



Program Studi Teknologi Pangan



Departemen Ilmu dan Teknologi Pangan – Fakultas Teknologi Pertanian – Institut Pertanian Bogor




Internationally Recognized Undergraduate Program by IFT & IUFOST



FST 200
Pengantar Teknologi Pertanian



Program Studi Teknologi Pangan
Departemen Ilmu dan Teknologi Pangan, FATETA-IPB



Topik 10b

Pemisahan dan Ekstraksi

Capaian Pembelajaran

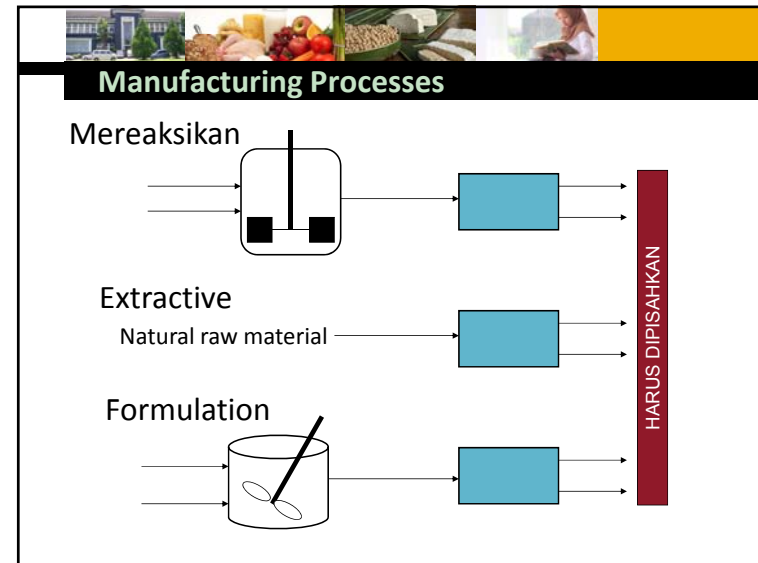
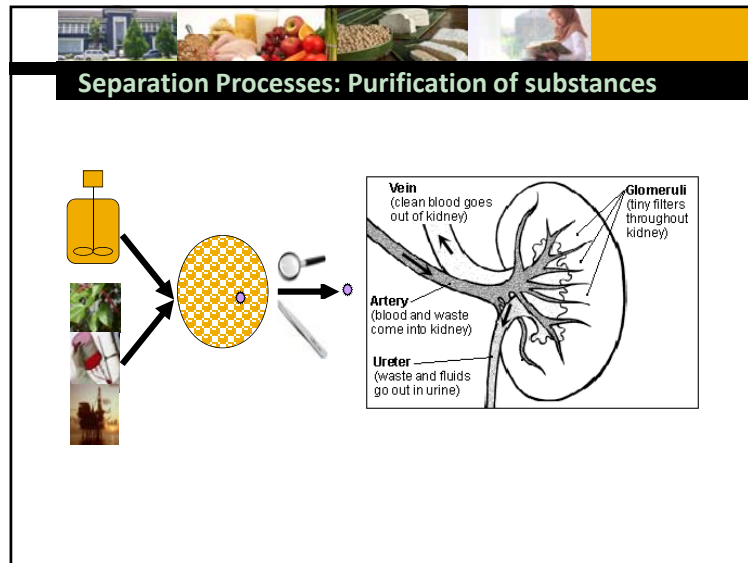
Setelah menyelesaikan topik ini, mahasiswa diharapkan mampu :

- menjelaskan prinsip-prinsip pemisahan dan ekstraksi di dalam proses pengolahan pangan.
- Menjelaskan beberapa teknik pemisahan dan ekstraksi.

