



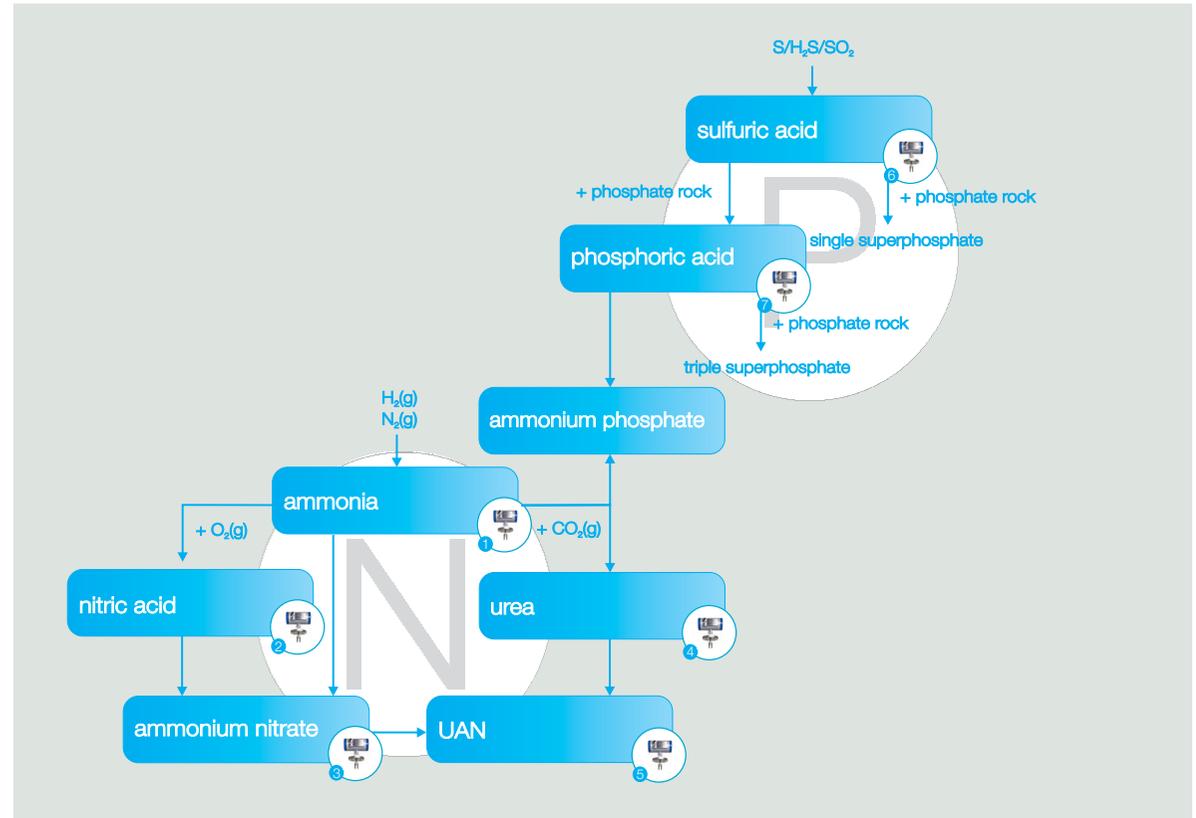
Fertilizer production

Fertilizer production

Introduction

• LiquiSonic® analyzer provides advantageous utilization for the measurement of various substances, which are necessary for fertilizer production:

