High-tech production of highly filled plastic compounds: state-of-the-art

Highly filled compounds with over 80% filler content

Premium plant units for consistent product quality

Easy-to-clean components afford maximum system availability

The challenge

There has been a boom in highly filled plastic compounds e.g. with calcium carbonate for a fair while. They are increasingly replacing conventional materials in branches like the automotive or packaging industry. The reason: they aren't just less expensive but they also have very good mechanical properties.

Production of these highly filled compounds however confronts the processors with great challenges, in particular with relation to reliability of production and consistent quality of products. What counts here are systems where all functions mesh flawlessly like clockwork.

This is why two leading manufacturers from the sectors of extrusion technology and materials handling have joined forces and set new standards. Leistritz Extrusionstechnik GmbH in Nuremberg and AZO GmbH+Co. KG have therefore developed a comprehensive package for this highly sensitive process.

In Nuremberg, the two companies have constructed a plant that is unique in the world, where they demonstrate with other partners involved in the project how to ensure particularly stable production conditions and exact measurement repeatability.

THE SOLUTION

"In building our high-tech plant, we offer the proof that you can achieve greater reliability in production with consistent product quality by using premium plant units".

Michael Thummert, Head of Marketing, Leistritz Extrusionstechnik GmbH

The task

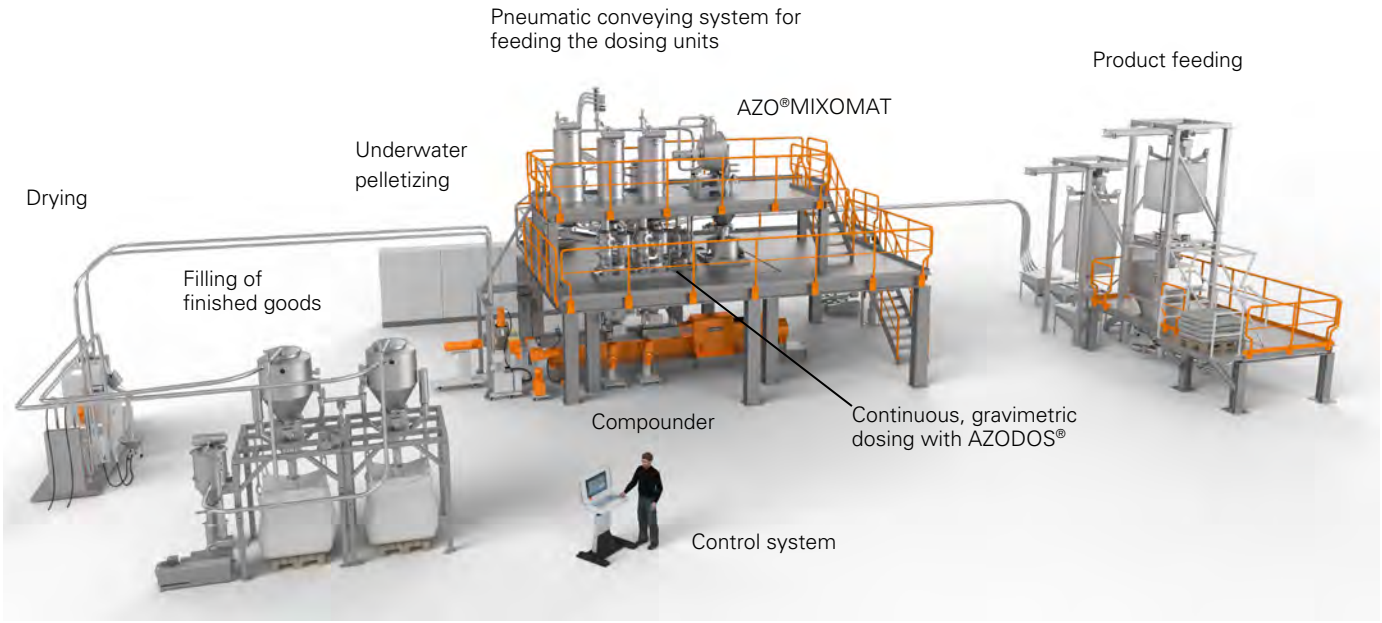
AZO's remit in designing this plant was to install a materials handling line for reliable feeding of the Leistritz compounder. Of utmost importance was that raw materials in powder form like chalk ($CaCO_3$) and additives are fed into the closed system with minimum generation of dust. Another priority was feeding of different polymers, which can be premixed using an AZO® MIXOMAT mixer. Vacuum conveying systems are used to feed the AZODOS® loss-in-weight-feeders. The goal was for there to be no interference with dosing processes while dosing units are being filled.
The controls for the material handling system and the continuous gravimetric feeding of the compounder were the task for AZO CONTROLS, of course with uninterrupted communication to the Leistritz controls.

