Modular, Continuous Production Concepts – A New Paradigm in Chemical Manufacturing

Thomas Bieringer, Bologna, 2014-10-01
There is strong evidence for a paradigm shift in the production and the supply chain of the Fine and Specialty Chemical Industry.

- The technical feasibility of modular continuous production units has been proven in European FP7 projects.
- Partners from industry and academic research have shown the technical, ecologic and economic benefits of those units compared to traditional production approaches.
- One key advantage is the flexibility of adjusting production to market demands.
- The partners prepare to close the remaining technological gaps.
- First industrial application cases are under realization.
The Factory of the Future?

Efficient but inflexible

Flexible but inefficient
Imagine the future of chemical production

Reduction of development time, lead-time and time-to-market by 50%

Access to a wide chemical space with one production platform, providing resource-efficiency, productivity and high-yield

Scaling production in line with market demand; entering new and volatile markets with lower CapEx and investment risk

Utilization of an intrinsically safe and reliable processing method for hazardous and tricky chemistry

*: costs of goods sold (produced)
The feasibility of modular continuous production units has been shown.

- **Process Intensification**
- **Modularization**
- **Standardization**

### Drivers
- F³ Factory = x %
- Conventional = 100 %

<table>
<thead>
<tr>
<th>Parameter</th>
<th>F³ Factor</th>
<th>Conventional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time-to-market</td>
<td>- 50%</td>
<td></td>
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<tr>
<td>CAPEX</td>
<td>- 40%</td>
<td></td>
</tr>
<tr>
<td>OPEX</td>
<td>- 20%</td>
<td></td>
</tr>
<tr>
<td>Design effort</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Processing steps</td>
<td>- 30%</td>
<td></td>
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<tr>
<td>Solvent use</td>
<td>- 100%</td>
<td></td>
</tr>
<tr>
<td>Space time yield</td>
<td>10²-fold</td>
<td></td>
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<tr>
<td>Energy consumption</td>
<td>- 30%</td>
<td></td>
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<tr>
<td>Logistics</td>
<td>- 30%</td>
<td></td>
</tr>
<tr>
<td>Footprint</td>
<td>- 50%</td>
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</tr>
</tbody>
</table>

- Footprint: up to 50% reduction
- Process time yield: up to 10²-fold increase
- Energy consumption: up to 30% reduction
- Logistics: up to 30% reduction
- Footprint: up to 50% reduction

**SOLVAY**

*brain power of over 300 scientists, engineers, PhD students, business & academic experts*

- Polymers, multi-product
- Intermediate, dedicated

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F³ Factory: Flexible, Fast, Future

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Alignment of public initiatives & investment in infrastructure can make a difference

- Demonstration center
- Best practice hub for partners
- Training facility
- ~ 20 new jobs

Successful techno-economic feasibility of new production technology
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