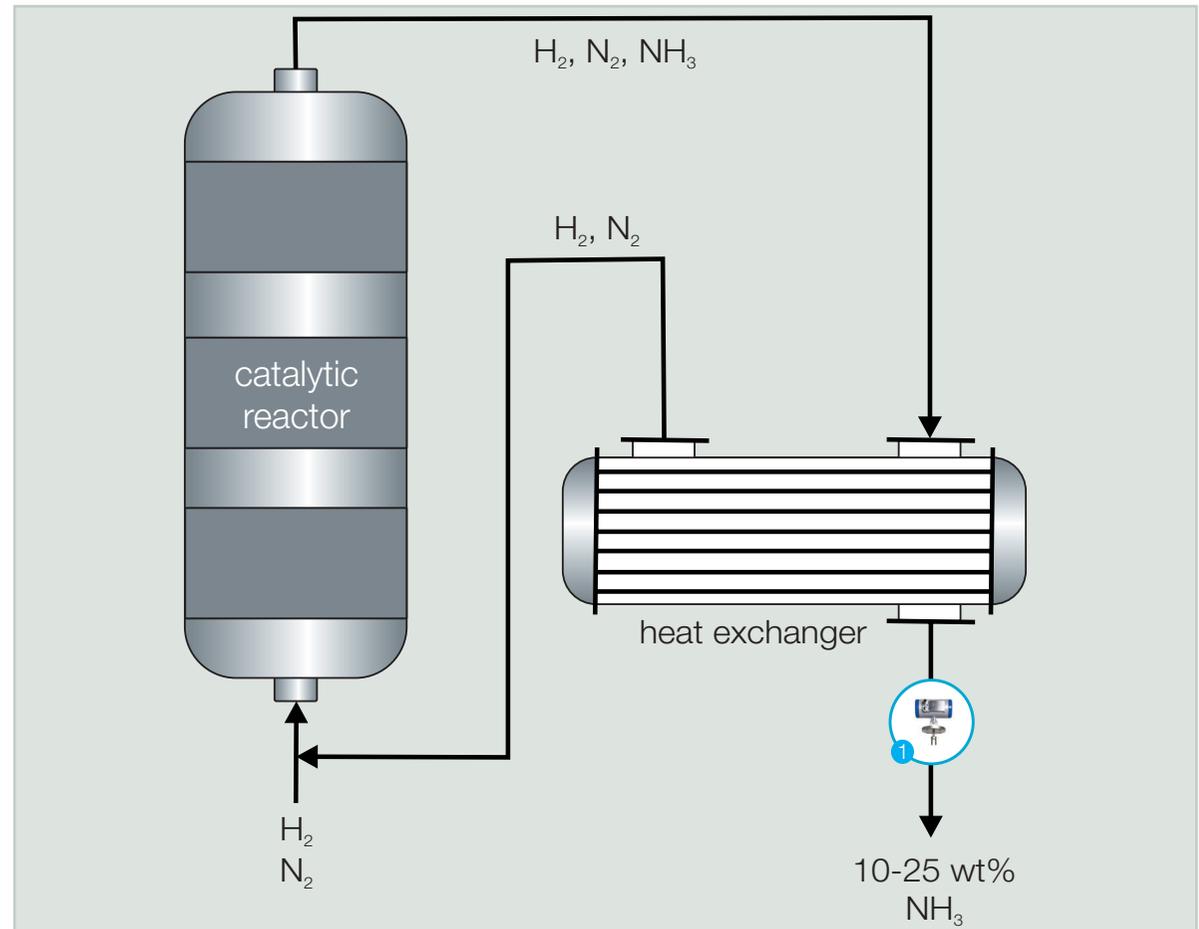
- ammonia
- nitric acid
- ammonium nitrate
- urea
- urea ammonium nitrate
- sulfuric acid
- phosphoric acid



Fertilizer production

Application - Ammonia synthesis

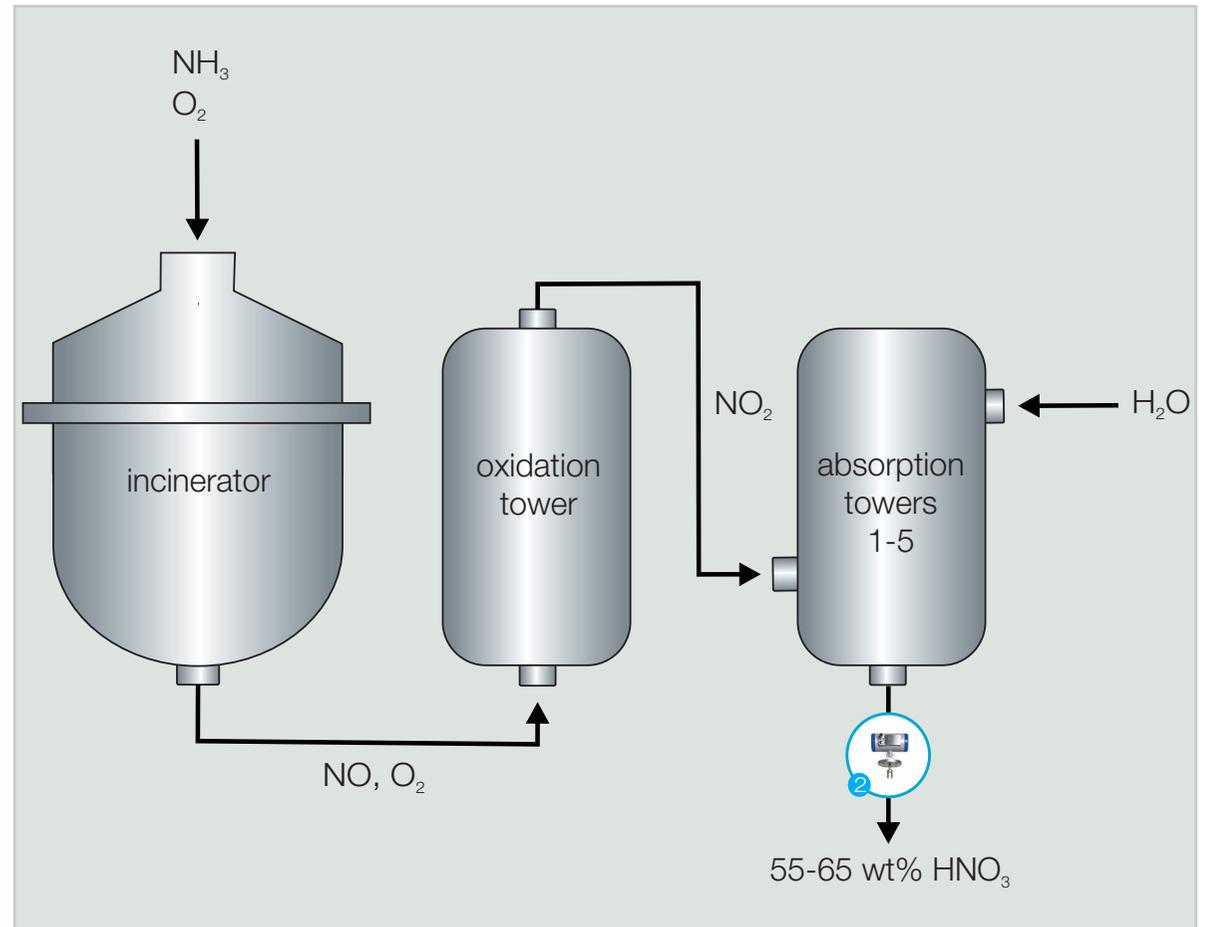
- Ammonia (NH_3):
 - key ingredient in nitrogen fertilizer production
 - activation material for the synthesis of nitric acid and urea
- industrial production by the Haber-Bosch process in three production stages:
 - [1]: gas production
 - [2]: gas purification
 - [3]: synthesis (see figure)
- synthesis: $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$
 - reaction is catalyzed by iron or ruthenium in a catalytic reactor
 - finally: cooling condenses ammonia
 - concentration typically ranges from 10 wt% to 25 wt%



