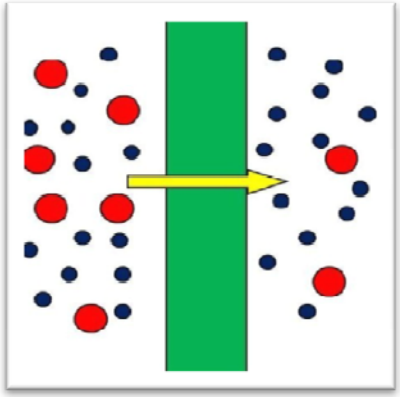
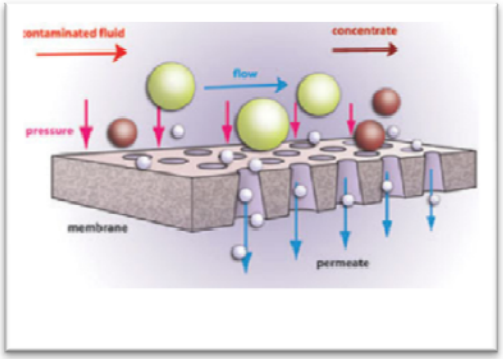
Membranes

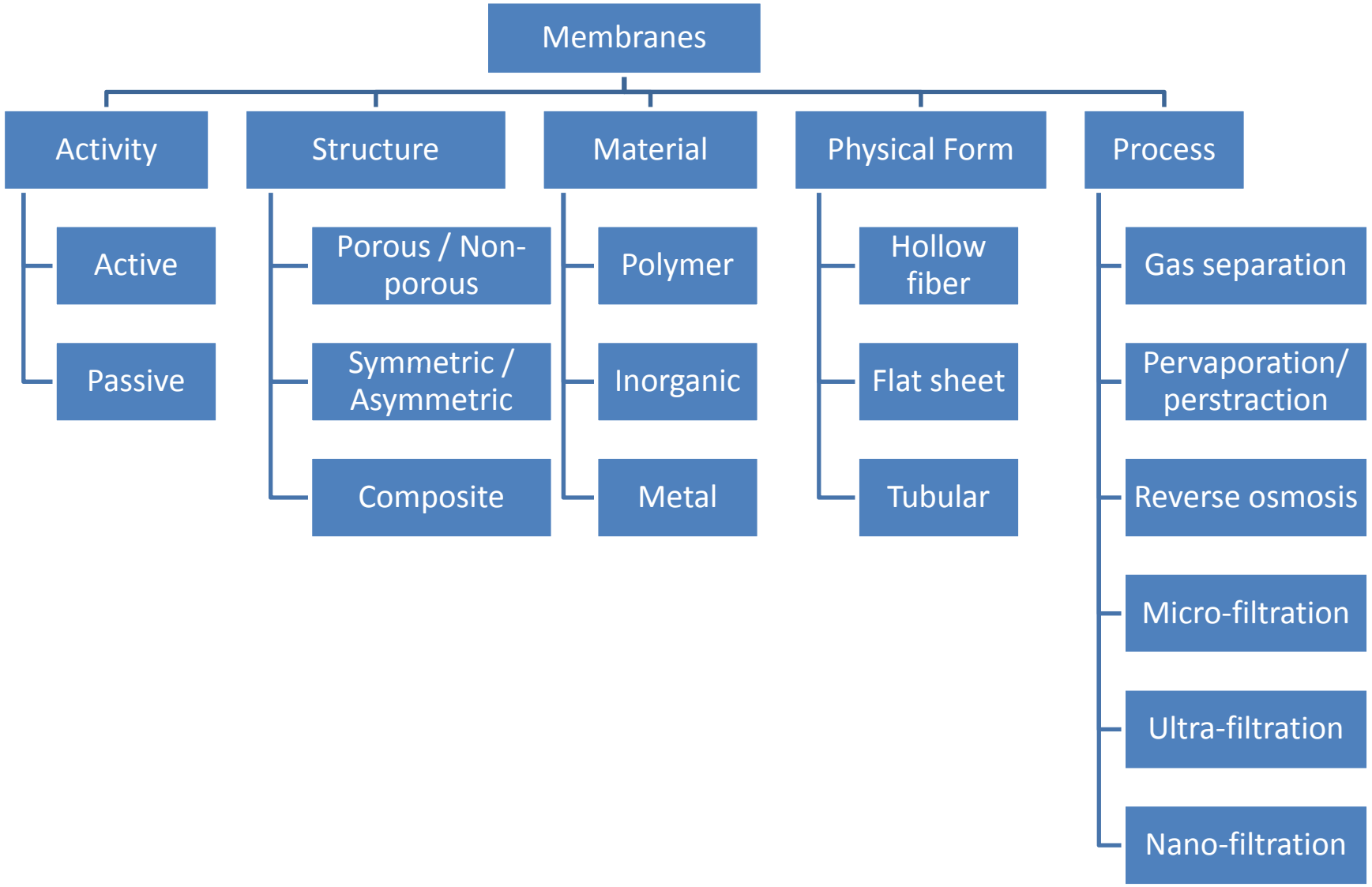
Background for Membrane

- Membrane
  - Membrane is a thin barrier, which permits selective mass transport
  - Permeation rate and transport mechanism depends on
    - Magnitude of driving force (pressure, temperature, current)
    - Size and shape of permeating species
    - Nature of permeant / membrane material





Membrane Classification



Scientist

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Areas of interest :

Processes using polymeric membranes

- Ultra filtration,
- Gas permeation,
- Proton exchange membranes,
- Perstraction

Web: http://www.ncl-india.org/people/showframe.jsp?personid=20

