

# Highly efficient vibrations for urea granules

Pardis Petrochemical Company (PPC), Iranian owner of one of the world's largest urea granulation plants, uses RHEWUM direct excitation screening technology to achieve the desired high process efficiency, availability, reduced energy consumption and high quality urea granules.

Increasing world food and energy consumption has led to growing demand for fertilizers and the need to save natural resources. For these reasons, a major producer of high quality urea in the Middle East decided to set up a third urea plant with the world's latest urea granulation design. The aim of the producer for this long-term investment was to achieve the highest possible efficiency paired with reduced energy consumption.

At the heart of the new plant, RHEWUM screening technology ensures the desired efficiency of the process as well as the purity of the urea product. The producer selected RHEWUM for design, manufacturing and commissioning of the extractor lines and main screens with the proven direct excitation technology for the production of granulated urea.

As the pioneer in directly excited screening technology RHEWUM has been successfully developing, designing and

manufacturing screening machines for new and existing urea granulation plants for many decades. Since 1956, RHEWUM has supplied more than 1,800 machines to fertilizer plants which are installed in more than 60 different countries.

## Screens for urea granules

For urea granulation, the combination of vibrating extractors with linear motion screens guarantees the level of the fluidised granules in the granulator and additionally protects the process by screening out the lumps. Downstream in the granulation unit the main screens ensure the quality of the final product. RHEWUM extractor lines, diverters, special chutes, distributing feeders, safety and process screens ensure a consistent process.

The feed capacity of the main screens is 4 x 65 t/h. The screening task is to separate the lumps (>15 mm) in a separate

outlet and the coarse particles (4 to 10 mm) in the second outlet while the product (2 to 4 mm) and the fines (<2 mm) flow into separate inlets of the product diverter. The steady product requirement for 95% purity with minimum product loss in the coarse and fine fraction is essential for high performance screening.

## Efficient screening

### Step 1: Distribution

To make use of the complete screening area requires a constant and uniform distribution of the urea directly at the inlet of the screening machine. The distribution feeders are pre-positioned to the screens and guarantee the continuous quality of the product in following steps.

The moving inner distribution plate which is vibrated by two outer out-of-balance motors and a static housing allows a firm and dust-tight flange connection without flexible sealing. The static housing further permits inspection of the distribution feeder and adjustment with guiding plates during operation. The low weight of the vibrating inner distribution plate reduces the energy consumption to 0.68 kW per motor and the dynamic loads to a maximum of 0.25 kN in vertical and 0.125 kN in horizontal direction per support point.

### Step 2: Screen cloth

The most important contact part of the screening machine with the urea is the screen cloth. Choosing the right mesh opening will create a high quality product. In addition, a constantly open screening area will increase the plant capacity and reduce the costly recirculation of material. Easy and fast maintenance of the screen cloths will lead to high availability. All these points have been incorporated into the design of the main screen cloths.

Fig. 1: RHEWUM SV feeder for constant and uniform distribution of screening materials.

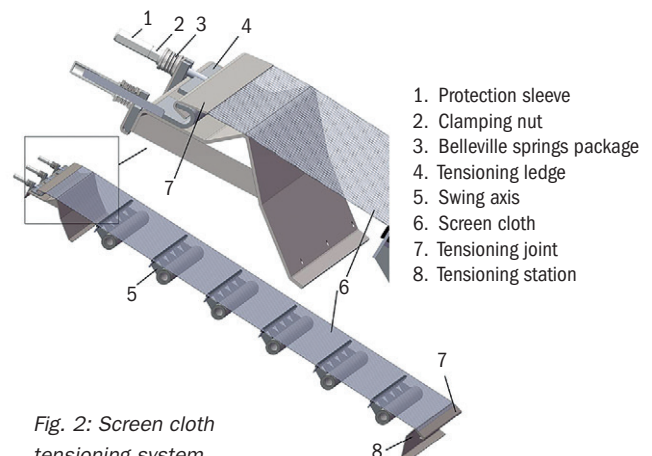


Fig. 2: Screen cloth tensioning system.



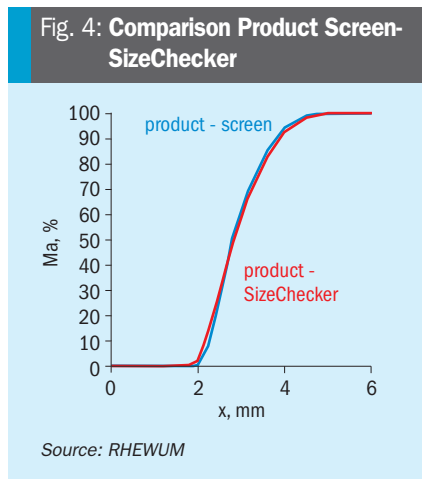
Fig.3: RHEWUM WAU screening machine with direct excitation of the screen cloth.

