الكلية	الصيدلة
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اسم التدريسي	م.م. عمار عبدالمجيد أحمد
عنوان المحاضرة باللغة الانجليزية	**Filtration Process**
عنوان المحاضرة باللغة العربية	عمليات التنقية
رقم المحاضرة	**8**
المصادر والمراجع	Pharmaceutical Dosage forms and Drug Delivery Systems By Haward A. Ansel; latest edition.
	Sprowel's American Pharmacy.

محتوى المحاضرة

Clarification

- Widely used in the pharmaceutical industry in the preparation of drug substances and drug products.
- Achieved using **filtration** or **centrifugation** techniques.
- Main uses:
    - Remove unwanted solid particles from fluids.
    - Separate a required solid from a fluid.
- Clarification = removal or separation of a solid from a fluid, or a fluid from another fluid.

Types of Filtration

1. Solid–fluid filtration

- Separation of an **insoluble solid** from a fluid by means of a porous medium that retains the solid but allows the fluid to pass.
- Most common type in pharmaceutical manufacture.

Applications (advantages):

- Improve appearance of solutions.
- Remove irritants (e.g., from eye drops or mucosal solutions).
- Produce water of suitable pharmaceutical quality.
- Recover desired solid material (e.g., after crystallization).
- Clarify extracts (e.g., vegetable drug extractions).
- Sterilize liquids or semisolids when heat processes are unsuitable.

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2. Fluid–fluid filtration

- Example: flavoring oils added to formulations as alcohol spirits.
- On mixing with aqueous preparations → some oil separates → turbidity.
- Filtration removes oil droplets, producing clear appearance.

Mechanisms of Filtration

- **A. Straining/Sieving**
    - Pores smaller than removed material retain particles.
    - Filtration occurs at filter surface → **membrane filters**.
    - Risk of blockage; used for low contaminant levels or small volumes.
    - Example: remove bacteria/fibers from parenteral products.
- **B. Impingement**
    - Fluid flow disturbed around filter fibers.

- Particles with sufficient momentum impinge and are retained.
- Main mechanism in **depth filters** (especially for gases).

- **C. Attractive Forces**
  - Electrostatic/surface forces retain particles.
  - Example: dust removal in electrostatic precipitators.
- **D. Auto-filtration**
  - Deposited material ("filter cake") acts as its own filter medium.
  - Used in **metafilters**.

Factors Affecting Filtration Rate

Filtration must remove contaminants at an **economically fast rate**.
Lab example: Büchner funnel & flask.

- **Area (A)**: larger filter area = higher rate.
- **Pressure difference (ΔP)**: driving force, decreases as liquid head drops; vacuum can increase ΔP.
- **Viscosity (μ)**: viscous fluids filter more slowly.
- **Thickness (L)**: thicker filter or cake = slower filtration.

Darcy's Equation: combines these factors.

- Constant **K** = permeability of filter medium/cake.
- Larger **K** = higher filtration rate.

Methods to Increase Filtration Rate

1. Increase filter area (larger filters / parallel units).
2. Increase pressure difference (gravity insufficient → apply vacuum).
3. Decrease viscosity (heat formulation, use dilution if thermolabile).
4. Decrease filter cake thickness (remove or distribute cake).

Filtration Equipment

Ideal properties:

- Fast filtration rate, cost-effective.
- Easy to clean, corrosion-resistant.
- Capable of filtering large volumes before cleaning/replacement.

Selection considerations:

1. **Chemical nature** of product (avoid interactions with filter).
2. **Volume and rate** required.
3. **Operating pressure** (vacuum or high pressure).
4. **Load of material** to be removed (may need prefilters or continuous cake removal).
5. **Degree of filtration** required (pore size, sterility needs, sterilizable equipment).

Centrifugation

- Often used in labs to separate solid from liquid.
- Solid forms a **plug** at the tube bottom after centrifugation