NCL Competencies

Gas separation membranes

- Spiral wound thin film composite (TFC) membranes used
- Output of 7-10 lit/min. with 30 -35% oxygen content
- Requires dry air at 7 bar approximately
- Consist of 3-5 spiral modules
- Weight: 7-8 kg

Ultrafiltration membranes for drinking water

- Spiral module of approximately 1 meter length
- Up to 1lit/min. of flow rate is achievable at tap water pressure of 0.5 bar
- 5 log reduction for viruses
- 7-9 log reduction for bacteria

Proton Exchange Membrane for Fuel Cell

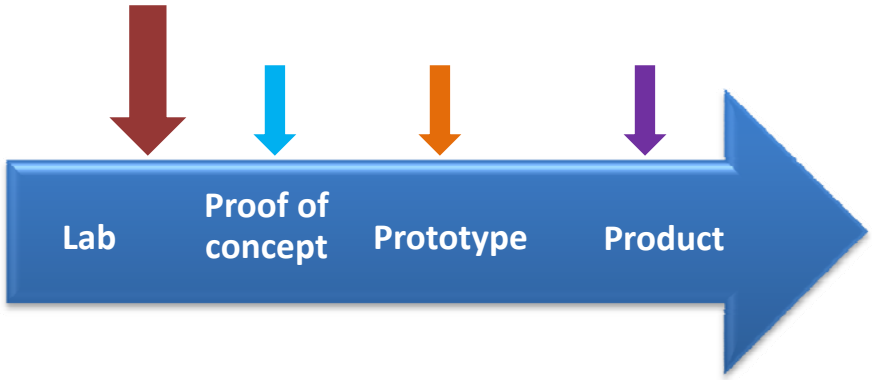
Perstraction

Know How: Process for making membranes

Representative Markets

Healthcare	■
Automotive	■
Construction	
Agriculture	
Entertainment	
Infrastructure	
Personal care	
Industrial	■
Water	■

