Proses Hulu dalam Bioteknologi Industri

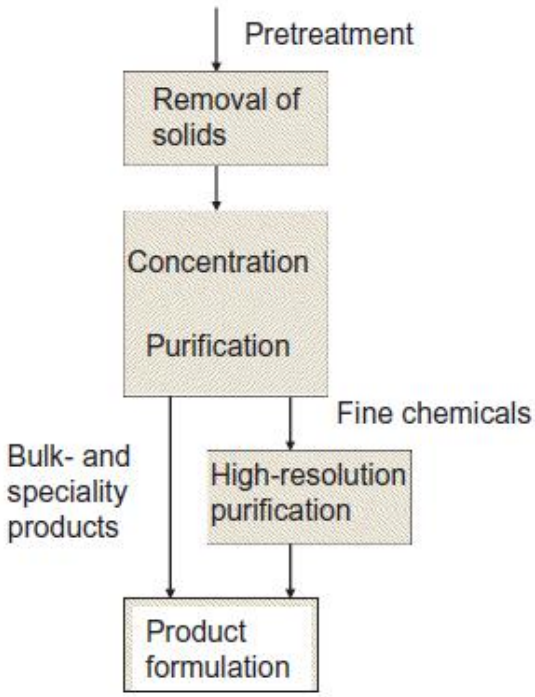
Nur Hidayat

Pendahuluan

- Downstream processing (DSP)/Pengolahan hilir (DSP) menyiratkan penapihan produk bioteknologi dari bioreaktor dan pemurnian untuk bentuk yang diharapkan
- Produk Bioteknologi industri umumnya dikelompokkan dalam kemikalia, material dan bahan bakar
- Sebagai produksi terutama didasarkan pada teknologi fermentasi dan Biocatalysis,
- titik awal pengolahan hilir seringkali merupakan salah satu dari fermentasi cair bahan yang mengandung sel-sel penghasil, nutrisi, metabolit, substrat yang tidak dikonsumsi, produk-samping, dll dalam volume besar air atau campuran reaksi yang mengandung sel-sel enzim / utuh (bebas atau imobilisasi), reaktan, pelarut, air, dan sisi - produk.

Pendahuluan

- The main challenges in downstream processing thus involve separation of the product, which is often formed in relatively low concentrations, from a multitude of other components, especially those with similar properties as the product itself
- conventional sequence of separations starts with the use of techniques that separate components having largest difference in physiochemical properties and ending with separation of molecules with more or less similar properties
- This makes separation of the soluble product from cell mass or biocatalyst a primary recovery operation



Pendahuluan

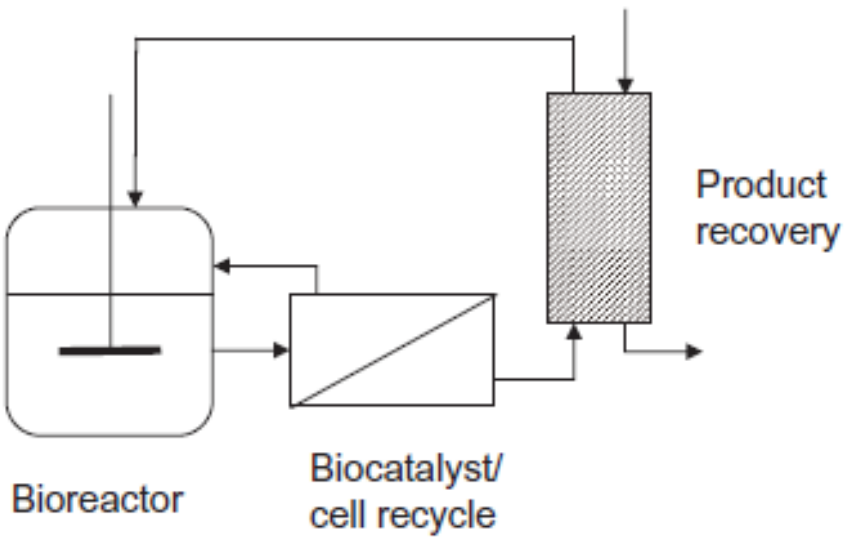
- Dalam kasus produk intraselular, misalnya, protein dan biopolimer lain, sel-sel harus dirusak untuk membebaskan produk diikuti oleh langkah pemisahan padat - cair.
- Partikel - bebas cair kemudian diproses untuk konsentrasi dan pemurnian produk menggunakan sejumlah unit operasi, pilihan didefinisikan tidak hanya oleh sifat dari produk tetapi juga oleh kompleksitas pemisahan, skala operasi, ekonomi, dan kemurnian yang diinginkan dari produk.