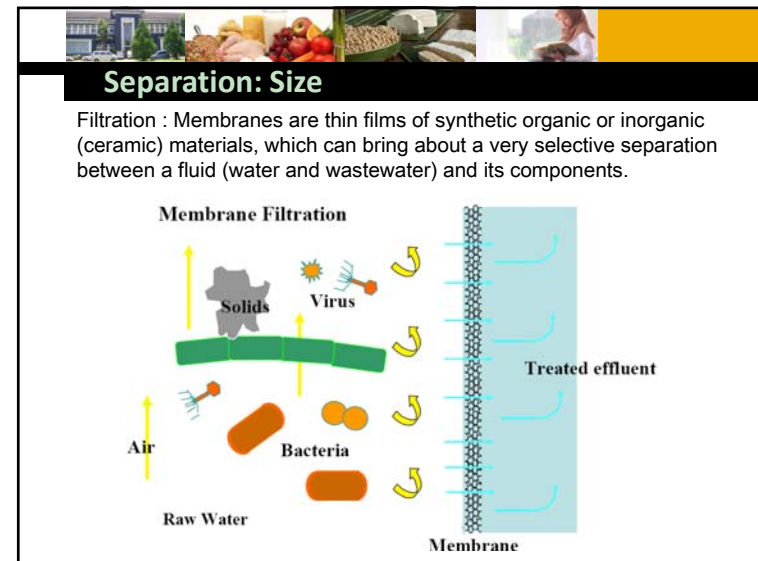


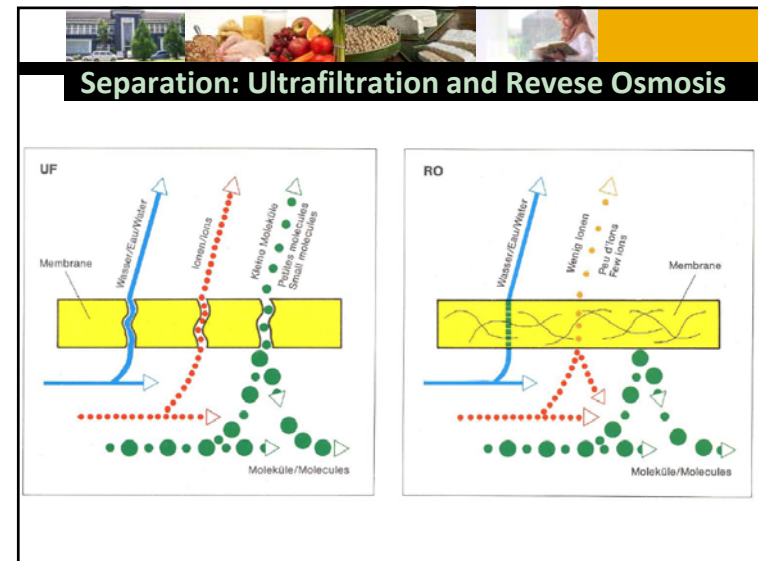
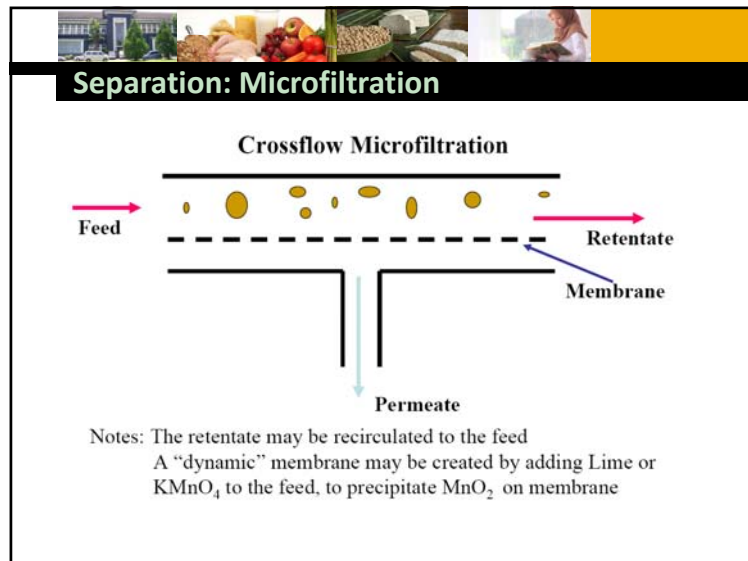
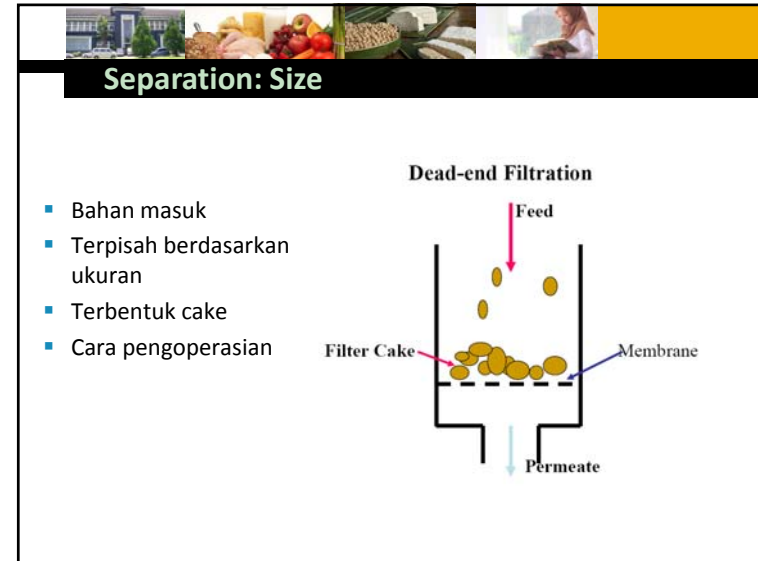
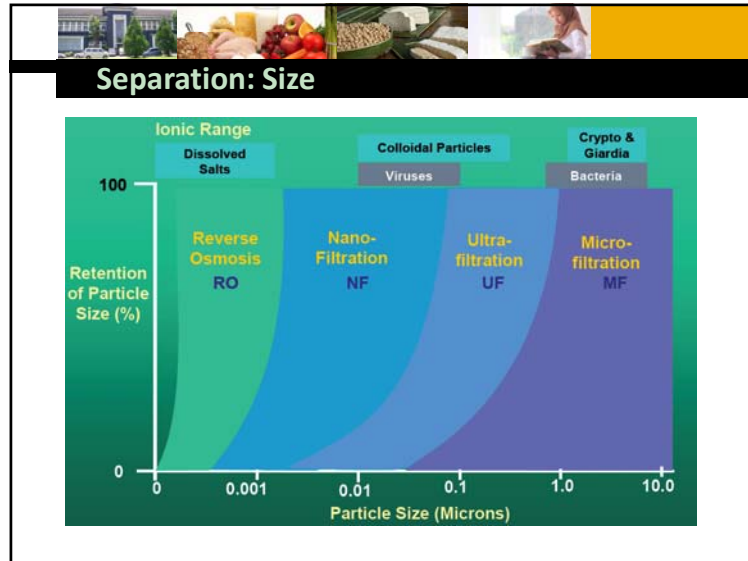
Sub Topik

- 10.1. Prinsip Pemisahan (Separasi)
- 10.2. Prinsip Ekstraksi

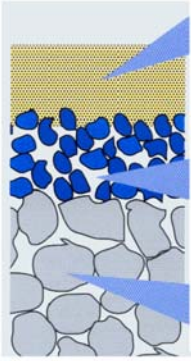


- ### Basis of separation
- Size / Ukuran
 - Shape / Bentuk
 - Charge / Muatan
 - Polarity / Kepolaran
 - Solubility / Kelarutan
 - Volatility / Kemampuan menguap
 - Mobility / Kemampuan bergerak





