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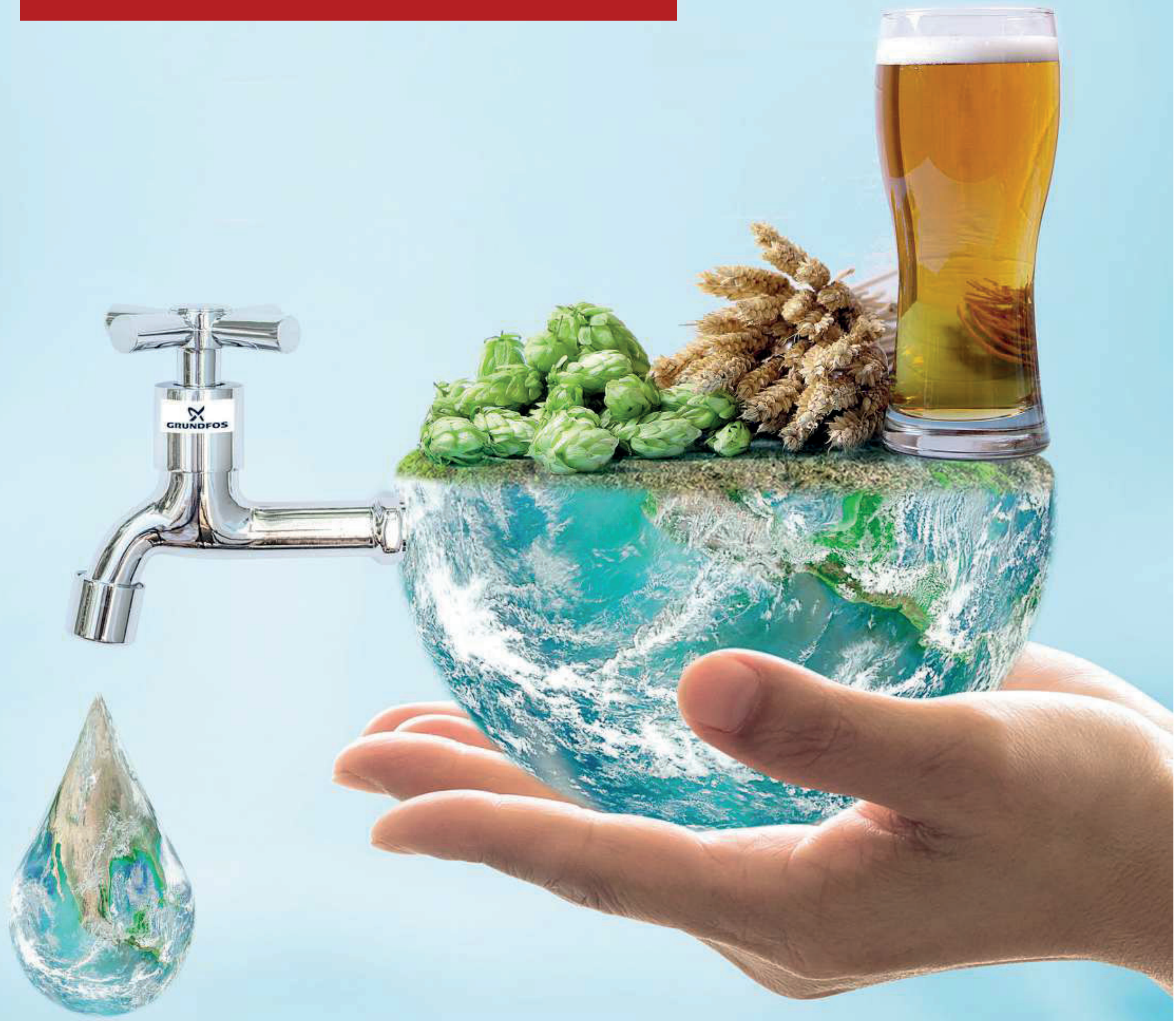

ENERGY-SAVING SLUDGE DRYING

Recycling Metals from Thin Sludge – How Condensation Drying Saves Energy and Reduces the Carbon Footprint

SPECIAL PRINT

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ENERGY-SAVING SLUDGE DRYING

Drying for more Sustainability

The technology to dry sludge resulting from production processes captured the market 30 years back. The issue at that time was to reduce disposal cost. Why sustainability, recycling and new markets play an even more important role today.

Time is money – most of us are familiar with this saying. That water may also cost money only those of us know who have ever had to pay the cost for sludge combustion or disposal. Thin sludge, after all, has a water content of between 60 and 80 percent even after pre-dewatering.

According to the Federal Statistical Office of Germany, disposal costs a neat sum of money – between 25 and 50 Euros per cubic metre. And this is only true for "normal" sludge.

30 years ago, sludge was dried to save on disposal costs. Today it's all about sustainability, recycling and new markets.

Some types of sludge from plating, chemical, textile, leather or paper industry processes are considered hazardous waste and have to be disposed of in hazardous waste combustion plants – at higher cost commensurate with the effort involved.

The waste management market is changing, too. The cost of energy, discussion about closed-loop economy, shortage of rare earths, the environmentally hazardous mining of copper, nickel and cobalt, regulations concerning phosphorus recovery, recycling quotas for electronic scrap and batteries – all this whips on the recycling market and companies to find new solutions. Thin sludge formed in recycling processes must undergo intense drying in order to extract the coveted metals.