Pendahuluan

- Pentingnya DSP untuk proses diwujudkan oleh pengaruhnya terhadap total biaya produksi.
- Disarankan bahwa DSP biasanya menyumbang 50-70% dari total biaya produksi untuk produk fermentasi, karena produk massal biaya bisa di kisaran 10 - 50%, dan hingga 90% untuk produk - produk farmasi kemurnian.
- Produksi bioteknologi bregerak menuju volume besar, bahan kimia berharga rendah, sehingga perlu untuk meminimalkan biaya dengan memaksimalkan efisiensi pemisahan dengan masukan energi minimal dan rendah limbah

Pendahuluan

- Penting untuk mempertimbangkan strategi pengolahan hilir ketika merancang bioproses.
- Sebuah pilihan optimal dari teknik pemisahan sangat penting.
- Namun aspek lain yang menarik adalah kemungkinan memanfaatkan pemisahan produk sebagai sarana panen produk secara langsung dari bioreaktor



Separations in Industrial Biotechnology

- **Separation of Solid Particles**
  - **Filtration**
  - **Microfiltration**
  - **Centrifugation**
  - **Hydrocyclone**
  - **Flotation and Extraction**
- **Cell Disruption for Release of Cell - Associated Products**

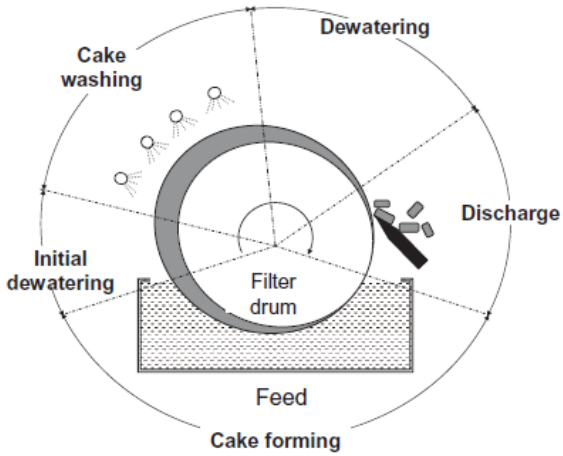


Figure 8.3 A rotary drum vacuum filter and its operation. The equipment comprises a rotating drum covered with a filter partially immersed in a tank of particulate broth. The drum is maintained under reduced internal pressure and rotated at a slow speed, picking up the biomass that is deposited as a cake on the filter surface. The continuous rotation of the drum allows dewatering, washing, and drying of the filter cake to be performed prior to its discharge from the drum surface. The filter is normally pre-coated with a filter aid.

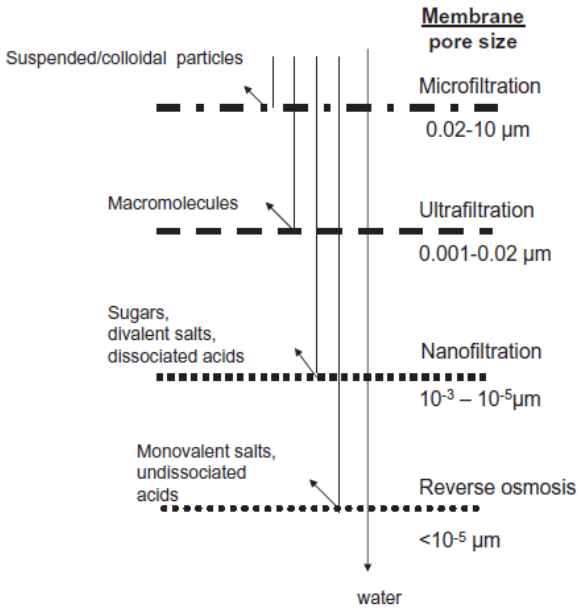


Figure 8.4 Types of membrane filtration operations used in biotechnology for separations according to size [11].