Technology Status



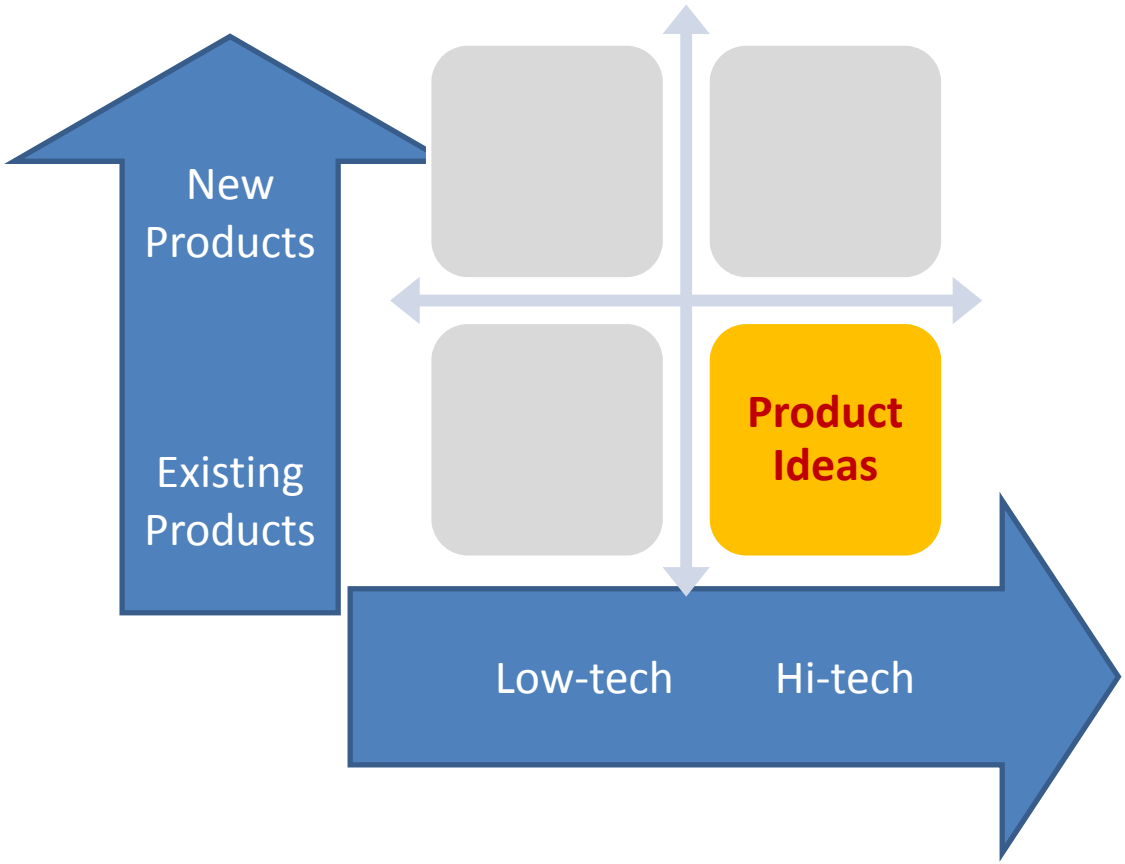
Costs Associated with Technology

Major costs/risks

- Key raw materials
- Additional materials
- Cost of manufacturing
- Regulatory cost
- Certification cost & quality control
- Scale of production
- IP costs
- Human resources cost
- **Capital expenditure**

IP Status

- IN 199837
- IN 226551
- IN 215506
- WO 05021469 A1
- US0050006302A1


New Products
Existing Products
Product Ideas
Low-tech
Hi-tech

Membranes

Membrane Modules for Home Drinking Water

MEMBRANES

Use

- Home online water purifier
- Table top water purifier

Mechanism

- Substances smaller than the pore size of the membrane pass with the solvent as permeate while larger solutes or particles are retained as concentrate

Key Engineering Parameters

- Length discharge: 40 liter at 0.5 Bar
- Molecular weight cut off: 70 kDa

Price

- Rs 2495 per unit

Market Segment

- Low cost mass market water purification – Rs. 300 crore

Repr. Manufacturers

- Foreign
  - Dow
- Indian
  - Aqua-plus water purifier (P.) Ltd.

Source: http://www.aquaplusltd.com/membmodule.html
http://www.dow.com/liquidseps/prod/tw30_181224.htm http://www.priceindia.in/consumer-electronics/kent-water-purifier-price-list/

Purioin

Use

- Online water purifier

Mechanism

- Based on ultrafiltration technique
- Gravity driven process

Key Engineering Parameters

- Water flow rate: 1 litre/min.

Price

Market Segment

- Low cost mass market water purification – Rs. 300 crore

Repr. Manufacturers

- Indian
  - Membrane filters(India) pvt. Ltd.

Source: http://www.telegraphindia.com/1060313/asp/knowhow/story_5963635.asp /

Membrane for Clear Fruit Juices without Color Loss

Use

- Clear fruit juice generation without color loss
  eg. apple, pineapple, cherry, grape

Mechanism

- Substances smaller than the pore size of the membrane pass with the solvent as permeate while larger solutes or particles are retained as concentrate

Key Engineering Parameters

- Yield: up to 98%
- Capacity: ~ 170,000 liters per day
- Size: 4.3-inch diameter modules

Price

Market Segment

- Fruit juice processing

Repr. Manufacturers

- Foreign
  - Koch membranes systems

Source: http://www.kochmembrane.com/prod_supercor.html

UF Membrane for Electrocoat Painting of Automotives

Use

- Removes suspended solids and oily waste from high volume

Mechanism

- Substances smaller than the pore size of the membrane pass with the solvent as permeate while larger solutes or particles are retained as concentrate