The finished compound granulate was to be filled into big bags with this plant. This required a conveying and filling line.

AZO® SOLIDS

AZO SOLIDS Solution

This plant sets the benchmark for producing highly filled plastic compounds



Comprehensive worry-free package: from the supply of raw materials to the extrusion section and through to the entire downstream process with underwater pelletizing and filling line

The AZO solution

The plant consists of the following key sections:

- AZO provision of material from bags and big bags, including feeding and dosing
- Extrusion section from Leistritz
- Downstream process with underwater pelletising and drying
- AZO filling into big bags

Product feeding

Using a combined discharge base, raw materials in powder form, like chalk, additives, dyes and additional ingredients, can be fed into the closed system from both bags and big bags with little generation of dust. The station is equipped with aspiration, which switches on immediately when the cover of the feeding hopper is opened.

Granulate polymers, like polypropylene and polyethylene, are fed via feeding hoppers or also via a combined big bag/ feeding hopper station.

Raw materials are conveyed in receivers over the compounder with the aid of pneumatic vacuum conveying systems. The collective feeding employed here has been designed to be energy-efficient and operates at optimal conveying speeds. Dosing screws are used to fill the dosing units underneath. Vibration bottoms under the receivers ensure that products are discharged reliably and that the dosing screws fill evenly.

Feeding of dyes/additives

These small ingredients are fed immediately above the compounder at a feeding hopper.

Feeding hopper for small ingredients

Feeding of raw materials, dosing and extruder for producing highly filled compounds

Feeding of raw materials in powder and granulate form

Cost-effective production of premixes with AZO®MIXOMAT and reliable loss-in-weight-feeding with AZODOS®

AZO®MIXOMAT
As the polymer has to be assembled from various feeding points, AZO employs the MIXOMAT mixer as conveying scales immediately above the extruder. The polymer components are drawn in here in accordance with the formulation, weighed precisely and blended homogeneously. This means a number of raw materials can be conveyed to a single dosing unit, thus saving costs. The premixes are now discharged into the following buffer hopper. A fresh mixing process can be started immediately, resulting in higher throughput rates.

AZO®MIXOMAT with large door for cleaning

Cleaning
The inside chamber of the MIXOMAT can be easily accessed via a large door, making thorough cleaning quick.

"Even when we are producing special products in small-size batches, we achieve short changeover times thanks to the easy-to-clean feeding system from AZO and we can then make very effective use of the plant."

