



# MELAMINE

**uLEM**

The benchmark process for energy-efficient production  
of high-quality Melamine



We are a global partner  
in the chemical industry,  
offering **integrated technologies,  
engineering, contracting  
and construction solutions**  
for over a century.

## Our mission

*Contribute to shape a new sustainable planet with our plants for the production of fertilizer, methanol, hydrogen, melamine and derivatives, and help our customers creating value respecting the environment.*

*We are a global company front leader in the energy transition: a key player in the sustainable transformation of the chemical and energy industry, from a social, economic and environmental point of view.*

## Our values

**INNOVATION** PEOPLE CARE **PROFESSIONAL EXCELLENCE**  
QUALITY **SAFETY** ETHIC **SUSTAINABILITY**

# uLEM

Harnessing more than more than 40 years of experience, uLEM technology (the evolution of LEM® technology) ensures a reliable production of high-quality melamine while boasting the industry's lowest energy consumption.

In addition to the ease integration with the urea plant, these features make uLEM the benchmark process for melamine production.

## Capacity

- **≥ 20,000 MTPA**

## Performances

- Lowest energy consumption amongst the melamine technologies available in the market



## Enviromental Impact

Lowest CO<sub>2</sub> emissions per ton of melamine.

Ammonia and dust are emissions, as well as liquid effluents in compliance with the most stringent environmental regulations.

**NO Solid wastes.**

## Benefits

- Lowest energy consumption, proven in industrial plants
- Optimal energy utilization achieved through the combination of deep heat integration with a streamlined process design, ensuring inherent simplicity and robustness in process control
- Best melamine product quality with consistent particle size distribution
- Highest urea to melamine conversion
- High-pressure anhydrous melamine off-gas (heat of condensation recovered)
- Robust technology thanks to the easy-to-control chemistry of the melamine purification based on caustic soda as alkaline agent
- Reliability and easy plant operation. The plant can quickly rump up the production to 100% since first start-up
- No heavy maintenance required nor heavy-cleaning devices need to be installed (such us centrifuges or cooled crystallizers)
- World-class safety track records: the plant includes highly efficient safety systems for plant operations and shutdown

## Casale technical assets

- Urea-based off-gas scrubber and its ancillary equipment. This kind of scrubber is the only one actual industrial with running references. Its optimized and proven design along with its material of construction ensure reliability, durability, complete melamine removal from the off-gas and the easiest integration with urea plant
- The high-pressure melamine reactor (available in a wide range of capacities)
- New advanced Melamine Combined Reactor
- Melamine adiabatic vacuum crystallizer (only 1 crystallizer necessary up to 60'000 MTPA plant capacity) with a very low cleaning frequency

## PROCESS OUTLINE

The uLEM Process shown in **Figure 1** is based on the following key design features:

- two stage, high pressure, liquid phase, non-catalytic synthesis (also available with new advanced melamine combined reactor)
- urea-based off-gas scrubber
- off-gas condensation at high pressure
- low pressure, melamine (aqueous) purification based on caustic soda as alkaline agent
- adiabatic vacuum crystallization
- vacuum filtration
- flash drying
- pneumatic transport
- waste water treatment for TKN reduction in effluent water.

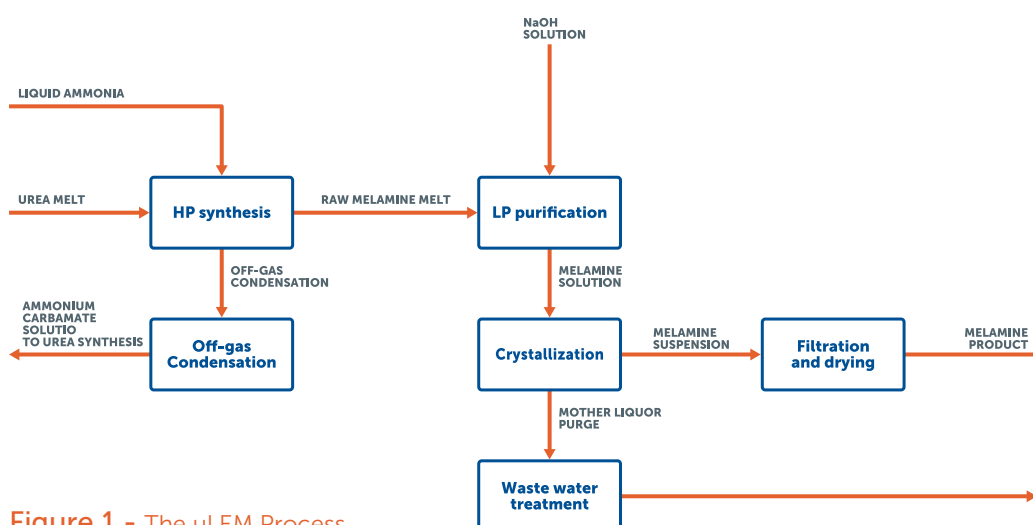


Figure 1 - The uLEM Process

# INTEGRATING AN ADVANCED MELAMINE TECHNOLOGY WITH UREA PLANTS:

## The advantages of a single licensor

Casale uLEM technology, in the industry ensures the production of high-quality melamine with the lowest energy consumption and carbon footprint.

