UFT fluid bed granulation
Superior technology

A company
of ThyssenKrupp
Technologies

Uhde Fertilizer Technology

ThyssenKrupp

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Superior technology for you
With its fluid bed granulation process, Uhde Fertilizer Technology offers you the most reliable technology for the production of high-quality urea fertilizer.

Company profile

Uhde Fertilizer Technology's office in Roermond, the Netherlands

Uhde Fertilizer Technology (UFT) was established in 2005 as a subsidiary of ThyssenKrupp Nederland B.V. and is domiciled in Roermond, the Netherlands. UFT holds the exclusive licence rights for the fluid bed urea granulation technology, acquired from Yara Fertilizer Technology (YFT) of the Netherlands, and now exclusively licenses the renowned fluid bed urea granulation technology world-wide. In addition, UFT also provides for after-sales services, troubleshooting, spare parts and revamps for existing granulation plants built under licence from YFT.

In connection with the technology transfer, UFT has access within the Yara organization to resources for licensing, engineering and commissioning activities. Further development of the process is guaranteed as a result of the permission granted by Yara for the use of its research and development facilities, including the pilot plant in Sluiskil, the Netherlands.

Signing Ceremony acquisition of the Yara fluid bed technology by ThyssenKrupp Nederland in Amsterdam August 31, 2005

UFT fluid bed granulation
Plants throughout the world

Fluid bed granulation technology was developed in the mid-1970s by NSM Sluiskil (then Hydro Agri, later Yara), a large nitrogen fertilizer company, a producer of urea in Sluiskil (The Netherlands) since the 1950's.

Granulated urea was required by the market at that time to overcome the various shortcomings (particle size limitations, poor hardness, product caking, environmental constraints) of prilled urea.

The process was developed with the following requirements in mind:

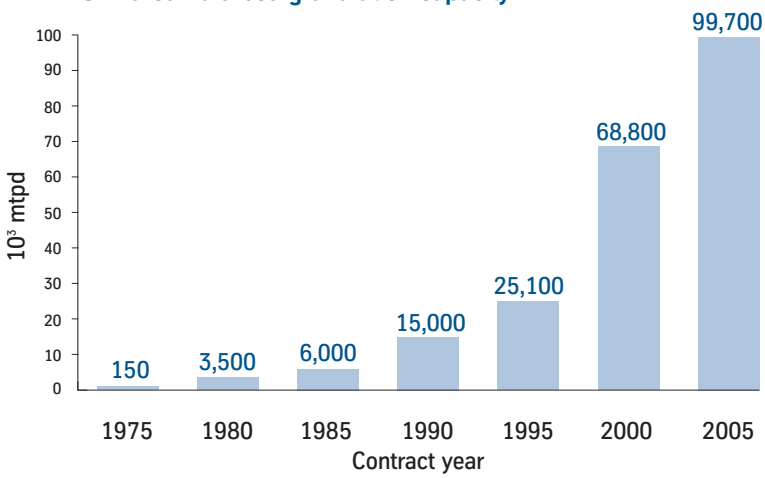
- the production of urea granules of the highest possible quality and sizes required by the market
- environment-friendly operation at competitive costs
- maximum straightforward operational flexibility
- a single-train design to match ever-increasing urea synthesis capacities
- competitive investment costs

After extensive laboratory research and pilot plant tests, the process was successfully implemented on an industrial scale in Sluiskil in 1979. HFT/YFT, a dedicated licensing company registered in Sluiskil, then began licensing the technology to fertilizer producers worldwide in 1980. Fluid bed granulation became the leading technology, boasting more than 50 reference plants with single-stream capacities ranging from 500 mt/d to 3,600 mt/d.

In 2004, after the demerger of Norsk Hydro's fertilizers activities into Yara International, an independent company, Yara's decision to focus strictly on its core business (production and marketing of fertilizers) led to the divestment of its urea fluid bed granulation licensing business. In 2005 Uhde Fertilizer Technology acquired the exclusive worldwide rights to further license the technology without any restrictions.

