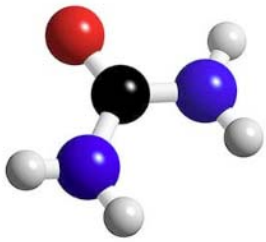
VBDT Van Bommel Dedusting Technology



In association with:

UreaKnowHow.com
Where the urea industry meets

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Abstract

Dusty urea product often leads to uncomfortable discussions between a urea producer and their clients. Dusty product leads to caking and causes unpleasant and even hazardous working conditions for any employee working with such a product. Additionally, dusty urea can cause damage to the spreading machines, leading to reduced yields in the agricultural sector.
Dusty urea product is typically caused by operation parameters of the evaporation section in the urea melt plant, operation parameters of the granulation or prilling section, storage conditions and logistic procedures. In most of these cases an end-of pipe solution is the most efficient and cost-effective solution to improve the product quality and produce premium-grade urea.

The “Van Bommel Dedusting Technology” (VBDT) offers such a solution.

The main challenge with this technology is to develop a proven and reliable process, which minimizes not only the fines and broken product, but also the large amount of ultra-fines and dust that typically occur when high capacity loading and unloading procedures take place. The unique VBDT has been operationally proven to successfully meet these challenges leading to the production of Dust Free Premium Urea Granules or Prills.

Content

1. Introduction

Dusty urea product often leads to uncomfortable discussions between a urea producer and their clients. Dusty product leads to caking and causes unpleasant and even hazardous working conditions for any employee working with such a product. Additionally, dusty urea can cause damage to crops, leading to reduced yields in the agricultural sector.
Dusty urea product is typically caused by operation parameters of the evaporation section in the urea melt plant, operation parameters of the granulation section, storage conditions and logistic procedures. In most of these cases an end-of pipe solution is the most efficient and cost-effective solution to improve the product quality and produce premium-grade urea. The “Van Bommel Dedusting Technology” (VBDT) offers such a solution.

Figure 1 - Typical Urea storage

The VBDT was developed in 1992, and has since been in continuous operation at a modern fluid bed urea granulation plant in North America.

The original VBDT design was a one-line unit with a design capacity of 200 metric tons per hour. It was capable of breaking up the soft lumps with a diameter larger than 8 mm), take out fines and broken product (90 µm – 1.0 mm), and remove dust & ultra-fines (1 µm – 90 µm). The design made it possible to guarantee an "on-spec" premium-grade urea granular product of between 1.0 mm and 4.0 mm at variable feed rates.

The line was expanded in 1994 to 500 metric tons per hour. The VBDT has also been implemented at various DAP & MAP plants.

The VBDT can optionally perform cooling of the product and warehouse air-refreshment to improve visibility during unloading and loading operations.

Figure 2 - Urea storage warehouse showing angle of repose

2. Process Description

The flexible design is capable of handling all season storage unloading, and variable flow reclaimed products (front-end-loader) including product directly from urea production.

The main principle key equipment of the VBDT design includes:

- ✓ Magnet
- ✓ Lump breaker
- ✓ Elevator
- ✓ Scalper
- ✓ Double-Aspirator
- ✓ Fines Cyclone and Air Fans
- ✓ Dust Bag house filter
- ✓ Containers for "off-spec" product
- ✓ Cooling of the product and warehouse air-refreshment (optional)
- ✓ Automatic sampler and Size Analyzer with Statistical Process Control (optional)

The aforementioned machinery is proven technology, leading to reliable operation, readily available spare parts, and therefore straightforward operations, however some details of these equipment items need to be adapted to fulfill the required performance.

VBDT is custom-designed to suit the specific environmental & climatological requirements, end-product specifications and reduction of product losses during plant load out operations.

The magnet above the belt removes iron parts (bars, tools, nuts & bolts etc). Further down the line a grizzly bar catches large "non-urea" parts (such as helmets, goggles, cloves etc). The typical large flow during loading and unloading operations of for example 400-450 metric tons per hour is then fed to the lump-breaker, and elevated up to a diverter gate above the scalper, which removes the *overs* and shakes any water bridged urea granules loose.

The throughs are distributed over Double-Aspirators, which remove the fines and dust through the cascading air wash effect. The fines and broken product are sucked into the fines cyclones through air fans, which sent the ultra-fines and dust to the absolute filter bag house. Fines and broken product can thus be handled separately from the ultra-fines and dust, as to realize maximum values for these side streams.

Figure 3 - Loading of "on-spec" Urea onto cargo vessel

The "on-spec" cleaned granules or prills are led to the load out belt conveyor, and onto a waiting vessel or truck to be shipped to your customer.