Fertilizer production

Application - Nitric acid synthesis

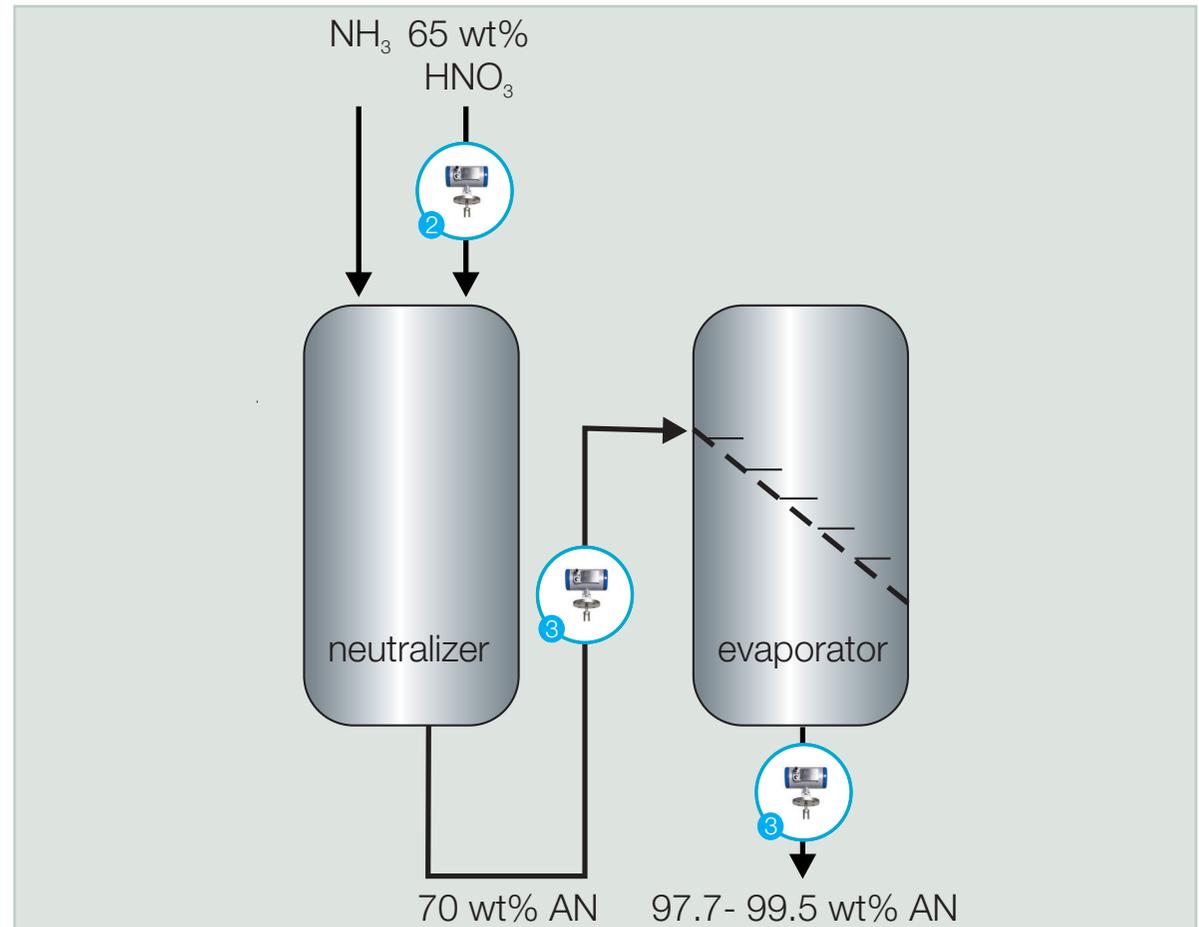
- Nitric acid (HNO_3):
 - 70 % of the HNO_3 goes toward developing fertilizer ammonium nitrate (AN)
 - rest is used for :
 - production of explosives
 - pickling of stainless steel
- Nitric acid is formed by the Ostwald process in three stages:
 - [1]: gas mixture of NH_3 and air is incinerated where NH_3 reacts on a platinum-rhodium catalytic surface to form nitric oxide (NO)
 - [2]: NO gas reacts with secondary air to prepare nitrogen dioxide (NO_2)
 - [3]: NO_2 feeds an absorption tower to engage counter-flowing water (H_2O) to yield nitric acid in typical concentrations of 55 - 65 wt% HNO_3