There are now fluid bed granulation plants based on UFT`s technology on all five continents, and new capacities are constantly being added.

UFT urea fluid bed granulation capacity



There are UFT fluid bed granulation plants operating under a wide variety of different climatic conditions all over the world. UFT's share of the market for fluid bed granulation technologies is more than 80% with respect to overall production capacity in operation

Some remarkable references

Customer	Location	Capacity
QAFCO	Qatar	3,850 mtpd
SAFCO	Saudi Arabia	3,600 mtpd
CNOOC	P.R. China	2,700 mtpd
Profertil	Argentina	3,250 mtpd
AFC, EFC & MOPCO	Egypt	2,000 mtpd
Kaltim	Indonesia	1,725 mtpd
GPIC	Bahrain	1,700 mtpd

For more details see separate list of reference plants.

Process description

Feed solution, typically a 96% to 97% urea solution, is dispensed to the injection heads, where it is finely atomized upwards into the bed of moving particles. This is assisted by air.

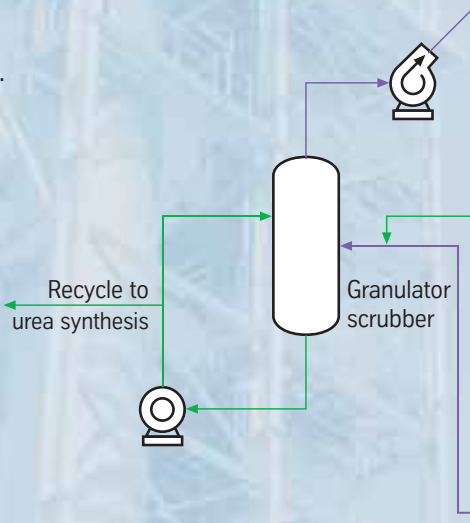
Fluidization air, delivered by a fan under the perforated plate, flows through the product layer to create a fluid bed and is exhausted at the granulator top.

Granular urea flows at a controlled rate from the granulator to a fluid bed cooler. After cooling, the granules are lifted to the sreening section by means of a bucket elevator.