The melamine quality makes the product of the uLEM-based plants suitable for the most demanding applications such as the production of decorative laminates.

Drawing upon its experience as licensor of both Melamine and Urea technologies, Casale can deliver the complete uLEM production line, starting from:

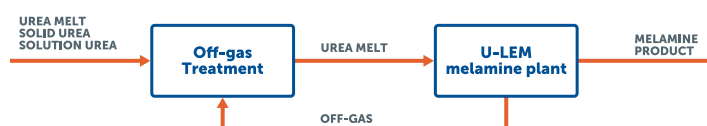
- urea melt
- urea solution, therefore including a dedicated urea concentration section
- $\text{NH}_3$  and  $\text{CO}_2$  therefore including a dedicated urea plant able to produce the urea feedstock required for the melamine synthesis (Figure 2)
- urea melt (or urea solution, or solid urea), therefore including a dedicated off-gas treatment section able to recover the off-gas from the melamine plant, without integration between melamine and the existing urea plant (Figure 3).

Casale can also revamp any existing urea plant as required to accommodate a new uLEM plant.

Figure 2 - Melamine from  $\text{NH}_3$  and  $\text{CO}_2$

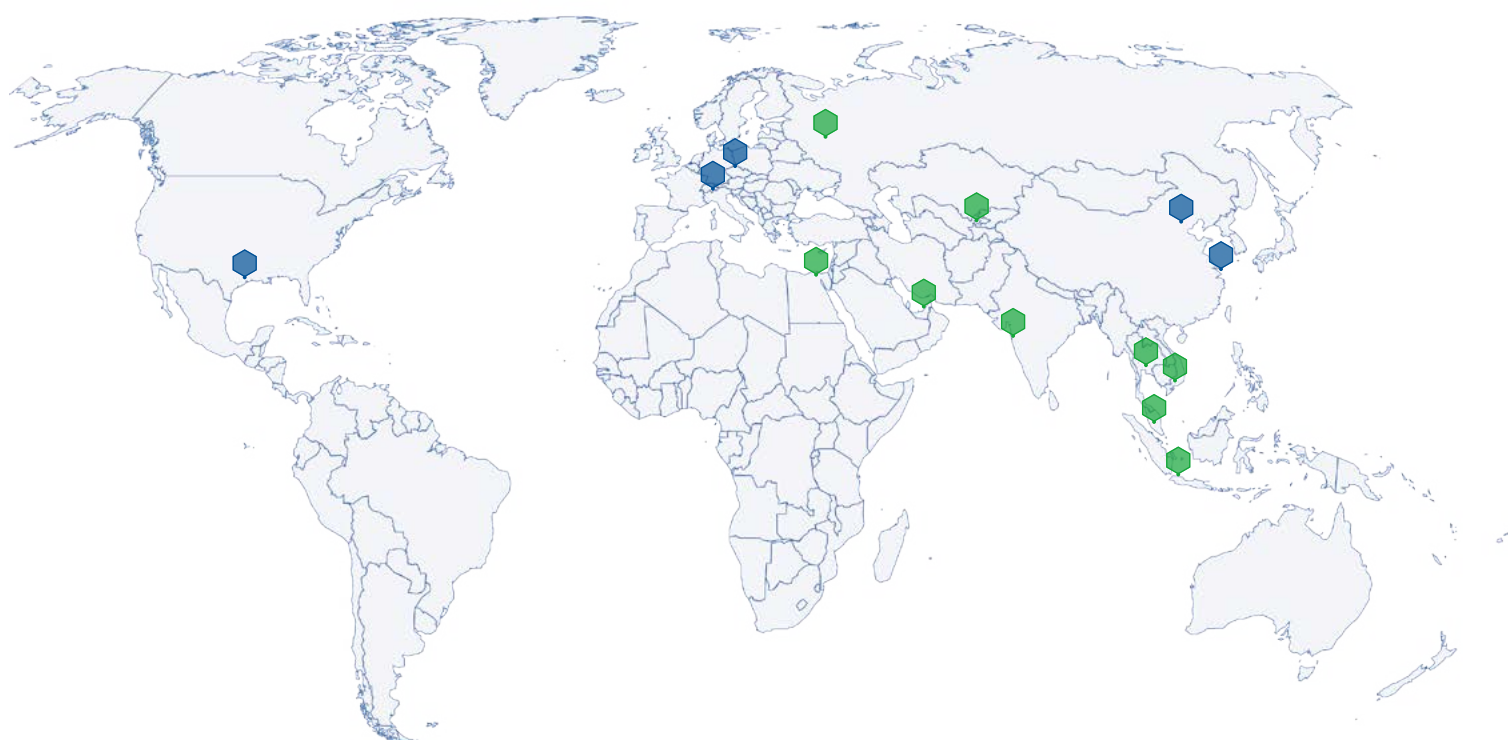


Figure 3 - Melamine with off-gas recovery taking place in a dedicated Off Gas Treatment section



**PLANTS FOR  
A NEW PLANET.  
SINCE 1921.**

## Casale in the world



### Headquarter

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Egypt, India, Uzbekistan,  
Indonesia, Thailand, Malaysia,  
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