One single source for all your needs, from Gas to Melamine.
**ME Melamine HP Technology**

**The Key for Technology Leadership**

**Process Safety**
Casale Melamine HP Technology has a world-class safety track record. The plant design encompasses highly efficient safety systems for plant operations and shutdown.

**Differentiation Features of the Casale Melamine HP Technology**

**Energy Efficiency**
- Less energy (steam and gas) consumption
- Less Green House Gases (CO2)
- Recover heat of condensation

**Melamine Conversion Efficiency**
- Reduced feedstock cost for melamine production
- Frees up additional urea volumes for sales
- Reduced energy demand for reprocessing of off-gas into urea

**Urea Yield from Off-Gas**
- Water free off-gas as additional feedstock for urea production ("debottlenecking effect")
- Off-gas available at much higher pressure
- Simple integration of off-gas stream into high pressure section of urea plant

**The Process**
- Two stage, high pressure, liquid phase, non-catalytic process
- Consists of high pressure and low pressure (aqueous) sections
- Main process steps are synthesis, purification, crystallization, filtration and drying

**Your Benefits as a Licensee**
- Superior high pressure process
- Biggest commercial melamine high pressure plant worldwide
- High value water-free off-gas, no compression and no separation needed
- Heat of condensation recovered by steam raising
- World class consumption figures (feedstock and utilities)
- Optimized layout for reduced melamine plant footprint
- Favorable investment costs
- Reliable plant design for maximum operation days per year
- Unique support by Borealis as plant operator and licensor for Borealis Melamine HP Process
- Excellent environmental performance
- De-Bottlenecking of Urea Plant and Urea Plant capacity increase:
  - Higher efficiency in the synthesis loop
  - Less load in the urea synthesis downstream equipment
  - Less energy consumption in the urea plant

**Casale Technology Benefits**

**Energy Efficiency**
- Casale Melamine HP Technology
- Conventional HP Technology

**Melamine Conversion Efficiency**
- Casale Melamine HP Technology
- Conventional HP Technology

**Urea Yield from Off-Gas**
- Casale Melamine HP Technology
- Conventional HP Technology
Plants with Casale melamine HP Technology

<table>
<thead>
<tr>
<th>Technology</th>
<th>Start-up</th>
<th>Capacity</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of HP Melamine Technology</td>
<td>Mid 1990's</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(through Borealis)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HP Melamine Plant 1 and 2* Montedison Technology (Acquisition by Borealis mid 1990's)</td>
<td>Early 1970's</td>
<td>20,000 tpa</td>
<td>Castellanza / Italy</td>
</tr>
<tr>
<td>Borealis HP Melamine Technology Plant 3*</td>
<td>1999</td>
<td>30,000 tpa</td>
<td>Castellanza / Italy</td>
</tr>
<tr>
<td>Borealis HP Melamine Technology Plant 5</td>
<td>2000</td>
<td>30,000 tpa</td>
<td>Linz / Austria</td>
</tr>
<tr>
<td>Borealis HP Melamine Technology Plant</td>
<td>2004</td>
<td>80,000 tpa</td>
<td>Piesteritz / Germany</td>
</tr>
</tbody>
</table>

CASALE MELAMINE PROCESS DEVELOPMENT HERITAGE

The Casale Melamine Process is the former BOREALIS HP Process, which CASALE acquired from BOREALIS in 2013. BOREALIS devised the HP Melamine Process after more than 40 years in the development of the melamine process technology. In the mid 1960’s the low pressure (LP) melamine technology Chemie Linz Process was introduced. A total of 8 plants were built for licensees in India and in Poland as well as for in-house use.

In order to achieve a step-change in melamine technology performance, the Borealis HP Melamine Technology was developed in the mid 1990’s.

HIGHEST MELAMINE PRODUCT QUALITY

- Total dissolution of the melamine melt
- All melamine is subject of purification
- Active carbon filtration
- Crystalization step
- Reduced colour and other impurities
- Consistent particle size properties

TYPICAL MELAMINE HP SPECIFICATION

<table>
<thead>
<tr>
<th>Specification</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>White, crystalline powder</td>
</tr>
<tr>
<td>Purity</td>
<td>99.8 wt.% min.</td>
</tr>
<tr>
<td>Loss on Drying</td>
<td>0.1 wt.% max.</td>
</tr>
<tr>
<td>Ash</td>
<td>0.01 wt.% max.</td>
</tr>
<tr>
<td>pH (10% aqueous susp.)</td>
<td>7.5 - 9.5</td>
</tr>
<tr>
<td>Colour</td>
<td>20 APHA max.</td>
</tr>
<tr>
<td>Aspect</td>
<td>Clear solution</td>
</tr>
</tbody>
</table>

CASALE MELAMINE IS RATED TOP QUALITY
Casale Group has been set up in 1921 as Ammonia Casale SA. Leveraging on the know-how and experience acquired in more than 500 successful projects worldwide, it has become a recognized worldwide leader in ammonia, urea, methanol and syngas production technology.

Casale Group acquired Borealis’ HP melamine technology in 2013 as part of a strategic plan aiming at widening the offer of core technologies and know-how with a new product that has strong synergy with the Group’s product portfolio and market base.

Casale Group’s main focus is on developing and licensing its proprietary technologies, but it also has the full capability to provide all the types of services that are required to successfully implement projects, including turn-key projects, as well as supplying all necessary after-sales assistance.

MELAMINE APPLICATIONS

MOULDING COMPOUNDS
Tableware, picnic ware, children’s dinnerware, electrical equipment, handles for pans and other utensils

DECORATIVE LAMINATES
Laminate flooring, furniture tops, kitchen/bathroom, countertops, furniture

FLAME RETARDANT ADDITIVES
Application in foam products (e.g. bed mattresses, public seats, upholstered furniture), flame retardant coating (fire doors, steel constructions)

ADHESIVES
Laminates, plywood, particulate boards, MDF

COATING RESINS
Vehicle body panels, household appliances, drink cans, coil of metal sheeting

CONCRETE PLASTICISER
Sulphonated melamine-formaldehyde resins are used as plasticizers for concrete castings to improve its flow characteristics

RESINS FOR PAPER FINISHING
Money, wallpaper, maps

EXPANDING THE NITROGEN VALUE CHAIN

- Melamine is a further diversification in the nitrogen value chain starting with hydrocarbons (e.g. starting from natural gas)
- Melamine can be stored and handled easily
- Melamine is traded globally
- Melamine is a sustainable business investment
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