A Change Of Screen

Tountzer Ramadan, RHEWUM, Germany, presents a case study on the installation of direct excited polishing screens at a fertilizer plant in Bulgaria.

Increasing capacities and higher quality requirements in existing fertilizer plants are the main challenges in revamp projects. For reaching these new standards, high frequencies and non-clogging surfaces are the basic requirement in the last process step before packing. The following case study presents the design and installation of a tailor made direct excited polishing screen at a fertilizer plant in Bulgaria.

A manufacturer of nitrogen fertilizers in Southeastern Europe and producer of phosphorus fertilizers on the Balkan Peninsula, Agropolychim AD, faced the challenge of upgrading a well-aged polishing screen and improving the product quality to standards.

The feed capacity of 100 tph should be maintained and, at the same time, the separation changed from 10 mm lump separation to 5 mm. In addition to this, 1 mm dedusting of fertilizer should be added to the screening task.

Modification on the existing concrete steel beams was limited and had to be respected in the new machine design. Installed at the top of the building with limitation in height, and respecting on and off going connections and footprint, a tailor made design was the only solution that could be fitted. Therefore, the fertilizer producer opted for a customised flexible solution from Remscheid. To analyse the installed machine, RHEWUM visited Agropolychim AD in Devnya, Bulgaria, to check the available area and provide fitting dimensions with the new machine. The available height for the screening machine was limited to 2.8 m.

Therefore, the distribution and outlet chutes were specially designed and integrated between the concrete floors.

Fertilizer types

Agropolychim AD produces a wide range of fertilizer that includes the following:

- Ammonium nitrate.
- Urea ammonium nitrate.
- Urea ammonium nitrate with sulfur.
- Urea, triple superphosphate.
- Mono-ammonium phosphate.
- Diammonium phosphate.
- NP.
- NPK.

These various fertilizers are produced in different granulation, prilling and compacting processes. Agropolychim AD has an annual production capacity of:

- 400 000 metric t of ammonium nitrate, or 800 000 metric t of urea ammonium nitrate.
- 300 000 metric t of mono/diammonium phosphate, or 330 metric t of triple superphosphate.

In addition to its own production, the company procures from its partners approx.

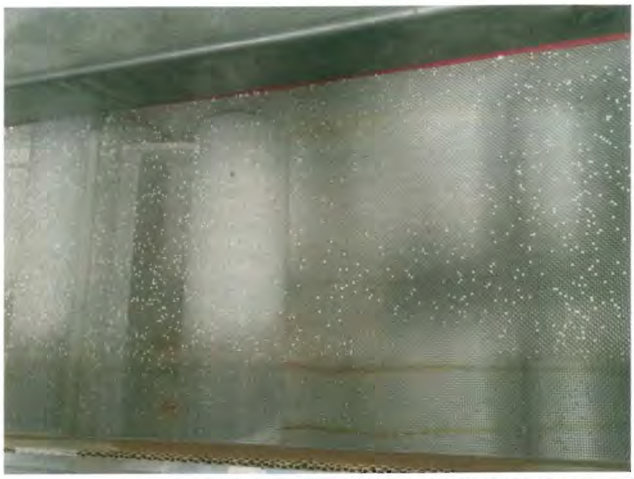

Figure 1. Clogging of square mesh after one trial.

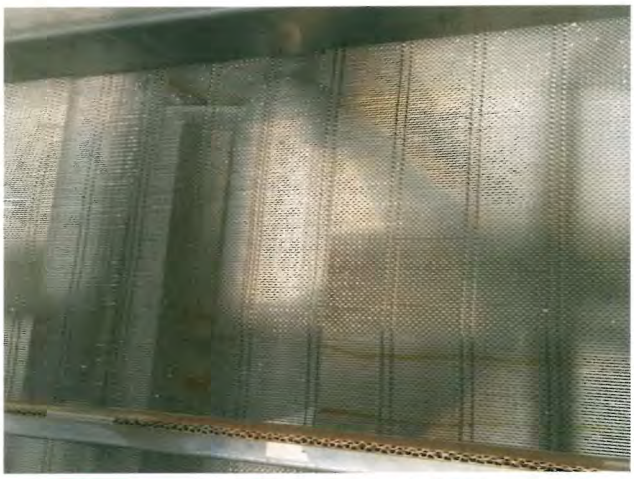

Figure 2. No clogging of rectangular mesh after one trial.

