is favored by low air flow velocities and high concentration gradients. Only particles less than 0.1 μ m will be removed to an appreciable extent by diffusion.



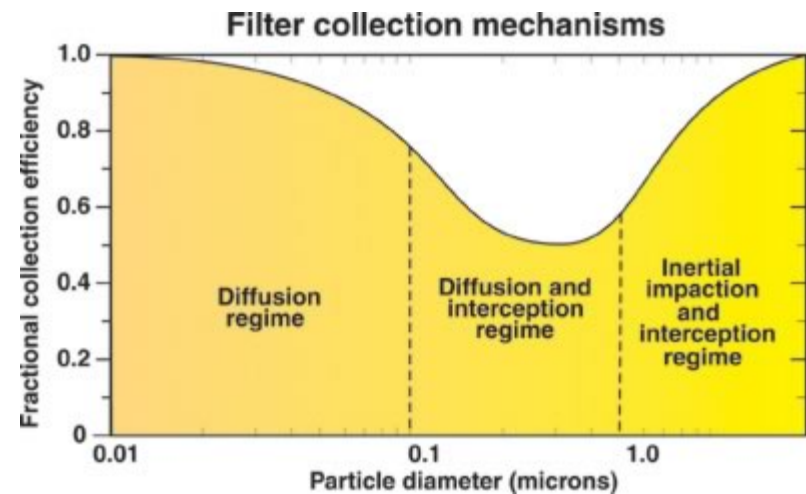
Particle Retention in Air: Typical Capture Profile



Example: Collection efficiency is greatest for smaller and larger particles and least for particles in a mid range of ~0.05-0.1um

Particle capture profile of a 5 um polycarbonate track etched membrane

The profile will shift based on filter type and pore size but the shape will remain



Fluoropore Membrane: Alpha Particle Monitoring

- Improved Data Collection
- Choice of Pore Sizes
- Contrasting Backing Material

ORDERING INFORMATION

Pore Size	Diameter (mm)	Qty/Pk	Catalogue No.
3 μm	25	100	FSLW 025 00
	47	100	FSLW 047 00
	90	25	FSLW 090 25
5 μm	47	100	FMLB 047 00

Thank you

Millipore is dedicated to being your filtration partner
Extensive sales force, R&D group, marketing team

Technical Service

- On line 8am to 8pm EST
- Samples are available

1-800-MILLIPORE (645-5476)

www.millipore.com