High-Grade Ceramic Water Filters:

Clean Water – Anytime, Anywhere

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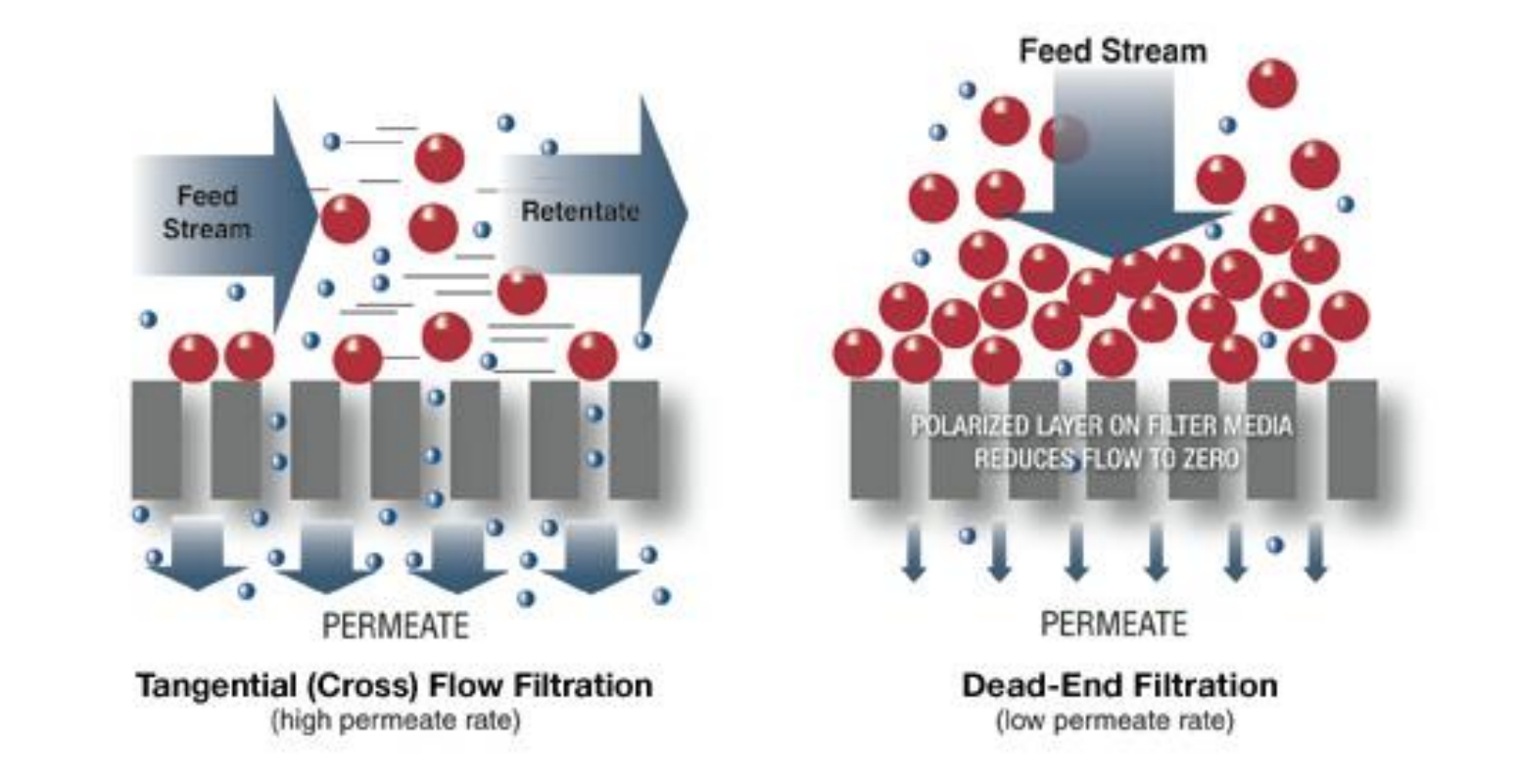
Why Ceramics?