Fertilizer production

Application - Ammonium nitrate production

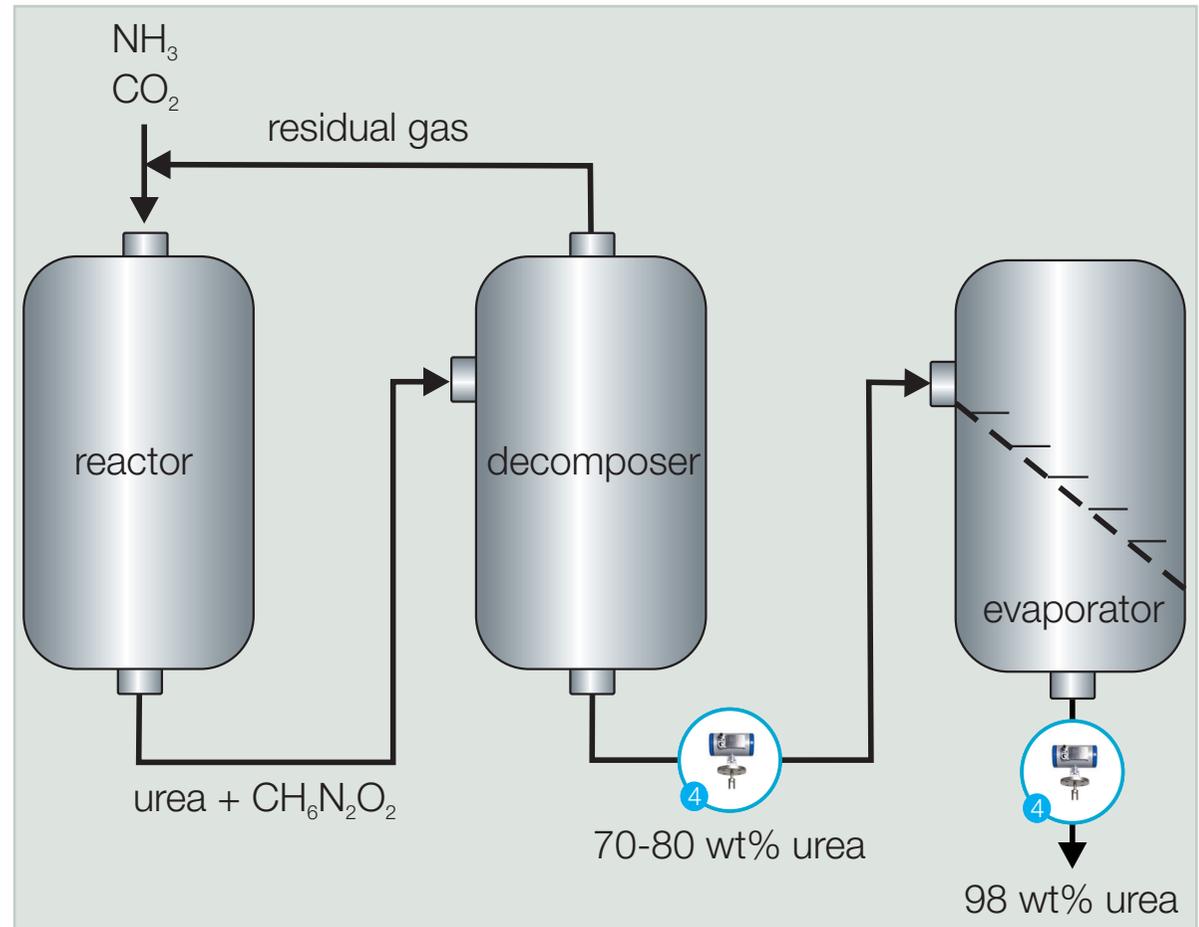
- Ammonium nitrate (NH_4NO_3) or “AN”:
 - one of the most important nitrogenous fertilizers
 - comprises 12.4 % of the world’s total nitrogen consumption
 - useful in the production of explosives
- Industrial production of ammonium nitrate:
 - almost exclusively by neutralizing NH_3 with HNO_3 to form 70 wt% AN
 - evaporation process: enhances concentration up to 99.5 wt%