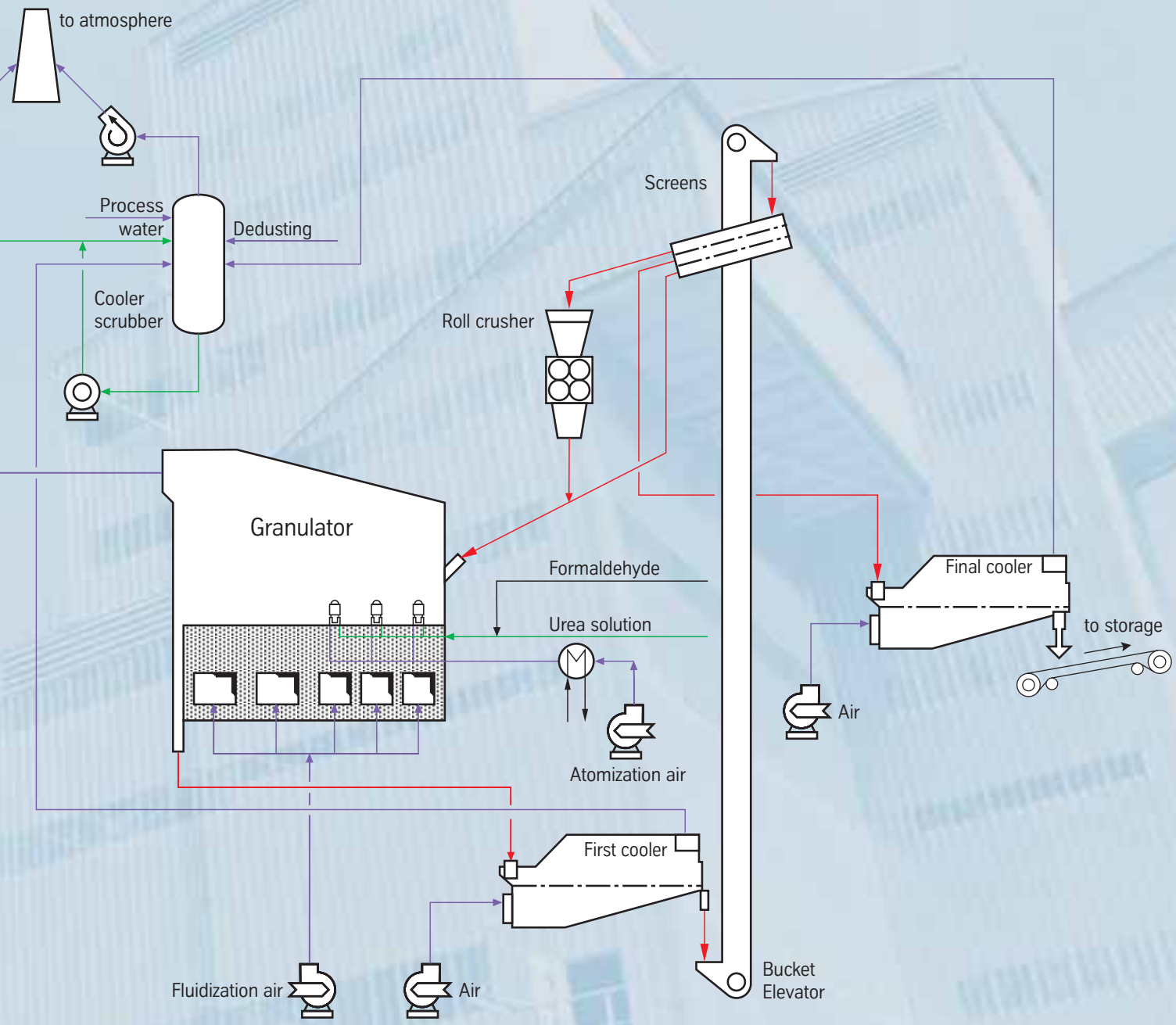
The fines fraction is recycled directly to the granulator while the coarse material is first crushed and then sent to the granulator as seeding particles.

The on-size product is sent to the warehouse after final cooling. The cooling of the urea to a constant and sufficiently low storage temperature is a key parameter in avoiding caking.

The air from the granulator and coolers contains some urea dust, which is easy to catch in standard scrubbing equipment. With industrially proven scrubbers, efficiencies of more than 99.5% are easily obtained. Therefore, dust outlet concentrations of less than 0.1 kg per tonne of urea produced can be achieved.



Granulator of pilot plant, capacity 150 mtpd


to atmosphere
Process water
Dedusting
Cooler scrubber
Screens
Roll crusher
Granulator
Formaldehyde
Urea solution
Atomization air
Final cooler
to storage
Air
First cooler
Fluidization air
Air
Bucket Elevator

Features of the granulation process

In UFT's process, the granulation mode is accretion. This means that particles grow through the solidification of tiny droplets on the seed material. The result is a very hard granule, far superior in quality than granules produced by means of layering or agglomeration-based processes.

This slow accretion process is unique in permitting the continuous and thorough stripping of the water present in the urea solution, thus achieving a remarkably low moisture content in the end product.

The solids recycle ratio, which at 0.5/1 is very low and stable, is another significant feature because it does away with the need for overdesign in the solids recycle loop equipment.

The low recycle ratio is acceptable because it only plays a minor role in the granulator heat balance.

Indeed, the bulk of the crystallization heat released at urea solidification is removed by evaporation of the water present in the urea solution. This mode of heat release allows the amount of fluidized air to be limited. This evaporation is highly efficient because it takes place direct on the granule surface itself.

Operation of the fluid bed granulation plant is simple and very reliable, guaranteeing a high on-stream factor. The granulator itself contains no moving parts, and its design is optimized to limit down time for cleaning to a strict minimum.

3D model of a 2,000 mtpd fluid bed granulation plant

Tailored revamps

Ammonia and Urea plant
Saskferco; Canada

Small revamps (10 to 15%) are easy to implement in UFT's fluid bed granulation plants if spare fluidization air is available. In such cases the urea spray system can cope with this extra capacity without requiring modification.