The "off-spec" material is dumped into containers. It is possible to handle the fines and broken product separately from the ultra-fines and dust, to realize maximum values for these side streams.

If the VBDT is applied at the Urea Plant, the most viable option is to recycle the “off-spec” product to the granulation solution tank.

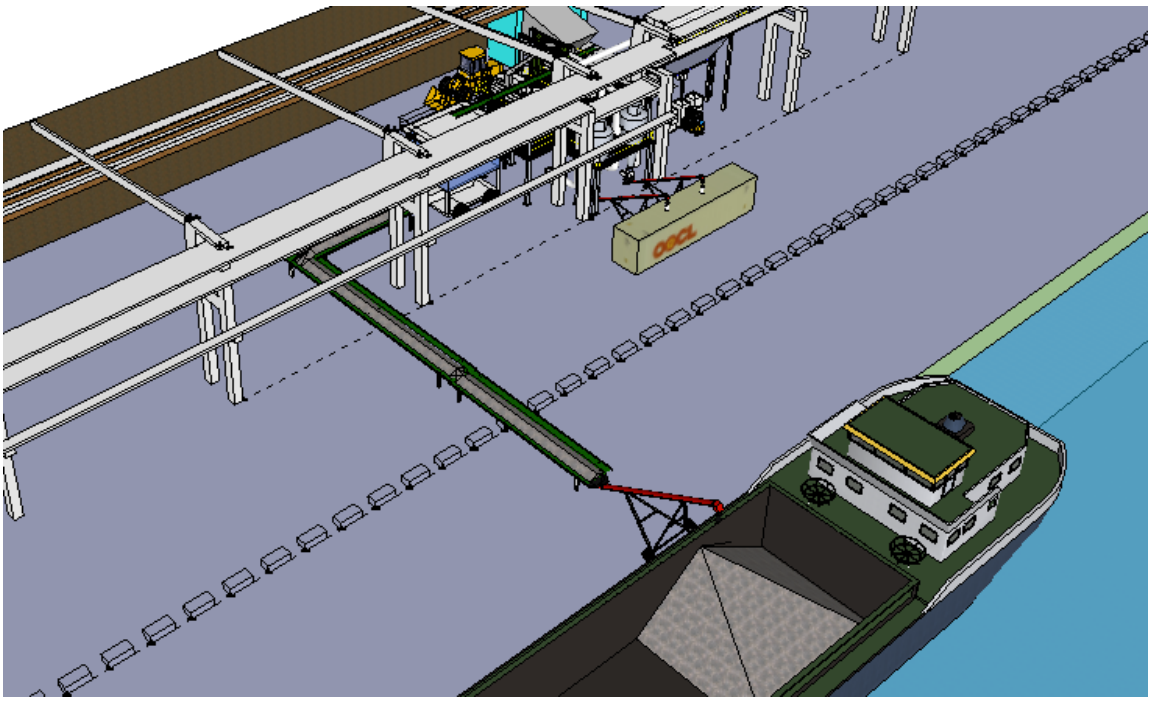

Figure 4 - VBDT showing loading of "on-spec" product

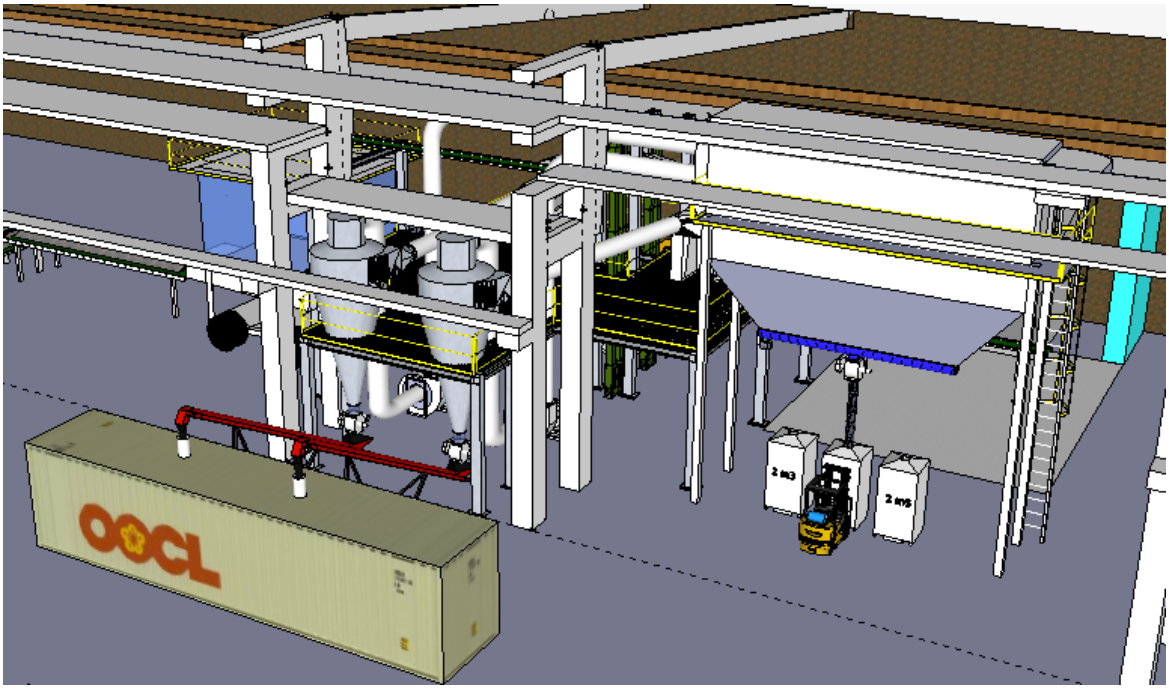

Figure 5 - VBDT process overview showing storage of "off-spec" product (for example fines and broken product in 20ft container and ultra-fines and dust in big bags)

The 3D model in figures 4 and 5 shows a typical lay-out of the VBDT. The compact footprint of the equipment reduces the amount of space that is required. This means that the VBDT can be easily located in a typical bulk port environment area. Dedusted “on-spec” product (1.0 – 4.0 mm) is sent via load out belt conveyor to a ship.

Figure 5 shows how fines and broken product (90 µm – 1.0 mm) are collected in a 20 ft container, and ultra-fines and dust (1 µm - 90 µm) in big bags or chemical bins.

The majority of the equipment layout is through gravity flow after the elevator, this reduces the OPEX significantly.

At the reference plant special features were installed, like belt & receiving & weigh bin “dedusting-lines”, and an automatic sampler with a particle size analyzer which enabled the client to do Statistical Process Control on the SGN and UI figures.

3. Indicative investment figures, capex

The approximate price for the delivery of a 400TPH VBDT is about € 750,000.

In Words: Seven Hundred and Fifty Thousand EURO (class D estimate, rough order of magnitude)

The price includes turnkey delivery in Western Europe.

Note: Prices are subject to currency exchange-rate fluctuations.

4. Indicative consumption figures, opex

Several electric motors are required for the design.

Motor power (KW)	Approximate amount required	Function
65	4	Fans and Scalper
25	3	Pulsation air, elevator, breaker
5	8	Airlocks, augers, sampler