Fertilizer production

Application - Urea production

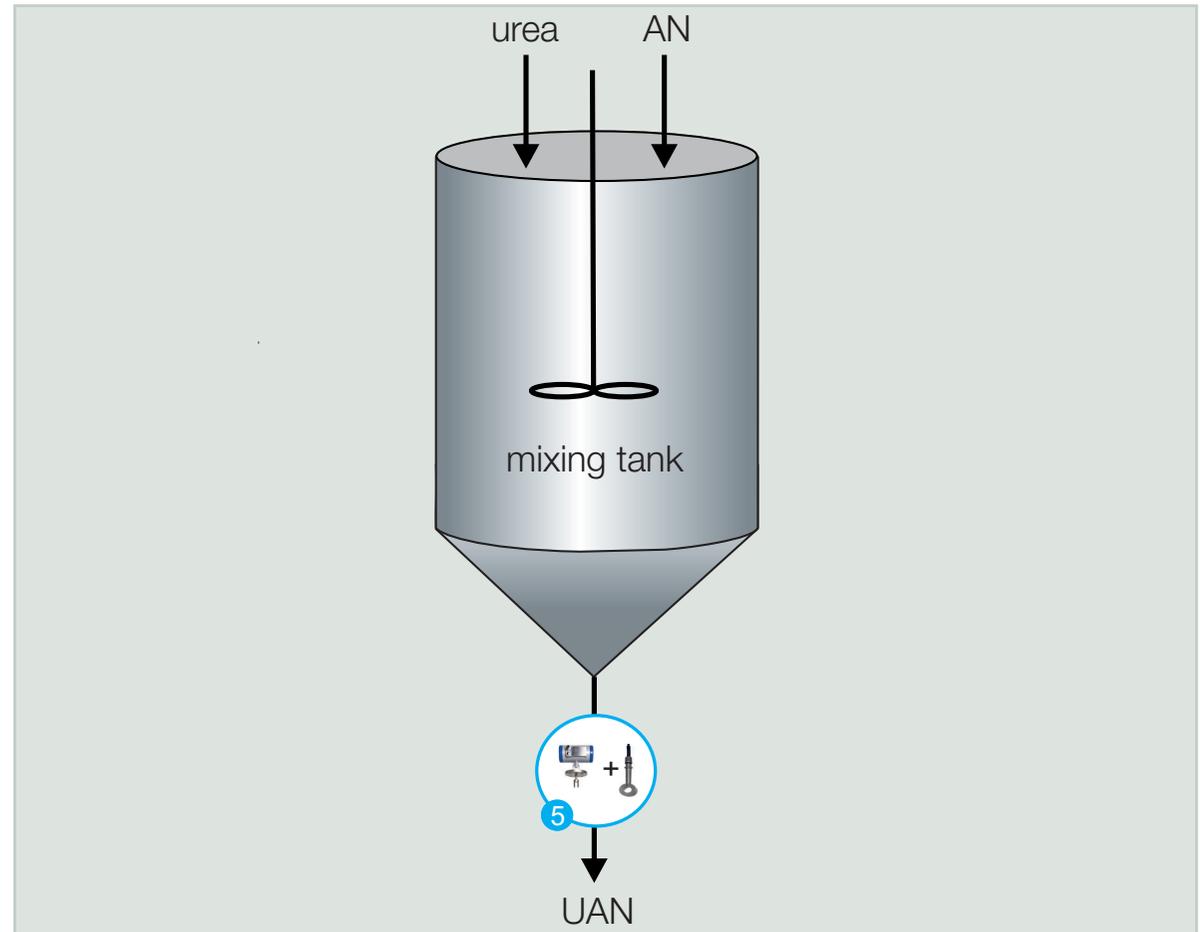
- Urea ($\text{CH}_4\text{N}_2\text{O}$):
 - high nitrogen content
 - ideal agricultural fertilizer
 - key roles in:
 - pharmacy (e.g. skin care)
 - chemistry (e.g. melamine)
- Urea production:
 - follows NH_3 formation
 - occurs in two stages:
 - [1]: NH_3 and CO_2 are heated under pressure to develop ammonium carbamate ($\text{CH}_6\text{N}_2\text{O}_2$)
 - [2]: dehydration removes H_2O to yield concentrations of 70 - 80 wt% urea
 - evaporation process: enhances concentration up to 98 wt%