- Can last a long time
- Can be cleaned / reused
- Can resist various chemical & environmental conditions (high/low pH, redox)
- Can be coated with antibacterial/antifungal mat'ls
- Can handle high pressure / mechanical stress
- Can be locally manufactured from local raw materials
- Can be recycled for another high-value material

	Filter	Catalyst	Bioreactor	Gas distributor	Sensor	Oil-containing bearing
Open Porosity (%)	>30	>30	>30	>30	>30	20-40
Pore size	Appropriate size, depending on applications	Appropriate size, depending on applications	For bacteria 5-30μm. For enzymes 10-200nm	>μm	Depending on application	>μm
Pore size distribution	Narrow	Narrow (depending on application, bimodal)	Narrow (depending on application, bimodal)	Narrow	Narrow	Insensitive
Specific surface area per unit volume	Depending on applications	1-2000 m^2/g	>1 m^2/g	Depending on pore size	>1 m^2/g	Insensitive
Permeability	High	Depending on application	Depending on application	High	Depending on application	Insensitive
Mechanical strength	High	Depending on application	High	High, depending on application	Depending on application	High
Others	Chemical resistance	Catalysis function	Appropriate surface potential		Sensing function. Appropriate surface condition	Chemical and wear resistance

Filtration mechanisms



The more common dead-end filtration results to decrease filtration efficiency and fouling through continued use.

Image adopted from http://www.spectrumlabs.com/filtration/Edge.html.

As energy diminishes – the particles are deposited based on size.