However, larger revamps are also easy to implement. The main item, the granulator, can be upgraded by increasing the number of urea sprayers installed in the granulator section originally intended as a cooler section. The heat balance of the granulator has to be closed, so an extra cooling section is added to the granulator and provided with dedicated new fluidization air. All other equipment has to be accommodated to the new required capacity, which has to be considered on a case by case basis. This may involve increasing the cooling capacity, expanding the screening surface or boosting the scrubber capacity.

Several UFT granulation plants have been revamped in the past: from revamps for minor capacity increases of 10% at PCS Trinidad to major capacity increases of more than 40%, such as the one for Saskferco, Canada or for ABF, Malaysia. The latter example has already undergone two revamps, increasing the capacity by more than 60%.

The daily capacity of the plant in Saskferco is now more than 3,000 mtpd and the total annual production capacity exceeds 1 million tonnes.

Remarkable references:

Customer	Location	increase from
PCS Nitrogen	Trinidad	1,620 to 1,800 mtpd
ABF	Malaysia	1,500 to 2,450 mtpd
Saskferco	Canada	2,000 to 2,850 mtpd

Facts and figures

Product characteristics

Urea granules produced in the fluid bed have a well-rounded shape and are very hard. They are particularly resistant to crushing and abrasion and hence dust-free, non-caking and completely free flowing, even after long storage and numerous handling and shipment operations.

Specification (Typical)

	Standard size	Large size
Total nitrogen	46.3 wt %	46.3 wt %
Biuret	0.7-0.8 wt %	0.7-0.8 wt %
Moisture	0.2 wt %	0.3 wt %
Crushing strength	4.1 kg (Ø:3 mm)	10.0 kg (Ø:7 mm)
Average diameter	3.2 mm	6.3 mm
Size distribution	95 wt % (2-4 mm)	95 wt % (4-8 mm)
Formaldehyde	0.4 wt %	0.4 wt %

Process advantages

- Technology proven over 25 years
- Single-stream capacities which are always large enough to handle the largest urea synthesis units developed to date
- High operating flexibility, even at only 10% of nominal capacity
- Use of 96% to 97% urea solution results in:
  - single stage evaporation only
  - minimized electrical power consumption
- Easy operation, allowing for reduction in manpower to the strict minimum
- Compact layout for maximum operability with minimum investment cost
- Flexibility in end-product size, ranging from an average diameter of 2 mm to 7 mm
- Efficient control of atmospheric emissions, compatible with the most stringent environmental laws
- No discharge of waste water to the sewer
- Maximum use of gravity flow as means of transport inside battery limit
- Maximum on-stream factor

Consumption figures

The consumption figures largely depend on the site climatic data, local environmental regulations, the end-product storage temperature as well as on the overall plant energy management system.

Specific Consumption

Electric power	33 kWh/mt[1)]
LP stream	35 kg/mt
Process water	0.2 m³/mt
Cooling water	none

[1)] depending on climatic conditions

Emission

The incorporation of efficient wet scrubbing equipment makes it possible to guarantee low urea dust emission from the granulation plant.

The urea dust is recovered as a 45% solution and recycled. All ammonia in the urea feed solution will be released in the granulator and can, if required, efficiently be absorbed with an acidic scrubbing system. The recovered ammonia, in form of an ammonium salt, should be removed from the process in case of technical grade urea production.

Emission

Urea dust	20 mg/Nm³ air
Ammonia	15 mg/Nm³ air

Application

Granular urea can be substituted for prilled urea in all applications. Moreover, due to their excellent physical characteristics, urea granules offer a number of superior features:

- bulk storage and transport in large volumes is possible without losses or quality degradation
- granular urea is particularly suitable for bulk blending operations; segregation or mechanical damage during mixing and transport is nearly nil
- the larger-size granules feature improved agronomical efficiency, in particular when used for paddy rice fertilization, and are also suitable for aerial spreading

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