Fertilizer production

application - Urea Ammoniumnitrate production

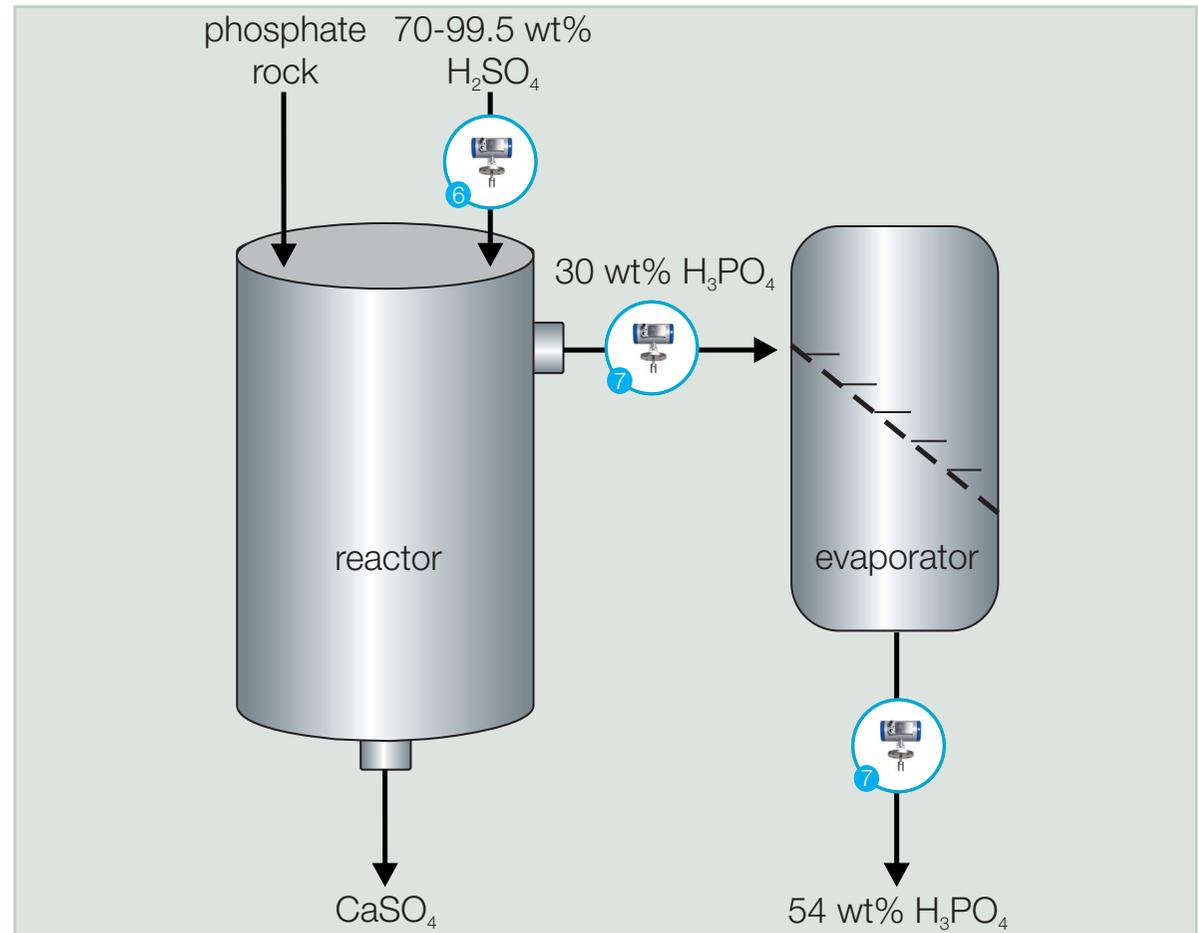
- Urea ammoniumnitrate (UAN):
 - nitrogenous liquid fertilizer
- Industrial production:
 - UAN plants usually incorporate urea and AN production lines upstream
 - Typical recipes:
 - 40 % AN
 - 30 % urea
 - 30% water
- LiquiSonic® analyzer measures the concentrations using a combination of sonic velocity and conductivity



