MEMBRANES FOR GAS/LIQUID SEPARATION

NCL Innovations: Solutions from CSIR India
Technology

- A method for preparation of aromatic polyester based membranes from readily available raw materials by conventional methods, with high yield
  - These membranes can be used for separating various gases (e.g., hydrogen from methane, helium from nitrogen, oxygen from nitrogen etc.)

- A method for preparation of PDMS based thin film composite membranes that can be used for
  - Pervaporation (alcohol dehydration, aroma recovery)
  - Perstraction (recovery of nonvolatile acids)
Applications

- Oxygen enriched air for medical applications
- $O_2/N_2$ enrichment, biogas processing, $H_2$ recovery (hydroprocessing purge systems, ammonia & petrochemical plant), synthesis gas ($H_2/CO$) ratio adjustment
- Aroma recovery in perfume industry
- Fragrance and flavor separation in food industry
- Removal of organics from water, water from organics, organic / organic separation
- Separation of organic and inorganic acids
- Separation of acids from complex mixtures like fermentation broths
Market Potential

- The world wide market demand for membranes has been predicted to reach $15 billion in 2012, growing at the rate of 8.6% annually*

- Global oxygen concentrator market has been valued at $1.2 billion in 2011 and further growth predicted^ - illustrating the potential for use of membranes in this market

- Membranes have great potential to be used in the flavor and fragrance industry. The flavour and fragrance industry in 2010 had revenues of over $20 billion), and has a high growth rate**

---

*World Membrane Separation Technologies Industry Study with Forecasts for 2012 & 2017, Study #2468, April 2009, Page 393- Freedonia
**http://www.leffingwell.com/top_10.htm
Value

- **Gas separation membranes**
  - Made from readily available raw materials, conventional methods of preparation (low cost), with high yield
  - Can be easily processed (the polymers used are soluble in common solvents)
  - Possess a very good combination of gas selectivity and permeability
  - Very stable at high temperatures

- **Pervaporation/Perstraction membranes**
  - High fluxes
  - High selectivity
  - Operational simplicity
  - Low energy requirements
Technology Status, IP Status

- Oxygen enrichment for medical applications: prototype developed and demonstrated at various hospitals in the country
- Other membranes: demonstrated at lab scale for various applications
- On the look out for partners to license/scale up technology
- US patent (6420511 B1) has been granted – for gas separation membranes
- Ready to be licensed
Links & References

- World membrane separation technologies- Industry Study with Forecasts for 2012 & 2017, Study #2468, April 2009, 393 pages- Freedonia
- Oxygen Concentrators: A Dual Market, Tuesday, 06 July 2010- http://www.medicalbuyer.co.in/2007/oxygen-concentrators-a-dual-market-2669-41.html (viewed 06/05/11)

Contact Info:

Dr. Magesh N.
Scientist, NCL Innovations
National Chemical Laboratory
Pune - 411008
Phone: +91-20-2590-2982
Fax: +91-20-2590-2983
Email: m(dot)nandagopal(at)ncl(dot)res(dot)in
### Technology Summary

<table>
<thead>
<tr>
<th><strong>Technology title</strong></th>
<th>Membrane for gas/liquid separation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Industry /sector</strong></td>
<td>Medical, food, perfume, chemical industry</td>
</tr>
<tr>
<td><strong>Year of development</strong></td>
<td>2002</td>
</tr>
<tr>
<td><strong>Related patents (with links)</strong></td>
<td>US patent (6420511 B1)</td>
</tr>
<tr>
<td><strong>Technology readiness level</strong></td>
<td>Demonstrated at lab-scale; Prototype demo-ed for O₂ enrichment for medical appl.</td>
</tr>
<tr>
<td><strong>Licensing status</strong></td>
<td>No current licenses/Ready to be licensed</td>
</tr>
<tr>
<td><strong>Encumbrances</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Availability</strong></td>
<td>Yes</td>
</tr>
</tbody>
</table>