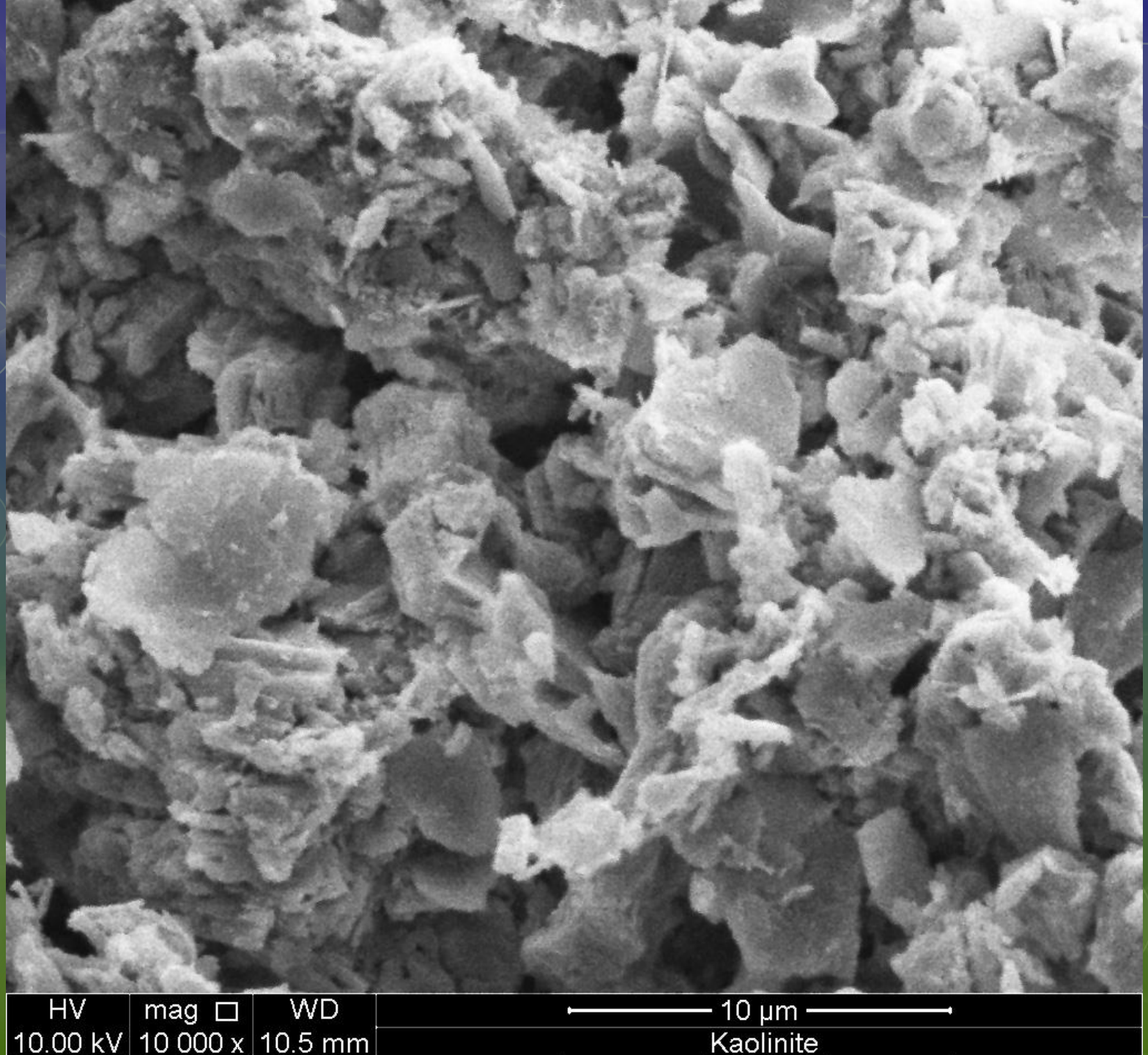
Feed
200kg

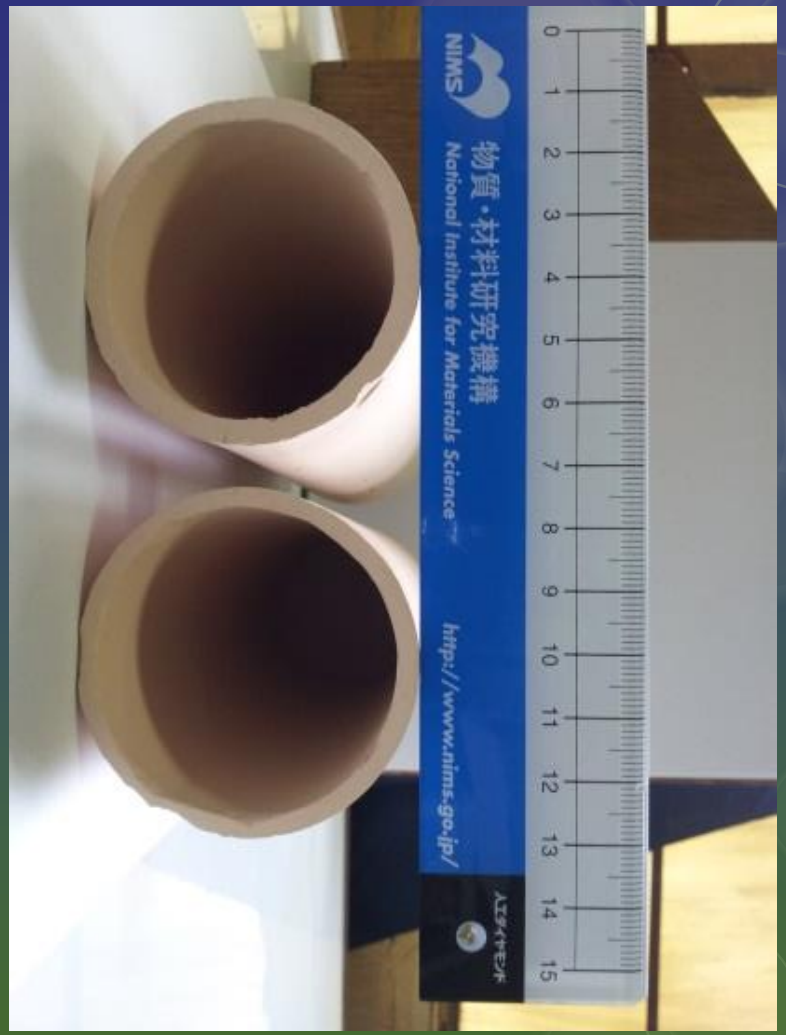
$$\boldsymbol{v_t} = \sqrt{\left(\frac{8gr(\rho_p - \rho_f)}{3C_d\rho_f}\right)}$$

$\boldsymbol{v_t}$-terminal velocity
$\boldsymbol{g}$-acceleration due to gravity
$\boldsymbol{r}$-particle radius
ρ_p-density of particle
ρ_f-density of fluid(dH_2O)
C_d-drag coefficient

