

AUTOMATED SAMPLE PREP SYSTEMS AND ANALYSIS FOR THE QUALITY OF FERTILIZER

FERTILIZER ANALYSIS AS QUALITY CONTROL IN A PRODUCTION PLANT

INTRODUCTION

The **accurate and rapid analysis of process samples** in a fertilizer production plant is critical for quality and safety of the produced fertilizer. Hence, there exists a demand for automated systems that perform the wet chemistry methods for analysis of the concentration of different anions, cations, free acids and pH. Automation brings the advantage of increased hands-off capacity, improving accuracy and precision for routine analysis. It may even come with a considerable reduction in process cost.

It also provides an **effective solution** to the **tedious process** of sample preparation with exposure of laboratory staff to major **safety risks** when working with concentrated aggressive chemicals such as HNO₃ and HCl.

AUTOMATED FERTILIZER ANALYSIS

Nucomat has engineered an automated platform for fertilizer analysis by executing wet chemistry methods. The system was developed in close cooperation with the customer and instrument vendors.

The concentration of the following molecules is determined: N-NH₃, N-NO₃, N-NO₂, P₂O₅, K₂O, CaO, MgO, SO₃, SrO, Cl and F.

4 Sets of **ion chromatographs of Metrohm** (each set contains 2 Metrohm 930 Compact IC Flex analysers for anion and cation determination) were installed to perform the measurements.

For the determination of Cl, HNO₃, P₂O₅ and the pH, 2 **titrators of Mettler Toledo** are being used.

Additional elements can be analysed by an ICP-OES. The sample prep will be integrated on the wetchem systems. Analysis on the ICP can be done on- or offline.

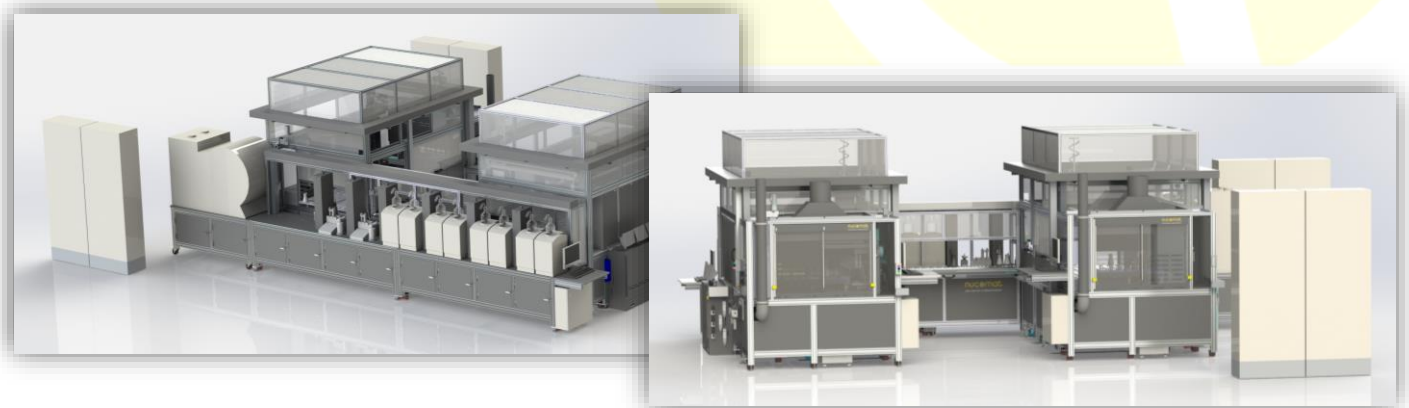


Figure 1: Render of 2 wetchems connected with a shuttle

The system can be installed as a stand alone unit (wetchem unit) with integrated instruments. It is also possible to add multiple units in line interconnected with a shuttle for increased capacity. The wetchem systems will perform the sample preparation. The shuttle will then contain all the analytical instruments for the analyses.

The input samples can be grains, powders, liquids or slurries.

Every step in the process is **controlled gravimetrically** ensuring the quality of the prepared samples and the obtained results of the analytical instruments.