The mesh openings were optimised during test trials in the RHEWUM pilot plant in Remscheid. Directly excited screen cloths with an automatic cleaning cycle keep the screen cloths free from clogging. Every screen cloth can be changed individually without removing any of the others, which is very useful considering that different wear of the screen cloths can lead to individual maintenance intervals. The screen cloths are tensioned by tensioning ledges with only four clamping nuts. Between the tensioning ledges and clamping nuts Belleville spring packages are installed to make the screen mesh more flexible and self-tension itself in case of wear or high temperature. A protection sleeve keeps the dust away from each screw and ensures easy replacing. In total there are only four screen cloths installed and each can be replaced within just ten minutes.

### Step 3: Screening technology

Requirements for urea granules are quite challenging: continuous and economic production of well-defined products in reproducible qualities. By choosing advanced technology the objective to efficiently operate the plant with lowest operation cost can reliably be achieved.

WAU type directly excited screening machines employ the vibration effectively into the screen mesh, thus directly into the urea granules. The required energy consumption is only 0.036 kW/ton of screened urea. Availability of each component in the urea granulation process needs to be as high as possible. One weak point in the process will create a bottleneck and in the worst case a shutdown of the whole granulation plant. To guarantee 100% availability, the screening machine is equipped with 15 small out-of-balance-



motors which keep the performance stable till the next scheduled maintenance period in case of one motor failure. The motors are flange connected to the vibrating axes which transmit the vibrations through knocker shaft profiles and screen cloths to the urea. The WAU's high number of motors increases the performance and allows the screen decks to have different amplitudes. As a result the amplitude remains uniform over the complete width of the screen, which leads to consistent screening quality of the entire screen area.

As the housing has only a static function, no dynamic loads are created and transmitted to the building. Due to the low vibrations the directly excited screens do not require a heavy steel structure even when located at the top of the building. Connections to on- and off-going chute work are designed dust-tight without flexible sealing to minimise down time for maintenance. Reducing energy consumption, increasing availability, saving steel structure and avoiding unnecessary maintenance have been successfully incorporated into the urea screening plant for increasing the efficiency of the whole urea granulation plant.

### Step 4: Quality control

To optimise the urea plant design screening trials are carried out. Test trials offer the possibility to compare laboratory results with the respective product data. These results have a significant role in the design process of the respective machine guaranteeing later success in production.

In order to check if the guaranteed product qualities can be reached, trials were conducted in the RHEWUM laboratory. Based on former experience, the trials were made using a WAU screen type. Furthermore, the screen products were

analysed on a laboratory screen tower and the optical measurement system "SizeChecker". The results of both measurements are presented in Fig. 4.

The diagram shows that all measurements of the SizeChecker match the corresponding analyses performed on a laboratory screen tower. The same samples were used for both the screening analysis and the SizeChecker analyses.

The SizeChecker is a compact particle size measurement device allowing simultaneous measurement of particle sizes and particle shapes continuously. By means of digital image processing pourable particles of 0.2-20 mm can be optically measured. Since all particles of the product sample are completely scanned, the RHEWUM SizeChecker offers a cost effective alternative to common analysis screens. The SizeChecker can be used in production with an automatic sampler device to avoid time consuming sample taking and manual analyses. The measured results are automatically recorded and alarms can be set in case of variation in the particle size distribution.

The sample is conveyed via a hopper and a distribution feeder along the light source to the material outlet. During this time the contact-free measuring is carried out. The digital pictures produced by the camera are free from distortion and are electronically processed.

The SizeChecker can be integrated into a process for production monitoring and quality control.

## Outlook

After the convincing performance at the RHEWUM test facilities the screening machine type WAU will prove its high-grade applicability for screening urea at the Persian Gulf for the next decades. The tests conducted by RHEWUM in Remscheid determined that PPC's demands on purity and yield have been reached and exceeded at site. The next reasonable step for the producer will be to set up a fourth urea granulation plant in the future.

## Conclusion

Together with PPC, RHEWUM has designed, supplied and commissioned a highly efficient screen for urea at high capacities. Aspects like availability, energy consumption, saving natural resources and optimising the maintenance schedules have been successfully incorporated into the operation. ■