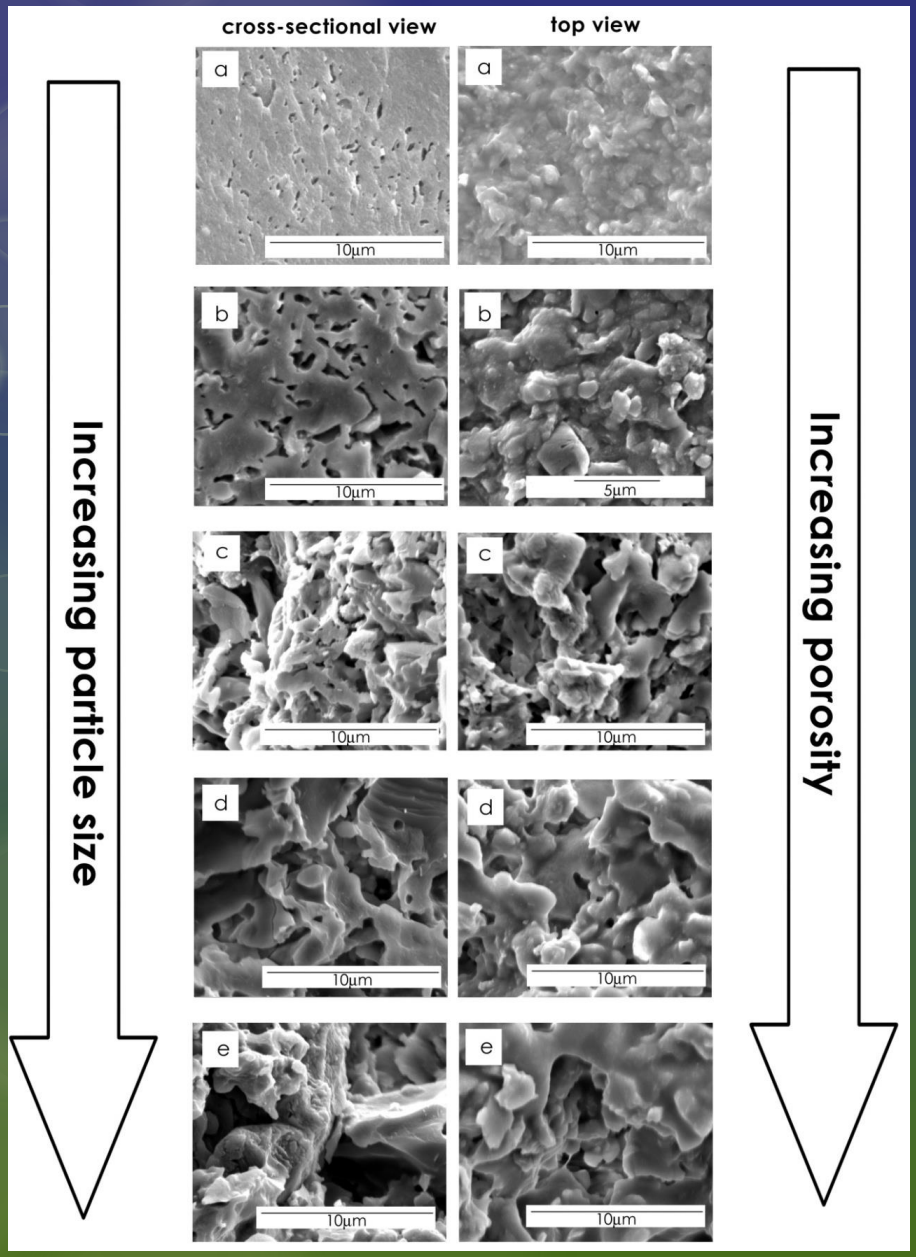
Smallest particles travel the farthest path…


