

Urea and Ammonium Nitrate – Highest Quality – Maximum Output

Relevant for: Fertilizers, DEF, AdBlue

Nitrate-based fertilizers are the most commonly used straight fertilizers accounting for millions of tons of products per year such as urea and ammonium nitrate. Measuring the concentration of urea and ammonium nitrate optimizes the output and ensures highest quality of the final products.



1 Introduction

Ammonium nitrate has the chemical formula NH_4NO_3 . Produced as small porous pellets, or “prills”, it’s one of the world’s most widely used fertilizers. It is also the main component in many types of mining explosives, where it’s mixed with fuel oil and detonated by an explosive charge.

Urea has the chemical formula $(\text{NH}_2)_2\text{CO}$. It is an important raw material for the chemical industry - widely used in NO_x control systems to reduce nitrogen oxides emissions. With SNCR (selective non-catalytic reduction) systems, urea is often the reagent choice for safety reasons. Urea is stable, non-volatile, non-explosive and non-flammable.

Both urea and ammonium nitrate can be further concentrated and converted into a solid form (granules).

Anton Paar’s inline refractometer L-Rix 5100 has proven to be well suited for the continuous concentration monitoring of urea and ammonium nitrate.

2 Production process

For nitrogen-based fertilizers, the largest product group, the process starts by mixing nitrogen from the air with hydrogen from natural gas at high temperature and pressure to create ammonia. Approximately 60% of the natural gas is used as raw material, with the remainder employed to power the synthesis process.

The ammonia is used to make nitric acid, with which is then mixed to produce nitrate fertilizers such as ammonium nitrate (AN). Ammonia may also be mixed with liquid carbon dioxide to create urea. Both products can be further mixed together with water to form UAN (urea ammonium nitrate) solutions.

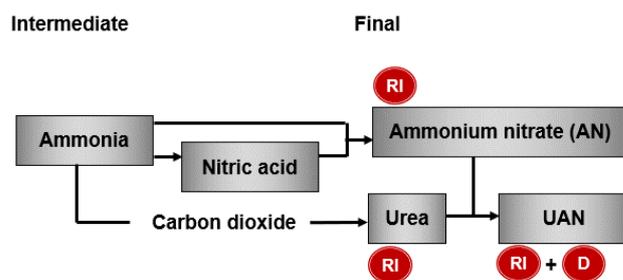


Figure 1: Urea and ammonium nitrate production process

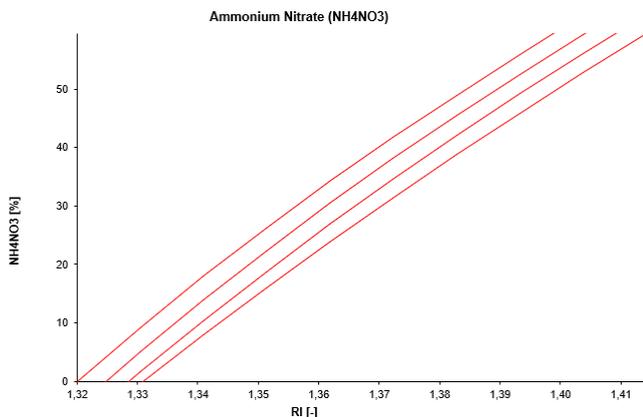


Figure 2: Ammonium Nitrate Concentration versus RI

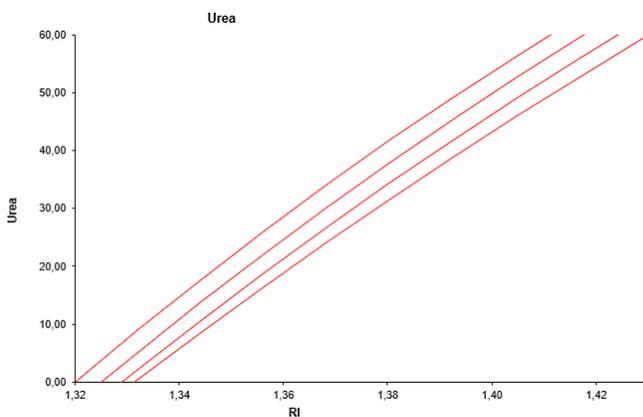


Figure 3: Urea Concentration versus RI

3 Urea Ammonium Nitrate (UAN)

UAN is a three components solution of urea and ammonium nitrate in water. It is used as a fertilizer and provides both fast-acting and long-lasting nourishment from three forms of nitration. These are ammonia nitrogen, nitrate and the water-soluble nitrogen in urea. A common grade of these fertilizer solutions is UAN 32, which consists of 45 % ammonium nitrate, 35 % urea and 20 % water, resulting in a total nitrogen concentration of 32 %.

4 Measurement Setup

The Anton Paar solution for concentration measurement consists of the L-Rix 5100 Inline Refractometer which is installed at different stages of the production process to measure the concentration of urea, ammonium nitrate or intermediate chemicals. This allows accurate process control and reduces manufacturing costs.

The L-Rix can be installed directly in the line or tank and continuously measures the refractive index and temperature.

In case of UAE, Anton Paar provides an easy and safe inline method using refractive index in combination with density. For this application the concentration of ammonium nitrate, urea, water and total nitrogen are calculated.

The application specific concentration calculations are carried out in the mPDS 5 or with the Pico 3000 evaluation units. The results can be displayed and transferred to a PLC or to the Davis 5 data acquisition and visualization software.

Alternatively, the L-Rix can be connected to a Pico 3000 RC housing for remote control (for a single production line).



Figure 4: L-Rix 5100 Inline Refractometer

5 Benefits

The reliable and accurate L-Rix 5100 enables

- Precise monitoring of the urea concentration in real-time
- Precise monitoring of the ammonium nitrate concentration in real-time
- Improved end-product quality and consistency
- Reduced manufacturing costs
- Direct comparison with the lab reference method

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