Figure 2: IC's installed on the shuttle

Each wetchem system contains the following device:

- Powder sampler with dispenser: samples grains or powder and dispenses liquids on a 10-3 balance
- Liquid sampler with dispenser: samples brines or liquids and dispenses liquids on a 10-3 balance
- Dual washer: Erlenmeyers used in the system are automatically washed for reuse
- Filter station: A station the pass the liquid sample over a filter on a 10-3 balance
- Main robot: Gantry robot to move all the vessels around in the system
- Hotcell with secondary robot: Fume hood containing a hotblock with magnetic mixing positions
- Magnet distribution station: distribution of stirring magnets

CENTRAL WEB BASED SOFTWARE

The platform is controlled by **ROBIN**, a real time event driven **scheduling software** developed by Nucomat. The user-friendly web interface allows the user to run samples, oversee the processes and get information and timely warnings on addition of fresh reagents. All samples are electronically **tracked** from registration to result and relevant actions are logged to a database. Instrument calibration, control, reference sample analysis and cleaning cycles are automatically managed and additional process control **business rules** can be implemented. Sample data can be validated online through the web interface and released for reporting, typically to a LIMS system. **Input and reporting** functionality is available with various file formats.



Figure 3: Web interface of 1 of the wetchem systems

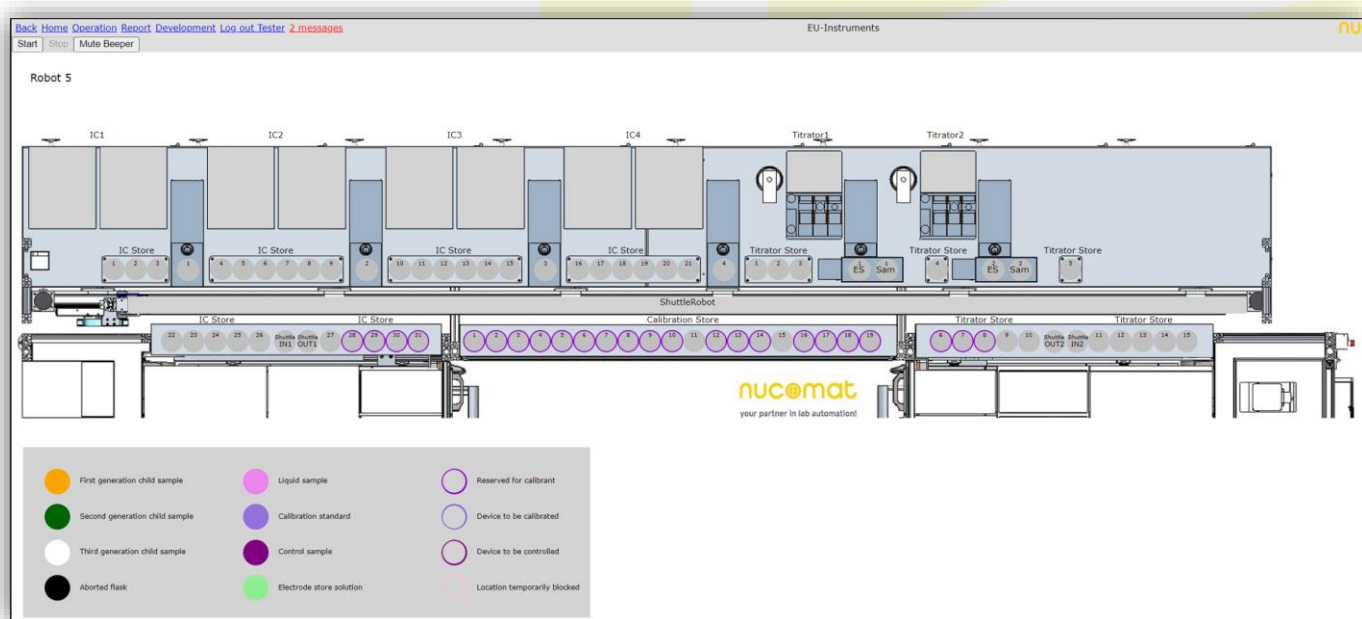


Figure 4: Web interface of the shuttle

BENEFITS FOR CUSTOMERS

- Operator safety
- Traceability and repeatability
- Gravimetric accuracy
- Validated results

TAILOR-MADE SOLUTIONS

Nucomat builds turnkey automated systems based on your requirements (required capacity, characterization protocols, ...). Instruments from other manufacturers can also be incorporated in the automated system to expand the system specifications.

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