Panzian
<5 µm
Panzian
<10 µm
Panzian
<25 µm


HV
10.00 kV
mag
10 000 x
WD
10.5 mm
10 µm
Kaolinite

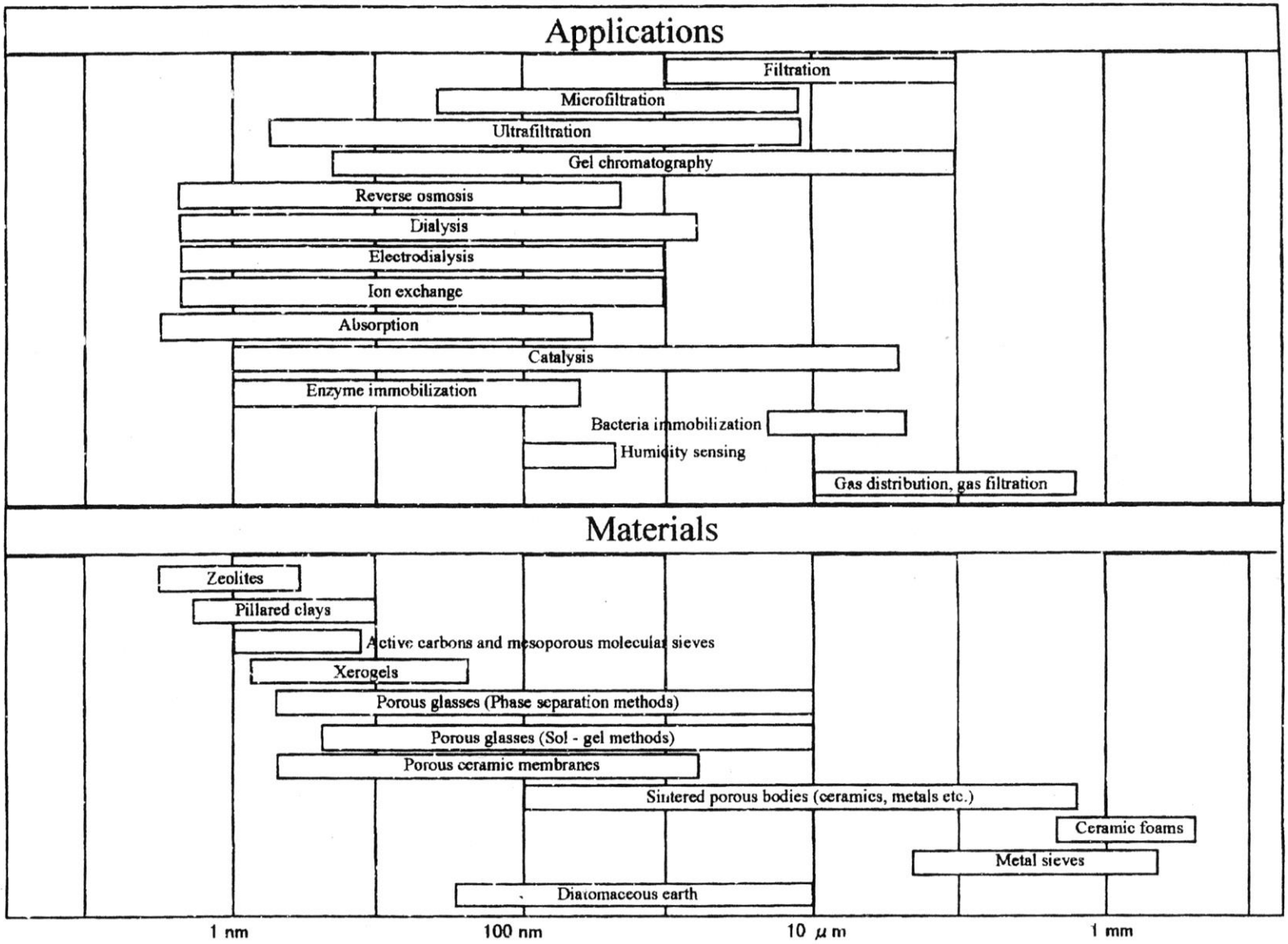