Separation: Membran Technology



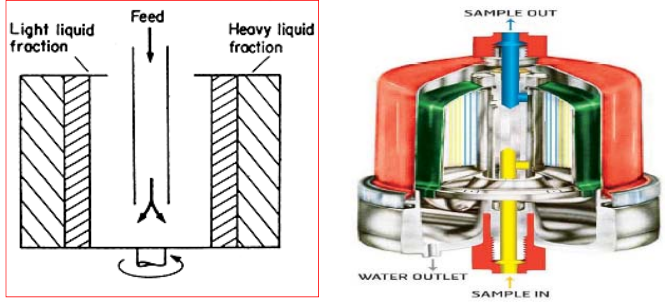
Critical Separation Layer(s)
 Pore Size: 4-50 angstroms
 Thickness: single or multiple thin layers
 Materials: Oxides
 Uses: RO, nanofiltration & molecular sieving

Primary Layer
 Pore Size: 0.005-0.5 μm
 Thickness: 1-20 μm
 Materials: oxides, carbides, nitrides, metals, metal alloys, and carbon
 Uses: Ultrafiltration & microfiltration

Porous Support/Substrate
 Pore Size: 0.5-50 μm
 Thickness: >400 μm
 Materials: Metals, metal alloys, oxides, carbides, nitrides, intermetallics
 Uses: Depth filter & surface-cake filter

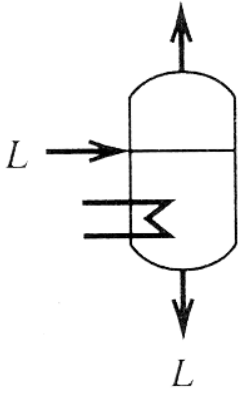
Asymmetric membrane layer configuration. (www.inorganicmembranes.info/uses.html)

Separation: Centrifuge



- Centrifugal force :
 - Radius, speed and the mass of the particle
- Terjadi pemisahan


Separation: Evaporation



- The transfer of volatile components of a liquid into a gas volatilization caused by heat transfer.
- Principle of separation: difference in volatilities (vapor pressure)
- Major applications
 - Humidification
 - Air conditioning
 - Concentration of aqueous solutions.

Separation: Evaporation

- Laju evaporasi dipengaruhi oleh:
 - sifat ikatan air pada bahan pangan
 - luas permukaan
 - suhu proses
 - kecepatan udara
 - kelembaban udara
 - laju penguapan
- Contoh aplikasi:
 - Susu evaporasi, konsentrat buah, dll



Separation: Evaporation

- Evaporator:
 1. *Pan/Kettle evaporator* : penguapan langsung
 2. *Vacuum pan evaporator*
 - P vakum
 - titik uap air lebih rendah
 - evaporasi pada $T < 100^{\circ}\text{C}$
 - mutu produk lebih baik
 3. *Plate evaporator*
 4. *Film evaporator*
- Proses evaporasi : *single effect, multiple effect*

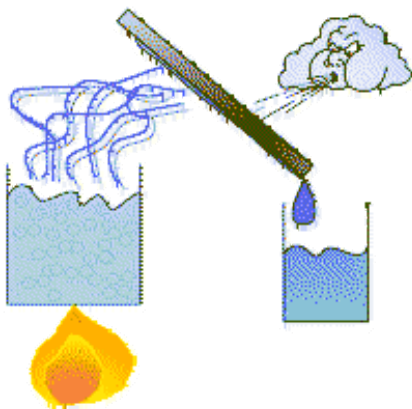



Separation: Distilasi

- **Definisi Distilasi atau penyulingan**
 - pemisahan bahan kimia berdasarkan perbedaan kecepatan atau kemudahan menguap (volatilitas)
- **Teori dasar**
 - pada suatu larutan, masing-masing komponen akan menguap pada titik didihnya
 - Model ideal : Hukum Raoult dan Hukum Dalton.
- **Tahapan proses**
 - Campuran zat dididihkan hingga menguap
 - Uap didinginkan kembali ke dalam bentuk cairan
 - Zat dengan titik didih lebih rendah, menguap lebih dulu.
- **Prinsip : perpindahan massa.**

