Acrylic Acid & Esters

Tecnon OrbiChem Marketing Seminar at APIC 2012
Kuala Lumpur, 17 May 2012

Keiji Wakatsuki, Tecnon OrbiChem
• World supply/demand balance becoming long
  o Consolidation in recent years by major global producers, but new Chinese capacity additions exceed demand growth
  o SAP demand growth is strong, particularly in the developing world
  o Paints and coatings demand is weak-to-modest
• High propylene prices are challenging production economics
  o US faces high propylene prices and imports of downstream acrylates
  o China importing propylene to produce acrylic acid and acrylates – not viable long-term
• Technology trends are toward bio-based feedstock but issues of land use for food vs. chemicals may limit this
• US investment growing due to shale gas expansions

Source: Tecnon OrbiChem
APIC 2012
WORLD ACRYLIC ACID SUPPLY & DEMAND

Source: Tecnon OrbiChem
APIC 2012
CHINA ACRYLIC ACID SUPPLY & DEMAND

Source: Tecnon OrbiChem
### APIC 2012

#### ACRYLIC ACID CAPACITY ADDITIONS

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>ktpa</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jiangsu Jurong</td>
<td>Taixing, China</td>
<td>160</td>
<td>Dec 2011</td>
</tr>
<tr>
<td>Sanmu Group</td>
<td>Taixing, China</td>
<td>160</td>
<td>Jan 2012</td>
</tr>
<tr>
<td>FPC</td>
<td>Mailiao, Taiwan</td>
<td>160</td>
<td>Cancelled</td>
</tr>
<tr>
<td>Zhejiang Satellite</td>
<td>Jiaxing City, China</td>
<td>60 e</td>
<td>Jan 2012</td>
</tr>
<tr>
<td>LG Chem</td>
<td>Yeosu, S Korea</td>
<td>160</td>
<td>Mid 2012</td>
</tr>
<tr>
<td>CNOOC</td>
<td>Huizhou, China</td>
<td>160</td>
<td>Jun 2012</td>
</tr>
<tr>
<td>Jiangsu Jurong</td>
<td>Taixing, China</td>
<td>160</td>
<td>Late 2012</td>
</tr>
<tr>
<td>SAMC</td>
<td>Jubail, Saudi Arabia</td>
<td>160</td>
<td>Q2 2013</td>
</tr>
<tr>
<td>Oita Chemical</td>
<td>Oita, Japan</td>
<td>80 e</td>
<td>May 2013</td>
</tr>
<tr>
<td>PT Nisshoku Acrylindo</td>
<td>Cilegon, Indonesia</td>
<td>80</td>
<td>Aug 2013</td>
</tr>
<tr>
<td>Nippon Shokubai</td>
<td>Himeji, Japan</td>
<td>80</td>
<td>Aug 2013</td>
</tr>
<tr>
<td>BASF Yangzi</td>
<td>Nanjing, China</td>
<td>160 e</td>
<td>2014</td>
</tr>
<tr>
<td>Shandong Kaitai</td>
<td>Zibo, China</td>
<td>80 e</td>
<td>2014</td>
</tr>
<tr>
<td>Formosa Chemical</td>
<td>Ningbo, China</td>
<td>160 e</td>
<td>Q1 2014</td>
</tr>
<tr>
<td>BASF</td>
<td>Camacari, Brazil</td>
<td>160</td>
<td>End 2014</td>
</tr>
<tr>
<td>Jiangsu Jurong</td>
<td>Taixing, China</td>
<td>160</td>
<td>2014</td>
</tr>
<tr>
<td>JSC Gazprom Neftekhim</td>
<td>Russia</td>
<td>80</td>
<td>2015</td>
</tr>
<tr>
<td>Zhejiang Satellite</td>
<td>Jiaxing City, China</td>
<td>320</td>
<td>2012-2015</td>
</tr>
</tbody>
</table>

*e = Expansion of existing capacity*

Source: Tecnon OrbiChem
APIC 2012

ACRYLIC ACID vs PROPYLENE PRICES

$/ton

Source: Tecnon OrbiChem
APIC 2012

ASIA, W. EUROPE & US PROPYLENE PRICES

Source: Tecnon OrbiChem
**NEW PROCESS DEVELOPMENT**

- **Nippon Shokubai** is developing a new acrylic acid process based on glycerine obtained from bio-diesel fuel production.

- Future commercialisation in Southeast Asia.

- Driving forces of technology development:
  - Environmental concerns (renewable raw materials)
  - High propylene price (high crude oil/naphtha prices)

**Diagram:**

```
Vegetable Oil → Glycerine (By-product) → Acrolein → Acrylic Acid
              - H₂O

Bio Diesel Fuel

Propylene (Existing process) + O₂ → Acrylic Acid
```

Source: Tecnon OrbiChem
**APIC 2012**

**ACRYLIC ACID PRODUCTION BY REGION - 2011**

**Total: 4.322 Million Tons**

- **China**: 25%
- **North America**: 25%
- **Northeast Asia**: 19%
- **East Europe**: 1%
- **West Europe**: 22%
- **Middle East & Africa**: 2%
- **South & Southeast Asia**: 6%
- **South & Southeast Asia**: 6%

**Source**: Tecnon OrbiChem
APIC 2012
ACRYLIC ACID CONSUMPTION BY REGION - 2011

Total: 4.322 Million Tons

- China: 24%
- North America: 26%
- West Europe: 21%
- South & Southeast Asia: 5%
- Northeast Asia: 21%
- Middle East & Africa: 2%
- East Europe: 0%
- South America: 1%

Source: Tecnon OrbiChem
APIC 2012
CONCLUSIONS

- Acrylic Acid and Acrylates supply/demand and economics present challenges for the future but new capacity will be curtailed due to propylene shortages and costs

- Strong demand for SAP in particular will support growth

- Bio-based developments stalled by food vs. fuel/chemicals land-use debate

- Investment opportunities exist in this area but propylene feedstock and technology challenges are barriers to entry

- Downstream opportunities in SAP are limited due to feedstock availability. Growth in paints and coatings demand is limited by sluggish economies in some regions, particularly West Europe

Source: Tecnon OrbiChem
Tecnion OrbiChem

.....your source of expert chemical industry knowledge