Fertilizer production

application - Phosphoric acid production

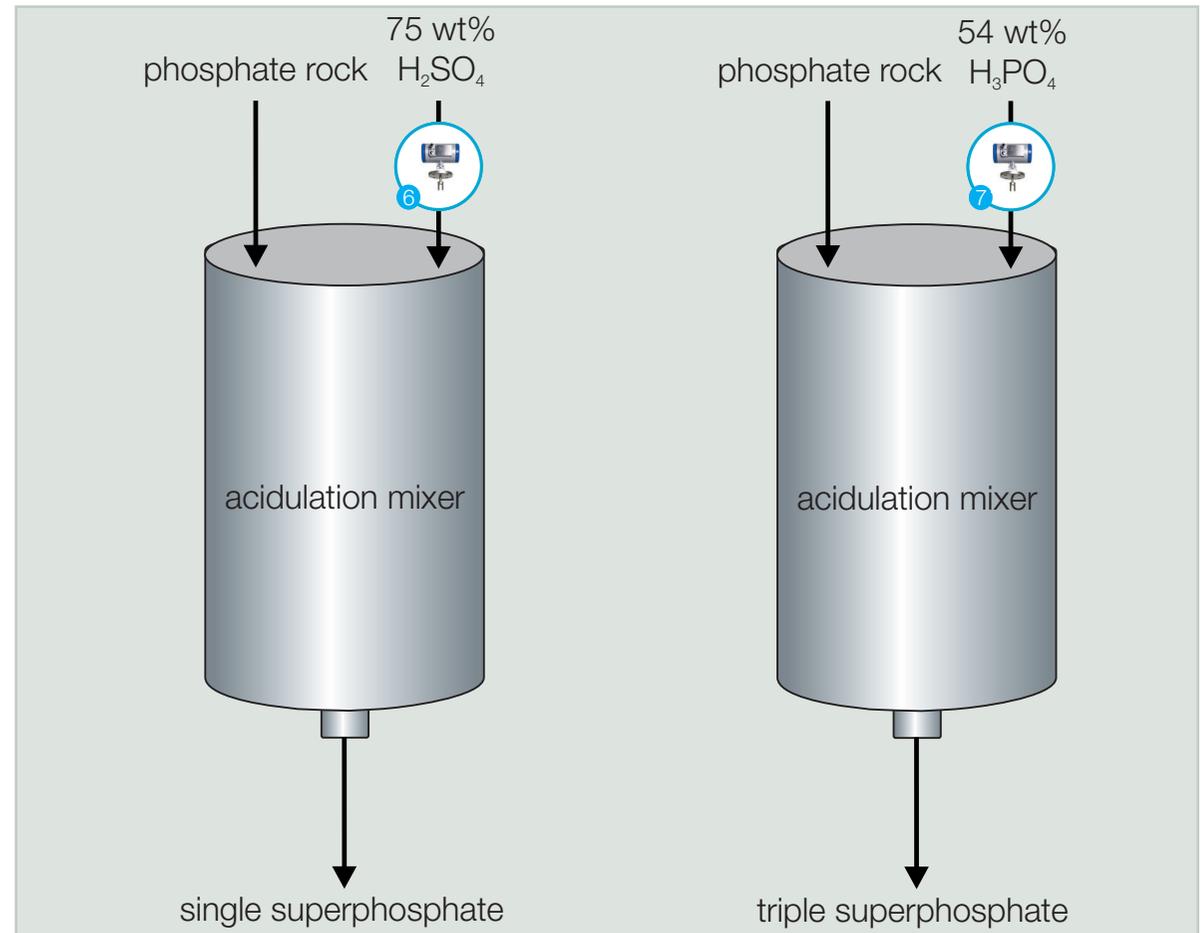
- Phosphoric acid (H_3PO_4):
 - one of the most important inorganic acids
 - necessary for the production of triple superphosphate (TSP)
- Industrial production:
 - formed by combining phosphate rock with concentrated sulfuric acid (98 wt%)
 - yield: about 30 wt% phosphoric acid
 - byproduct: calcium sulfate (CaSO_4)
 - evaporation process: enhances concentration up to 54 wt%



Fertilizer production

application - Superphosphate production

- Superphosphate:
 - fertilizers that vary in phosphate wt% and in secondary water-insoluble contents
- Single superphosphate (SSP):
 - formed by mixing pulverized phosphate rock with 70 - 75 wt% of H_2SO_4
 - solidified finished product contains 16 - 20 wt% phosphorus pentoxide (P_2O_5)
- Triple superphosphate (TSP):
 - prepared with phosphate rock that reacts with phosphoric acid (50 - 54 wt% P_2O_5)
 - product: solid fertilizer with 45 - 46 wt% phosphate content