300 000 t of nitrogen and phosphorus, mono/di-component and complex fertilizers annually. All of these fertilizer types should be sieved by only one polishing screening machine. Therefore, the flexible, direct excited screening machine type WAF has been proposed for handling all of the different screening tasks.

Screening machine

The screening machine type WAF is a combination of a direct excited screen and a linear motion vibrating conveyor. This polishing screen is characterised by low downtimes and low space requirements, as well as fast and easy maintenance. Additionally, it allows a maximum feed rate with maximum yield at a given purity, which is a good combination for polishing fertilizer. In the range of fine particles, excellent sieving results are achieved.

The linear motion is generated by two counter-rotating out-of-balance motors and ensures the transport of the fertilizer. The additional direct excitation of the screen cloth prevents the mesh from being blinded by clogged particles. With this combination of drive and excitation, difficult-to-sieve fertilizers, which normally cannot be screened on linear motion sieves, are classified precisely and at high feed rates. Furthermore, the automatic self-cleaning cycle with high accelerations of up to 15 g helps to keep the cloth free reliably even when screening sticky materials.

Reaching high product purities of at least 85% in all major fractions, especially the highly valuable fractions, amplified the arguments for the WAF screening machine. Screening fine materials with a high efficiency at high feed rates requires a precise adjustment of all machine parts. This is only possible on precisely working, high quality equipment. The setting of the amplitude for each screen deck has to be adjusted individually to ensure an ideal screening process for each fraction.

The screening plant can also be retrofitted in the original space in order to keep the construction cost economical. As a result, the WAF meets the requirements regarding pureness and yield of the project, and therefore guarantees a reliable screening process.

Due to the higher number of small drives compared to conventional screens with a lower number of larger motors, RHEWUM's direct excited screens are highly reliable. Each inlet and outlet half of each screen deck can have its individual amplitude and self-cleaning interval to maximise the efficiency for every fraction. Vibration is imparted into the screen cloth by high speed movement of transversally mounted knocker shafts, located beneath the screen cloth. The velocity of the material down the screen is thereby determined by the angle of the screen deck. Outside the screen housing, rugged electromagnetic drives excite the knocker shafts, conveying the high frequency oscillation directly into the screen mesh. The electrical control of the vibrating heads allows infinite control of the vibrator oscillation during operation and thus a perfect adaption of vibration amplitude to product variations.

Every screen cloth can be changed individually without removing any of the others, which is useful considering that the 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. A protection sleeve keeps the dust away from each screw and ensures easy replacement. In total, there are only four screen cloths installed and each can be replaced within just 5 – 10 minutes.

Trials

When designing and optimising production plants, it is inevitable that trials will be carried out despite all of the new developments in this field. The RHEWUM testing facilities offer the possibility to compare the laboratory results with the respective product data. These results have a significant role in the design process of the respective machine guaranteeing the later success in the production.

The screen will be fed with 100 tph of granulated fertilizer with a bulk density of 0.92 t/m³. Water content of the feed material is a maximum 1.0 %wt. Due to space limitations at the customer's site, a WAF screening machine was tested with similar material to optimise the screening area as much as possible.

Several mesh types have been tested in order to find the best solution for the customer. Square meshes showed a slight clogging, but rectangular meshes were

Figure 3. RHEWUM WAF.

Figure 4. RHEWUM WAF installed at Agropolychim plant.

tested successfully. The reason for the clogging was the high specific load in the compact machine. The high material layer pushed the round particles into the square opening and clogged the mesh, which was not the case with rectangular meshes. The difference concerning the clogging of square and rectangular meshes can be seen in Figures 1 and 2.

Outlook

After the convincing performance at the test facilities, the WAF screening machine will prove its suitability for screening fertilizer in the Agropolychim plant in Devnya. The tests conducted demonstrate that the necessary purity and yield will be reached and possibly exceeded.

Due to the high product quality which will be reached with the WAF screens, these machines are well suited to the requirements of screening different products in the modern fertilizer industry. They are able to ensure process guarantees regarding product yield and purity, as well as machine reliability even in limited areas.

Conclusion

Tailor made solutions can fit in limited areas and keep the required modification on surrounding structure very low. These guarantee a productive use of existing fertilizer plants with short shutdown of the plant and low risk on structure modifications. This case study demonstrated that existing fertilizer plants have high potential and enough space for upgrading them to current standard. **WF**