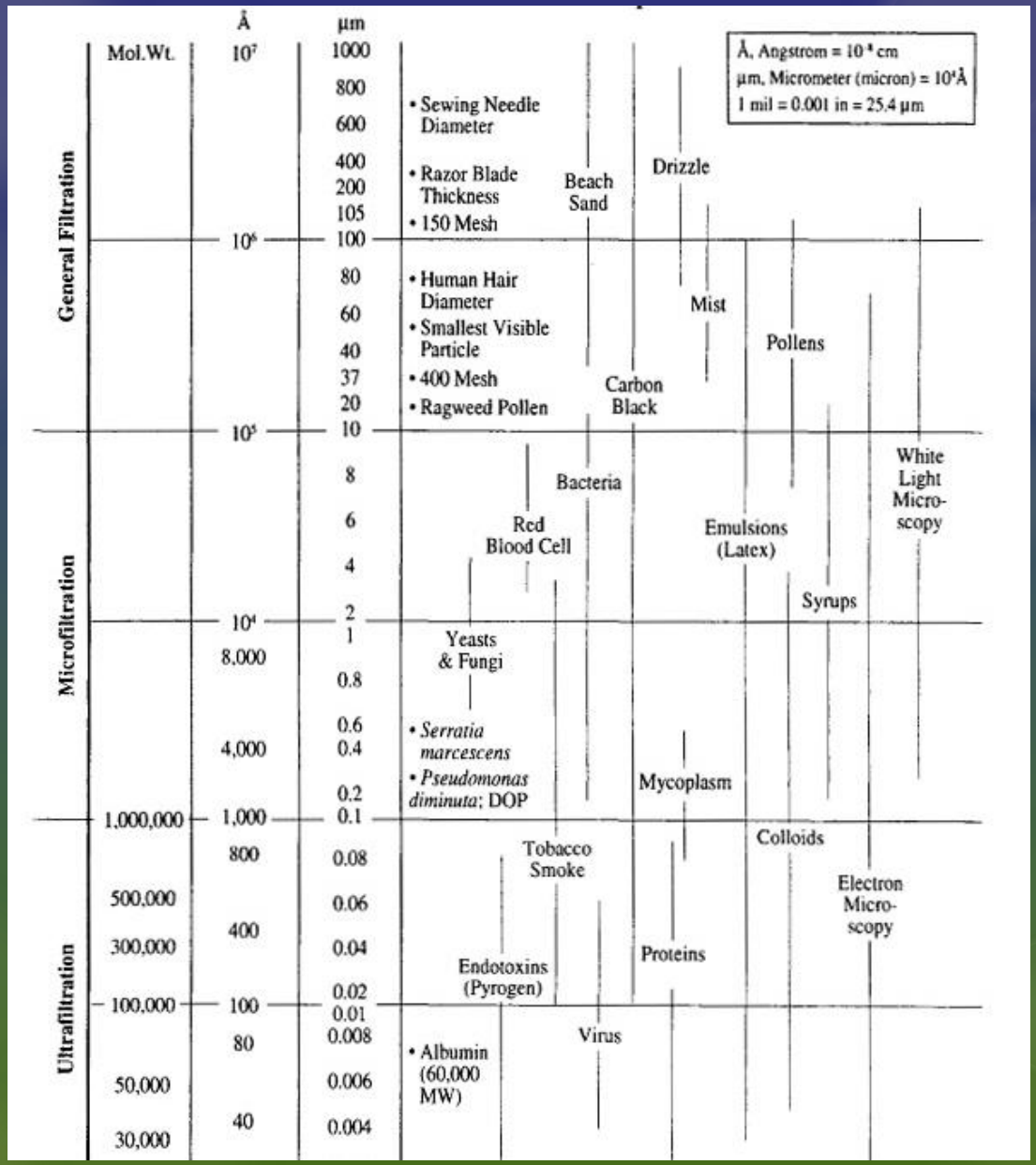
1st generation ceramic filter units (max. 300mL/min); ~25 cm tall; ~5 cm diameter & ~5 mm thick.