Fertilizer production

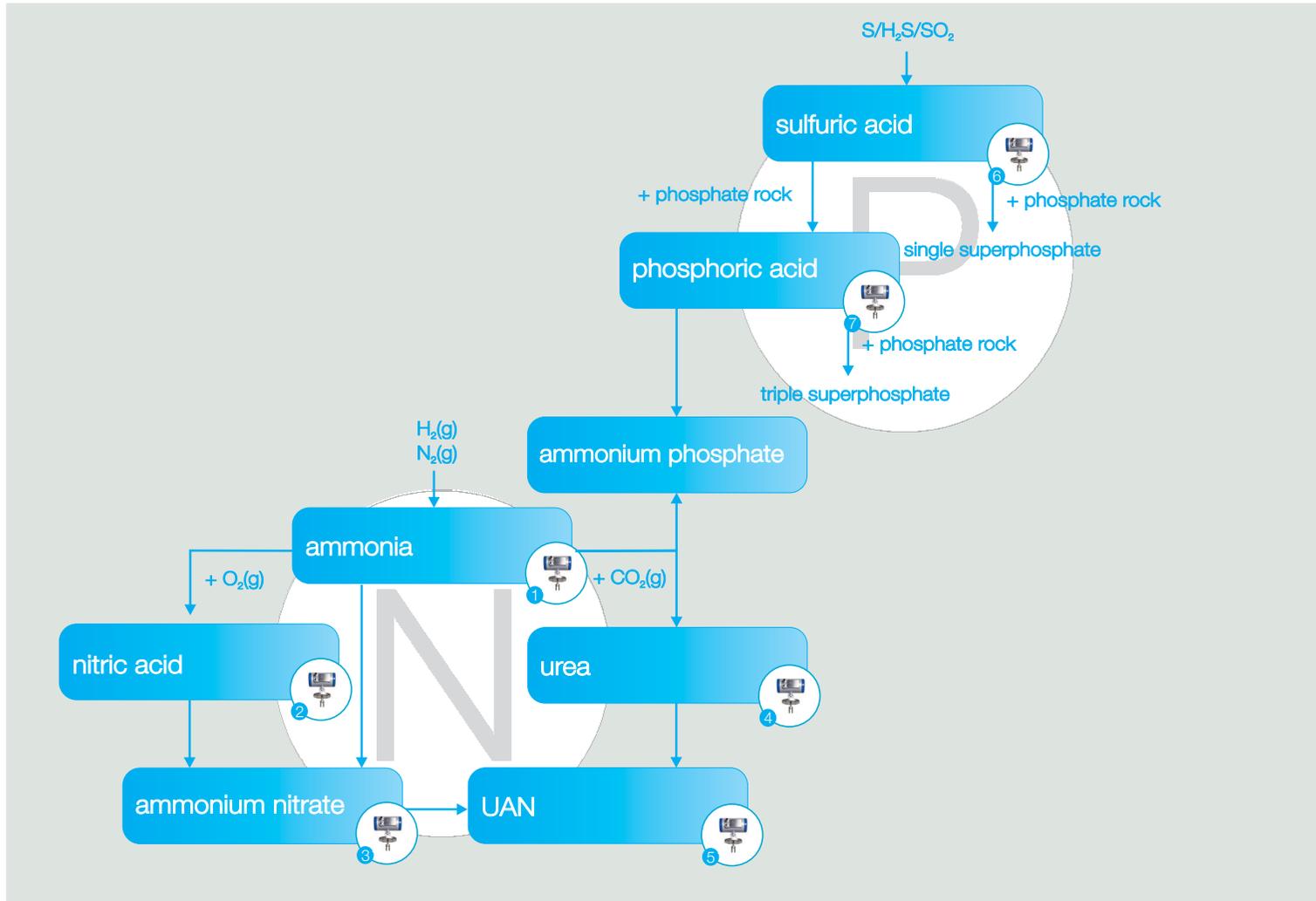
Devices

- LiquiSonic Controller 30 and 40
- immersion type sensor 40-14
- length: customized
- max. temperature: 120 °C (optional 200 °C)
- process connection: DIN, ANSI
- interface:
 - Modbus RTU /Profibus DP
 - analog outputs (4-20 mA)
- material:
 - HC 2000
 - stainless steel
 - on request: Halar, PFA, ETFE, Titan, Tantalum, Monel



Fertilizer production

complete process scheme



Fertilizer production

References



We are committed to quality in every way.





In liquids, we set the measure.