Key Engineering Parameters

- Inlet pressure: 3 - 5 bar @25^{0}C
- pH range: 3 - 7

Price

Market Segment

- Automotive painting

Repr. Manufacturers

- Foreign
  - Koch Membrane Systems, Inc

Source: http://www.kochmembrane.com/pdf/SPIRAPAK%204038-HFM-183-LPP3.pdf

Membrane for Hydrogen Separation

Use

- Hydrogen separation at high temperature

Mechanism

- Gases are separated due to their different solubility and diffusivity in polymers

Key Engineering Parameters

- High temperature stability up to 250^0C

Price

Market Segment

- Gas separation

Repr. Manufacturers

- Foreign
  - Pall corporation

Source: http://www.pall.com/pdf/Gas_Separation_Membrane.pdf

Membrane Module for Nitrogen Separation

Use

- Nitrogen separation purposes

Mechanism

- Gases are separated due to their different solubility and diffusivity in polymers

Key Engineering Parameters

- Yield: 95% at 25 degree Celsius

Price

Market segment

- Gas separation

Repr. Manufacturers

- Foreign
  - DIC Corporation

Source: http://www.pall.com/pdf/Gas_Separation_Membrane.pdf
http://www.dic.co.jp/en/products/membrane/separel_gas/pdf/separel_gas_en.pdf

Filtration Water Bottle/ Straw

PiMag-fliptop bottle

Nikken

LifeStraw

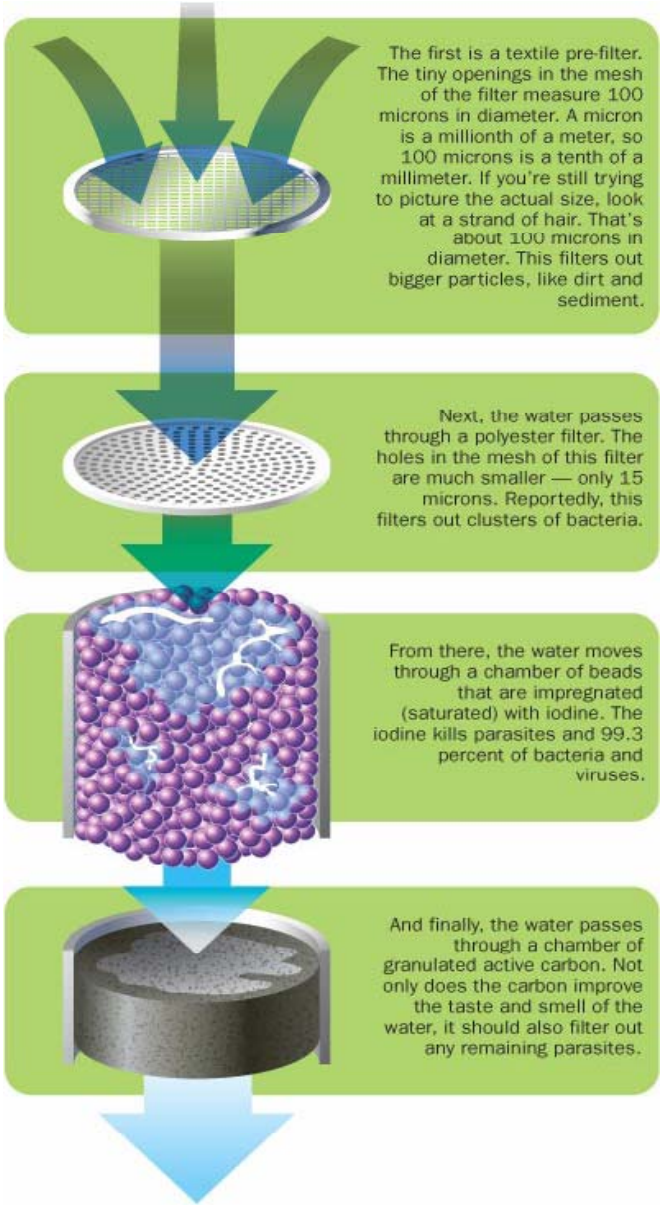
Vestergaard Frandsen

Use

- Water purification

Market Segment

- Low cost mass market water purification – Rs. 300 crore



Source: http://www.frequencyrising.com/nikken.htm http://www.vestergaard-frandsen.com/lifestraw-introduction.htm