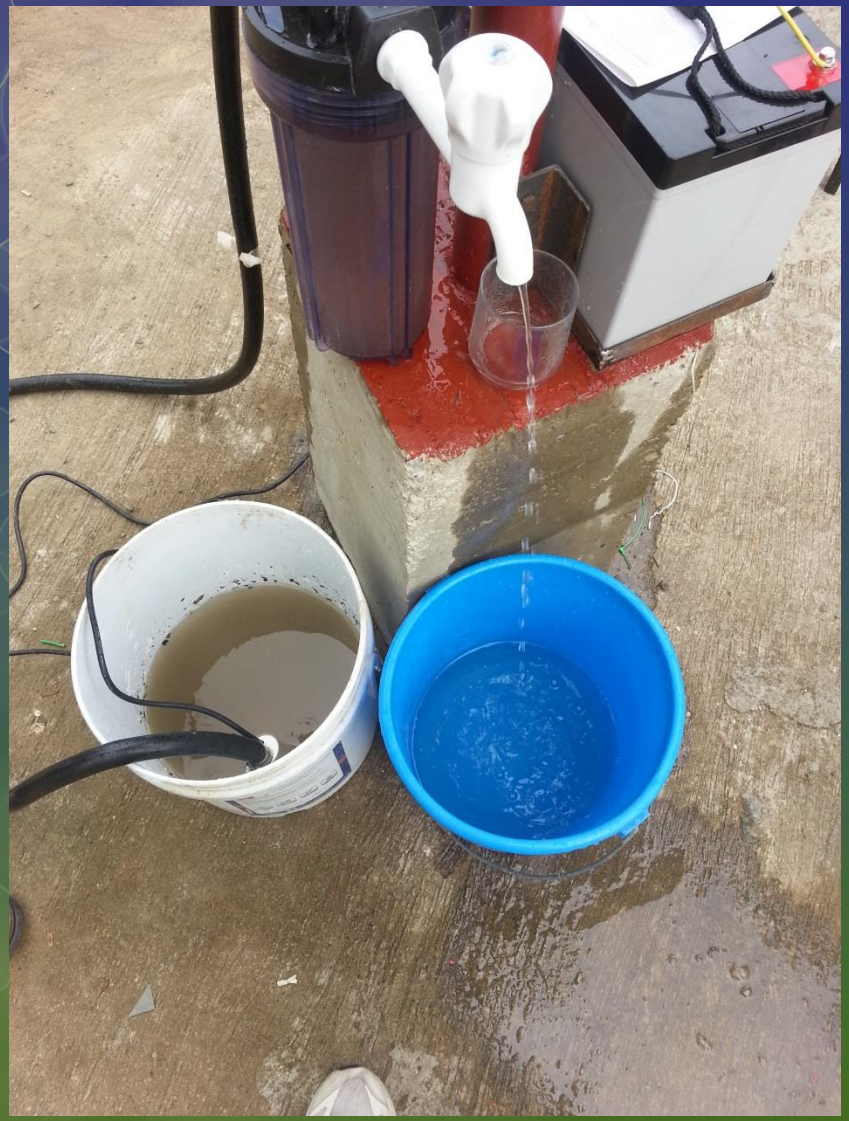
Average pore sizes with equivalent starting particle size:

<1μm : ~0.2μm
<5μm : ~0.5μm
<10μm :~0.75μm
<25μm : ~1μm
<45μm : ~1.5μm


Applications
Filtration
Microfiltration
Ultrafiltration
Gel chromatography
Reverse osmosis
Dialysis
Electrodialysis
Ion exchange
Absorption
Catalysis
Enzyme immobilization
Bacteria immobilization
Humidity sensing
Gas distribution, gas filtration
Materials
Zeolites
Pillared clays
Active carbons and mesoporous molecular sieves
Xerogels
Porous glasses (Phase separation methods)
Porous glasses (Sol - gel methods)
Porous ceramic membranes
Sintered porous bodies (ceramics, metals etc.)
Ceramic foams
Metal sieves
Diatomaceous earth
1 nm
100 nm
10 μm
1 mm


Å
µm
Mol.Wt.
Å, Angstrom = 10⁻⁸ cm
µm, Micrometer (micron) = 10⁴Å
1 mil = 0.001 in = 25.4 µm
General Filtration
Microfiltration
Ultrafiltration
10⁷
1000
800
600
400
200
105
• Sewing Needle Diameter
• Razor Blade Thickness
• 150 Mesh
Beach Sand
Drizzle
10⁶
100
80
60
40
37
20
• Human Hair Diameter
• Smallest Visible Particle
• 400 Mesh
• Ragweed Pollen
Mist
Pollens
Carbon Black
10⁵
10
8
6
4
2
Bacteria
Red Blood Cell
Emulsions (Latex)
Syrups
White Light Micro-scopy
10⁴
1
8,000
0.8
0.6
0.4
0.2
Yeasts & Fungi
• Serratia marcescens
• Pseudomonas diminuta; DOP
4,000
1,000,000
1,000
0.1
Mycoplasm
Colloids
800
0.08
500,000
0.06
400
300,000
0.04
Tobacco Smoke
Electron Micro-scopy
Endotoxins (Pyrogen)
Proteins
100,000
100
0.02
0.01
80
0.008
50,000
0.006
40
30,000
0.004
• Albumin (60,000 MW)
Virus