Michael Thummert, Head of Marketing, Leistritz Extrusionstechnik GmbH

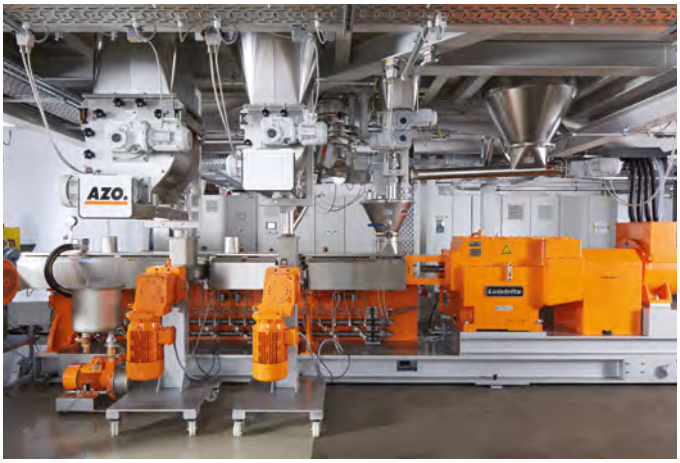
Receiver for feeding the AZODOS® units and AZO®MIXOMAT for producing premixes

Continuous dosing with AZODOS® units
The AZODOS® dosing units' mode of operation is continuous according to the loss-in-weight principle. It is even possible to dose non-free-flowing products reliably. The throughput rate is adjusted using a reference variable, taken from the extruder, by changing the speed of the screw feeder. The dosing unit was designed to swivel so that dyes and additives can be fed to the extruder at different positions. The platform with the dosing units is mechanically decoupled from the main frame. This prevents vibrations interfering with the weighing process.

Cleaning
With AZODOS® units, the dosing screws can be pulled out using extraction devices. Both the dosing screws and the interior are then freely accessible, making them easy to clean.

Compounding and downstream process
Leistritz employs a ZSE 75 MAXX twin screw feeder for this plant. The polymer is first melted with a low amount of chalk. Then more filler is added to the melt via the first side feeder and is wetted, dispersed and blended thoroughly with the melt in the following kneading section. Subsequent deaeration helps any air that has been introduced to escape. Then the remaining filler material is fed via a second side feeder. After the highly viscose, homogeneous melt has been pre-processed, it is filtered (maag melt pump and filter) and then cut immediately using a GALA underwater pelletiser. The mix of water and granulate is cooled via a pipe system and then dried in a centrifugal dryer. The finished granulate is now ready for filling.

Dosing screws are used to fill the AZODOS® units



AZODOS® units for continuous gravimetric extruder filling

Filling of finished goods
Faultless interplay between the AZO and Leistritz controls

LK80911103 GB

Filling of finished goods
The granulate is now conveyed with low attrition of materials via a vacuum conveying system to the filling station, where it is filled into big bags. Of course every other type of filling is possible too, e.g. into silos or bags. A secondary filter protects the vacuum pump from contamination.

Control system
It is only the precise interplay between all components that makes manufacture of high-grade products possible. First and foremost, this applies to the controls. This is why particular attention was paid to faultless communication between the Leistritz and AZO controls.

Filling of finished goods into big bags using a vacuum conveying line


MacromateXX S7 professional from Leistritz for controlling the extrusion process and all downstream units

AZO®CONT – for regulation of continuous gravimetric dosing
The Leistritz controls regulate the extrusion process and all following units. Formulation data are transmitted to the AZO control system via an interface in order to regulate feeding of materials. The AZO®CONT module is used for regulating the dosing units. This flexible system is characterised by the ease of integration, scalability and the standard hardware that is readily available throughout the world.

"Thanks to straightforward input of settings in the MacromateXX S7 and subsequent transfer to AZO®CONT, we are able to reduce start-up times and achieve the required product quality very quickly. What is more, we have a good overall picture of the overall production at a glance."

Michael Thummert, Head of Marketing, Leistritz Extrusionstechnik GmbH

Conclusion:

"Cooperation between Leistritz and AZO functions perfectly – true teamwork. Engineering for processes and controls has been fine-tuned by working together in close collaboration.

As a manufacturer in the premium segment, AZO has, in our opinion, the best technology to implement handling of the materials with little generation of dust and with optimised processes."

Anton Fürst, Managing Director, Leistritz Extrusionstechnik GmbH


Visualisation of feeding of raw materials


Visualisation of feeding of dosing units


Visualisation of AZODOS® units and extruder


Visualisation of filling of finished goods

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