Acrylonitrile – World Market Overview

Synthetic Fibres Raw Materials Committee Meeting at APIC 2015
Seoul, 8 May 2015

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• Trends in Global Acrylonitrile Production
• Downstream Sector Analysis
• Supply and Demand Balances
• Lessons from Other Markets
• Market Prospects
• Conclusions

Source: Tecnon OrbiChem
APIC 2015
WORLD ACRYLONITRILE CAPACITY

Source: Tecnon OrbiChem
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**WORLD ACRYLONITRILE PRODUCTION TRENDS**

- Rapid growth in capacity

<table>
<thead>
<tr>
<th>New Capacity</th>
<th>ktpa</th>
<th>Year</th>
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</thead>
<tbody>
<tr>
<td>Anqing Petrochemical, China</td>
<td>130</td>
<td>2013</td>
</tr>
<tr>
<td>Tong Suh Petrochemical, S Korea</td>
<td>245</td>
<td>2013</td>
</tr>
<tr>
<td>Shandong Keluer, China</td>
<td>130</td>
<td>2014</td>
</tr>
<tr>
<td>Shanghai Secco, China</td>
<td>260</td>
<td>2015</td>
</tr>
<tr>
<td>Jiangsu Sailboat, China</td>
<td>260</td>
<td>2015</td>
</tr>
<tr>
<td>SABIC/Asahi Kasei, Saudi Arabia</td>
<td>240</td>
<td>2017</td>
</tr>
<tr>
<td>Ineos Tianjin, China</td>
<td>260</td>
<td>2017</td>
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<table>
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<th>Capacity Shut Down</th>
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<tbody>
<tr>
<td>Asahi Kasei, Japan</td>
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</tbody>
</table>

Source: Tecnon OrbiChem
Increasing availability of propylene and ammonia feedstock

Propane dehydrogenation units in North America and Asia

Ammonia plants in North America and the Middle East

Low profitability

Source: Tecnon OrbiChem
Margin = Acrylonitrile – 1.1 x Propylene $/ton

Source: Tecnon OrbiChem
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DOWNSTREAM SECTOR ANALYSIS

- Acrylic fibre losing dominance in acrylonitrile downstream
- Slow growth in most sectors, except polyacrylamide
- Strongest growth in low-volume consuming industries

Source: Tecnon OrbiChem
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ACRYLONITRILE CONSUMPTION BY END USE

Thousand Metric Tons (of acrylonitrile)

Source: Tecnon OrbiChem
Global acrylic fibre production has declined by an average 2% per year during the last five years (Montefibre, Radici).

Production in 2014 was 1.735 million tons registering a decline of 9% from 2013.

Acrylic fibre costs continue to suffer from propylene prices and high acrylonitrile conversion costs.

Despite a sharp fall in production over the past 10 years, Tecnon OrbiChem expects modest (0.4%) production growth in the next 10 years, due to weak supplies of wool and cotton and continuing technical advantages for acrylic fibre in certain markets.

Source: Tecnon OrbiChem
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WORLD ACRYLIC FIBRE CAPACITY

Million Metric Tons

Source: Tecnon OrbiChem
APIC 2015
WORLD ACRYLIC FIBRE PRODUCTION

Source: Tecnon OrbiChem
• Steady growth, in line with economic growth in most regions
• Chronic overcapacity diminishes profitability
• Styrene prices guide ABS competitiveness
• Free-trade agreements encourage Korean exports
• Exchange rate fluctuations disrupt trade flows

Source: Tecnon OrbiChem
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ACRYLAMIDE MARKET TRENDS

- North American shale gas boom fuels consumption growth
- Water treatment remains biggest end-use, but growth is slow
- Pulp and paper markets are also mature

Source: Tecnon OrbiChem
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OTHER DOWNSTREAM MARKETS

- Nitrile rubber market growth is slow but steady
- New adiponitrile plant to come on stream this year in Shandong
- Spectacular growth in carbon fibre demand, but volumes are low

Source: Tecnon OrbiChem
ACRYLONITRILE SUPPLY AND DEMAND

Source: Tecnon OrbiChem
APIC 2015
ACRYLONITRILE SUPPLY AND DEMAND

- Consistent overcapacity
- Large producers manage operating rates globally
- Relatively stable trade flows among regions
- Japanese exports reduced after 2014 closures
- New capacities in China may reduce imports from the Americas
- Margins are likely to remain depressed

Source: Tecnon OrbiChem
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LESSONS FROM OTHER MARKETS – POLYESTER

Margin = PTA – 0.67x PX ($/ton)

Source: Tecnon OrbiChem
Margin = Adipic Acid – 0.7x Benzene ($/ton)

Source: Tecnon OrbiChem
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**ACRYLONITRILE PROFITABILITY**

Margin = Acrylonitrile – 1.1 x Propylene $/ton

Source: Tecnon OrbiChem
• Ineos/Sinopec intellectual property dispute
• Possible Montefibre Hispania acrylic fibre restart
• Continued conversion of acrylic fibre capacity to carbon fibre; output volumes are often reduced
• New demand for ABS resins in 3D printing

Source: Tecnon OrbiChem
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CONCLUSIONS

- Acrylonitrile profitability will remain low because capacity is expanding faster than demand is growing.

- Increasing self-sufficiency in China will reduce inter-regional trade; exports from the Americas to Asia are likely to decline, despite seasonal cost advantages.

- Slow growth to continue in acrylic fibre markets.

- Low oil prices will reduce demand for polyacrylamide in fracking operations.

- Carbon fibre production is growing rapidly, but very little acrylonitrile is consumed.

Source: Tecnon OrbiChem
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