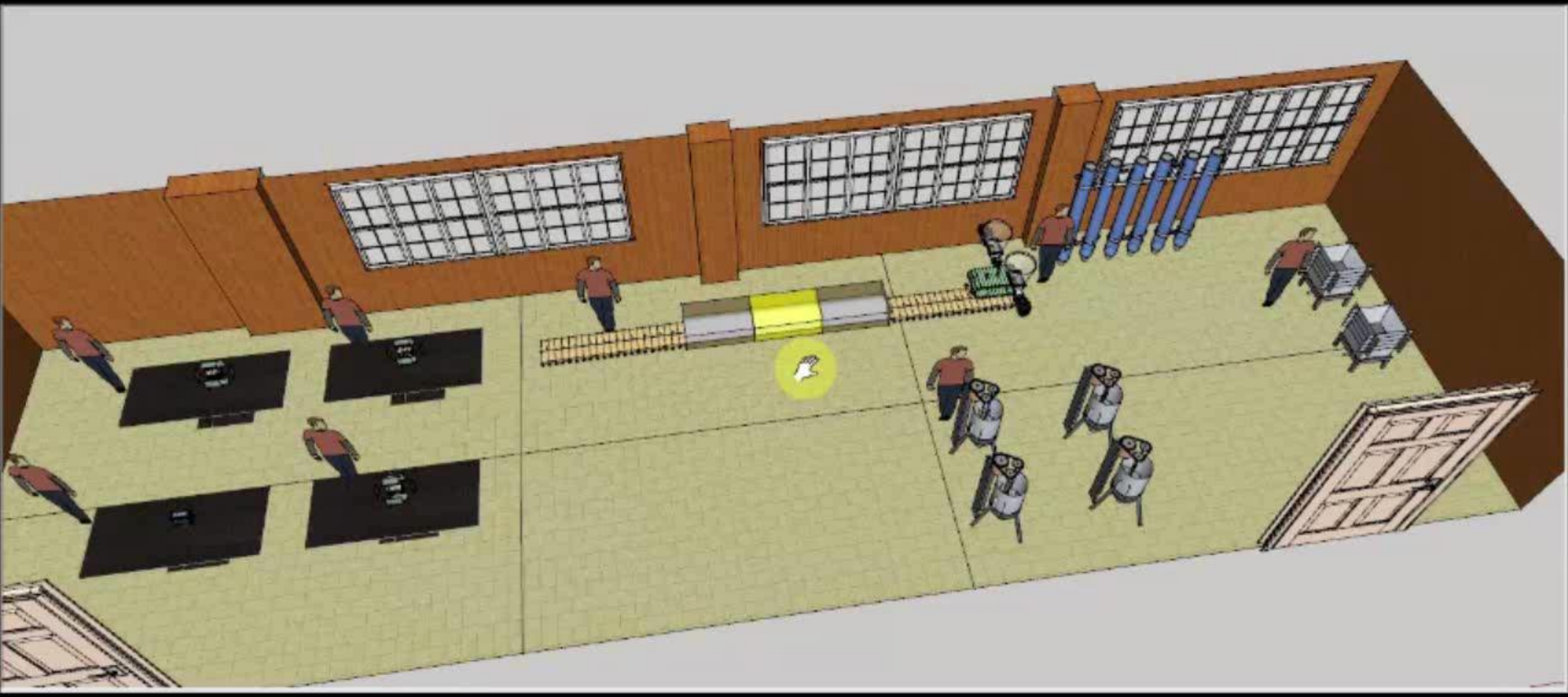
1st generation ceramic filter units



DOST-7 & 8 - Palo, Leyte

2nd generation ceramic filter units

Manufacturing plans



3rd generation ceramic filters