Some ½ FTE (Full Time Equivalent) is required for operations and quality assurance of the VBDT, some solids handling is required for moving and emptying or recycling the chemical dustbins.

5. Project development service

UreaKnowHow.com can offer **F**rond **E**nd **E**ngineering and **D**evelopment (FEED) service, specifically for the VBDT, based on StageGate. The StageGate method is a project management technique, which reduces risk, and leads to a higher success rate for projects.

We can offer our clients the following **FEED** steps, which can be supplied at cost.

FEL1

Basis of Design: Your exact design criteria need to be determined from present product quality. Business Case: Implementation area and needs will be illustrated with block diagrams and rough order of magnitude cost estimates of +50%/-25%.

FEL2

A customized process flow diagram, preliminary material balance and HAZOP study leading to an approximate cost estimate of +30/-15%.

FEL3

Basic Engineering (P&ID, datasheets), go-out for bid packages at vendors, including controls and operating manuals leading to a even more cost estimate of +15%/-10%.

At each FEL stage (FEL1-3), a recommendation of GO or NO GO will be provided by UreaKnowHow to the client. The aim is to provide honest and transparent advice for our clients, making sure that they receive the right advice and solution. After this FEED a customer can go to an EPC contractor and acquire the financial commitment or funding.

6. Additional services offered by UreaKnowHow.com

UreaKnowHow.com has the expertise to perform Product Quality Assessment Services (PQAS). The aim of PQAS is to seek out root causes of product quality issues, and then to propose and evaluate solutions. Implementation of the solutions can be managed by UreaKnowHow.com, including Statistical Process Control tools for abrasion test parameters, percentage moisture content, and implementation of Size Guide Number (SGN) en Uniformity Index (UI).

For more information about the unique Van Bommel Dedusting Technology and our Product Quality Assessment Services, please contact:

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