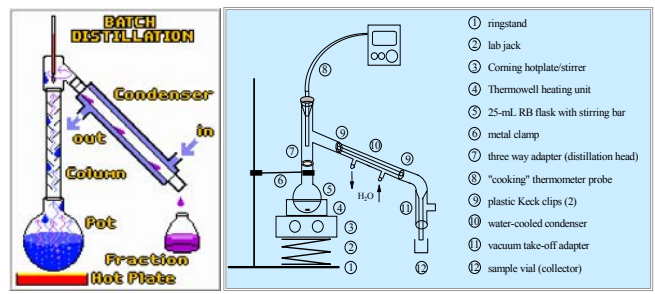


Separation: Distilasi

Separation: Distilasi

Simple Distillation Setup



- ① ringstand
- ② lab jack
- ③ Corning hotplate/stirrer
- ④ Thermowell heating unit
- ⑤ 25-ml. RB flask with stirring bar
- ⑥ metal clamp
- ⑦ three way adapter (distillation head)
- ⑧ "cooking" thermometer probe
- ⑨ plastic Keck clips (2)
- ⑩ water-cooled condenser
- ⑪ vacuum take-off adapter
- ⑫ sample vial (collector)

Separation: Distilasi

Simple Distillation Setup

Separation: Distilasi

- Distilasi fraksional; perbedaan titik didih yang kecil
- Faktor yang mempengaruhi :
 - Tipe campuran; makin tinggi selisih titik didih, makin mudah dipisahkan
 - Pengaturan fisik untuk mempertahankan perbedaan suhu
 - Pengendalian suhu

Separation: Distilasi

Industrial Distillation

Separation: Distilasi

Distillate Samples

Separation: Distilasi

Steam Distillation for the Extraction of Essential Oils

The diagram illustrates the steam distillation process. Steam enters the bottom of a retort containing plant material, causing it to vaporize. The resulting mixture of steam and oil vapors moves into a condenser, which is cooled by circulating cold water. The condensed liquid then enters a separator. The separator is designed so that the lighter essential oil floats on top and is collected from the top, while the heavier hydrolate settles at the bottom and is collected from there.

Extraction: Liquid-liquid Extraction

- Transfer of solute from one liquid to another
- Depends on the partition behavior of the solute
- Used when
 - Solute and solvent have similar volatility
 - Solute is thermolabile
 - Solute and solvent form azeotropic mixture
 - Solute concentration is low

Extraction: Lab Liquid-liquid Extraction

The image shows various types of separatory funnels used in laboratory liquid-liquid extraction. The first set shows four different designs: Teflon with a smaller funnel size, Teflon with a straight stem, Teflon with a ground glass stopper, and ground glass. The second set shows two funnels containing two immiscible liquid phases: diethyl ether (top) and water + food color (bottom). A checkmark is placed next to the top funnel, indicating it is the preferred design.

- Distilasi tidak bisa dilakukan;
- heat sensitive, selisih titik didih sangat kecil
- Prinsip : perbedaan kelarutan di dalam cairan 2 phase

Liquid-liquid Extraction: Sequence of events

- Mixing or contacting
- Phase separation
- Collection of separate phases

Extraction: Lab Procedures

closed!

METHYLENE CHLORIDE

Extraction: Shaking, Gas Release

layers just beginning to separate

METHYLENE CHLORIDE


Separation

layers just beginning to separate

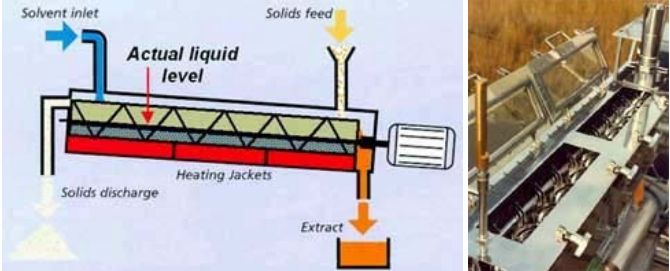
store cap unassembled!

Extractors

layers just beginning to separate



Continuous Counter-Current Extraction



The Niro CONTEX™ features true continuous counter-current extraction



Minggu 11

Mutu dan Keamanan Pangan