Separations in Industrial Biotechnology

- **Size - Based Separation of Molecules**
  - **Membrane Filtration**
  - **Size Exclusion Chromatography**
- **Separations Based on Product Volatility**
  - **Distillation**
  - **Gas Stripping**
  - **Membrane Distillation and Pervaporation**
- **Separations Based on Product Solubility**
  - **Extraction**
  - **Precipitation and Crystallization**

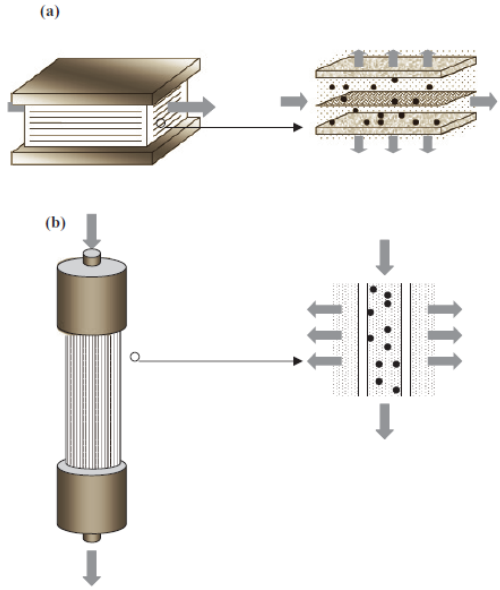


Figure 8.9 Crossflow filtration systems: (a) Plate and frame system having stacked membranes interspersed with spacers, and (b) hollow fiber cartridge comprising a bundle of membrane capillaries in a tubular module. Particles and molecules larger than the membrane pore size are retained on the membrane while smaller solutes pass through the membrane.

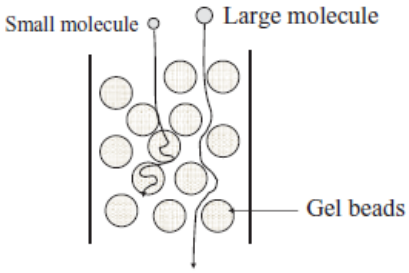
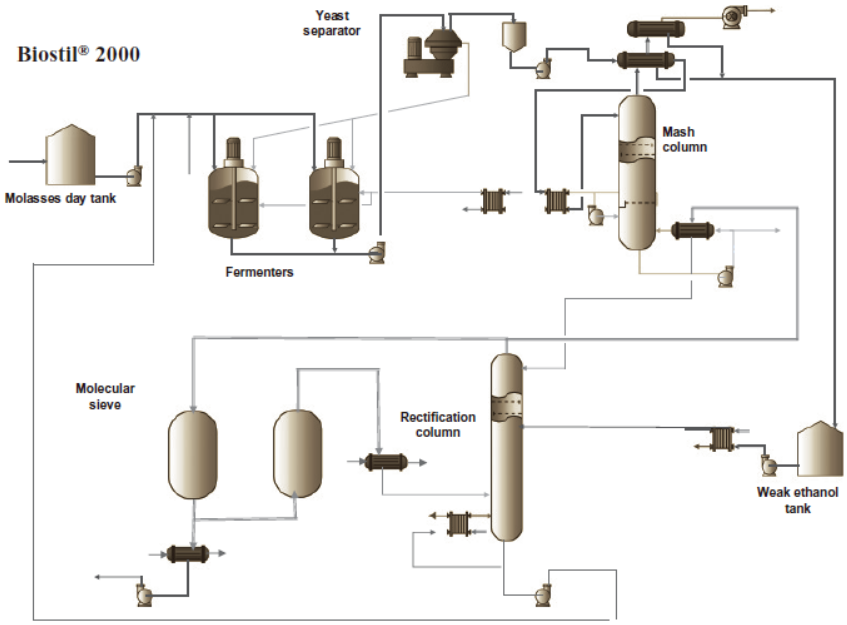


Figure 8.10 Size exclusion chromatography for separation of molecules varying in size. The stationary phase comprises a matrix with a defined pore size range to allow small molecules into the pores and delaying their passage through the column, while the larger molecules are excluded and pass unhindered through the column with the mobile phase.

- **Molecular Separations Based on Adsorption to a Solid Matrix**
  - **Adsorption Chromatography**
  - **Continuous Chromatography**
- **Molecularly Imprinted Materials for Selective Product Capture**
- **Membrane Separation of Ionic Solutes: Electrodialysis**
- **Chiral Separations Using Membranes**
- **Drying/Solvent Removal**

Examples of Downstream Processing of Different Product Groups

- **Alcohols**
- **Organic Acids**
- **Amino Acids**
- **Enzymes and Proteins/Peptides**
- **Antibiotics**
- **Carotenoids**
- **Biosurfactants**
- **Polyhydroxyalkanoates**



PUSTAKA

Rajni Hatti – Kaul.2010. **Downstream Processing in Industrial Biotechnology in** *Wim Soetaert and Erick J. Vandamme (ed).* **Industrial Biotechnology.** WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim.