



WORLD ENERGY PRODUCTION

Billion BTU's

CRUDE OIL	40,149,043
COAL	38,242,686
NATURAL GAS	29,530,339
HYDROELECTRIC	6,416,476
NUCLEAR	7,943,824
WIND	1,526,540
BIOFUELS	606,899
SOLAR	303,854
GEOTHERMAL	83,236
TOTAL PRODUCTION	123,021,800
TOTAL CONSUMPTION	123,086,800

OilPrice.com

Site Visits

Online	00000002
Today	00000067
Total	000074774

Melamine :

The melamine market growth foreseen in the next years represents an ideal factor for ammonia/urea producers to enter a new market, matching future domestic and export increasing demand.

Furthermore, the melamine market is not subject to the volatility of the markets of urea and the other fertilizers and can constitute a sound tool to stabilize the profits of a fertilizer producer.

Eurotecnica has licensed almost 40% of the world melamine capacity, thus demonstrating the superiority of its High Pressure Melamine Process.



The main features of the process can be summarized as follows:

- Continuous production of top grade melamine without interruptions
- Time between normal turn-arounds more than 500 days with plant operating 24hr/day
- Variation in quality, no costs for catalyst purchase and disposal
- Turn down ratio less than 50%
- Ammonia and carbon dioxide rich off gases fully recycled at medium pressure to the upstream urea plant or to a dedicated urea unit

PRODUCT OVERVIEW :

Melamine was first synthesized by J. von Liebig in 1834 and its molecular structure has been published by A.W. von Hoffman in 1885.

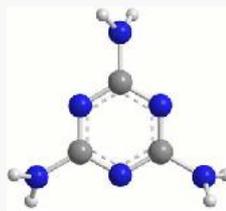
It has a cyclic structure and can be described as the trimer of cyanamide or the amide of cyanuric acid. Its chemical formula C₃N₃(NH₂)₃ and its molecular structure is outlined herebelow.

The IUPAC name of melamine is 2/4/6-triamino 1/3/5-triazine. Alternate names are cyanurotriamine cyanurotriamine cyanuramide.

Technical literature about melamine can be found under CAS number 108-78-1 PubChem 7955 or SMILES Nc1nc(N)nc(N)n1.

Melamine did not raise industrial interest until about 1930 and up to 1960 it was prepared almost exclusively from calcium cyanamide which was first converted into dicyandiamide and then heated above its melting temperature to produce melamine.

In the early 1940s Mackay discovered that melamine could also be synthesized from urea and today it is produced industrially almost exclusively with this route.



PHYSICAL PROPERTIES :

Melamine is manufactured and marketed as fine white powdered crystals.

The most important physical data are summarized in following table:

Appearance	Fine white crystalline powder
Color	White.
Molecular weight	126.13
Specific gravity 20 c	1.573
Melting point	354 c(sublimes at atmospheric pressure)
Boiling point	Sublimes at 300c under reduced pressure
Solubility in water	0.3g/100 ml(20 c)

MELAMINE SYNTHESIS :

Melamine can be obtained from three different raw materials; urea dicyandiamide and hydrogen cyanide. Of the three alternatives only urea and dicyandiamide based processes have been commercialized and only the urea process is currently used.

The urea process offers low manufacturing costs based on a more readily available raw material than the older dicyandiamide process has been progressively replaced world-wide by newer processes based on urea and all world melamine production capacity is now based on urea.

Manufacturing processes and integration within fertilizer complexes :

Melamine is produced from urea by either non catalytic high-pressure processes or catalytic low-pressure processes all of which can consist of one or two stages.

Melamine plants are normally integrated in fertilizer complexes so that the carbon dioxide and ammonia obtained as co-products in both processes are recycled as raw materials for the urea plant therefore improving the yield and economics of the processes as sketched in following.

Minor by-products are melamine poly condensates and oxo amino tri-azines which account for less than 5% and can be removed by means of several purification techniques. Whereby a product with melamine content exceeding 99% can be obtained.

The melamine yields based on urea are normally in the range of 90-95% of the theoretical according reaction above reported.

HIGH-PRESSURE PROCESSES :

High-pressure melamine synthesis was commercialized in 1963. In a typical high-pressure process the reaction is carried out in liquid-phase without a catalyst under pressures in the range of 7-15 MPa and in the temperature range of 370-450 °C.

The reaction sequence is as follows:

Molten urea is fed under relatively high pressure (7MPa) to the reactor where it undergoes conversion to melamine.

The endothermic reaction at temperatures in the range of 370 -450°C in the liquid phase and would allow an almost complete (95%) conversion of urea to melamine. Heat is provided by means of external sources e.g. molten salts heat transfer systems.

Melamine leaves the reactor in liquid phase and after depressurization is quenched with water in order to separate gaseous co-products (NH₃ and CO₂) from the main products . subsequently various process options are likely to be applied to for the purpose of removing by products from melamine and final melamine crystallization.

EUROTECHINCA HIGH PRESSURE MELAMINE PROCESS :

Eurotecnic's activities on Melamine date back to 1979 when it was awarded of an EPC contract for a 15000 MTPY unit at Kuwait Melamine Industries facilities Shuaiba-Kuwait. The plant design was based on the technology of the US company Allied Signal (now part of Honeywell).

Then Eurotecnic performed other projects based on the US technology up to the point when in 1998 it acquired the ownership of the process and developed a new 30000 MTPY reactor.

A strong R&D effort and mutually fruitful relationship with the customers allowed Eurotecnic's melamine technology to reach top operability levels. The time between to normal turn-around is now more than 500 days with 24hr/ day operation and product is spec right from the first ton.

The maximum size of the plant has reached 60000 MTPY and the system can operate below 50% of the nominal capacity.

Special focus was paid to the environment and the emissions . Eurotecnic's High pressure Melamine Technology can now offer full compliance practically to say gas emission regulation zero solid discharge zero liquid discharge as effluent water is fit to be used as cooling water make-up .

Ease of operation consistency in product quality world scale size top flexibility zero solid and liquid discharge... If you factor in all these qualities it is easy to understand why Eurotecnic's High pressure Melamine process is by far the most widespread process in the world.

PROCESS OVERVIEW :

The technology offered by Eurotecnic is based on the main pillars :

* Single-stage liquid-phase non catalytic reaction.

The reactor is as simple flexible and reliable as a heat exchanger. There are no recycle loops no compressors no fluid bed nor catalyst to be taken care of . The very high pressure inside the reactor allows to keep the pressure at high levels also in the downstream equipment and in the stream of off gases going back to the urea plant thus greatly simplifying the integration of the melamine plant in a fertilizer complex.

* Separation and purification based on intrinsic properties of products coming out from the reactor without additional of further chemicals.

The unit operations of the separation and purification step are based on Eurotecnic's deep knowledge of the equilibrium among ammonia and the other products coming out from the reactor . No additional expenses for chemicals are required nor salts to be disposed of are found in the effluents.

* Zero discharge total recovery of products and co-products

Reaction products in all streams coming out from the plant are recovered either as melamine or decomposed to ammonia and carbon dioxide and recycled with off gases to the urea plant . No valuable product is wasted and no solids liquid or gaseous pollutants are released to the environment

The Eurotecnic High pressure Melamine process is described the following paragraphs . Please make reference to the following simplified block diagram.

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