To recover zinc, for example, a residual humidity of eight percent is required. Much the same applies to nickel, cobalt and copper – an effort that requires much energy and makes recycling expensive.

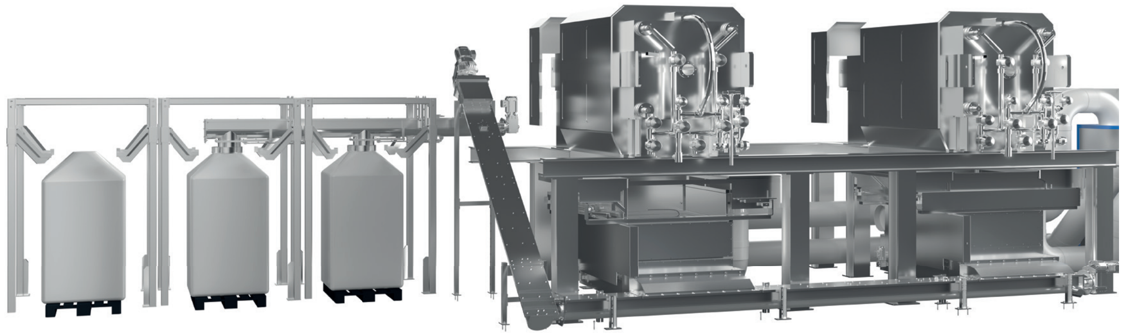
This is where a company based at Stiefenhofen, Germany, comes in. Drying system manufacturer Harter has been in drying for decades and since their establishment in 1991 they have been banking on heat pump based condensation drying. Ever since energy prices have gone ballistic and companies have been increasingly careful to mind their carbon footprint, this technology appears to become more appealing to many companies. This is because Harter's drying technology is so energy efficient and carbon saving that it was first classified sustainable in 2017. Customers in Germany, Austria and Switzerland are awarded government subsidies for choosing this sustainable heat pump technology.

Image: Harter

Drying in the roll-off container directly under the chamber filter press

From Standard Dryer to Bespoke System

Sludge dryers – with a sales share of 20 percent today – have always been an important part of Harter's portfolio from their early days. Their technology has been advanced from first generation dry air generators to the fully automatic, dust-free drying system that constitutes today's engineering ultimate. Then as now, the sludge is pre-dewatered mechanically by a chamber filter press and subsequently dried to obtain the final dry matter content. The original dry air generators were all standard systems with an integrated container holding 0.125 to 1.5 cubic metres of sludge. The compact system included a dehumidification module, a drying cabinet and two containers, one being filled below a chamber filter press and the other being dried in the drying cabinet at any given time. Extremely dry, unsaturated air at a temperature of about 50 °C was used for uniformly drying the sludge to obtain the desired dry matter content, normally 70 to 85 percent. After drying, the sludge was transferred to a transport container for hauling to the disposal site. The system showed some teething troubles at that time – such as dust creation – which were eliminated over the years.



Fully automatic system for dust-free filling into big bags

In 1995, Harter developed and designed special systems for customers with special requirements in terms of space or logistics. One of the first solutions was the so-called ceiling-mounted design. In this case, the chamber filter press is located at a higher level, e. g. on the first floor of the building, and the drying container directly underneath. The dehumidification module may be placed wherever space is available. The module is connected to the drying container through insulated ducting. The dried sludge falls into a skip used solely for the purpose of transport. One shortcoming of this design is the dust created as the sludge falls into the transport skip. Another one may be the cycle time of the chamber filter press which, if too short, will prevent the desired dry matter content to be obtained.

In-skip Drying

Harter developed a new system design in 2004 to meet these two challenges. Novel compared to the previous design was that the drying location was shifted to within the skip. Drying specialist Harter modified a customer's two existing skips such that they could also be used for dehumidifying the sludge. This solution provided several benefits. For one thing, the customer did not have to acquire any containers, they had only to bear the modification cost. Dust, too, is no longer an issue because there is no need to transfer or fill up dried sludge. Also, the drying sequence is no longer dependent upon the chamber filter press cycle; dried sludge may be repeatedly added into the skip because its volume is smaller than that of wet sludge. Suffice to say, conventional or roll-on/roll-off (RoRo) skips may be modified for in-skip drying.
The system was partly automated in 2008 when the skip was placed directly below the chamber filter press. The lid of the skip opens upon the push of a button. The drying process starts immediately upon feeding in sludge. Portions of sludge may be added again and again to make full use of the skip volume. What remains the same is the insulated ducting to the dehumidification module that conditions the required process air.

Fully Automated System for Dust-free Filling into Big Bags

Upon the customer's request, Harter developed a fully automated system for dust-free filling into big bags – the icing on the cake of many years of sludge drying development. The sludge drying system consists of two special stainless steel containers with a cross conveyor, a dehumidification module, a spiral conveyor and a big bag filling station. The stainless steel containers feature an intermediate bottom with rotary fins and are programmable logic controlled. The whole system is controlled by a purpose developed programme. The fully automated presses are installed on a structural steel platform about two metres above floor level. They are operating continuously, releasing their wet sludge into the drying containers underneath every 30 to 60 minutes. Once the programmable logic controller receives information that the chamber filter press is about to be emptied, precisely the same amount of sludge is released from the drying container as the amount of sludge topped up. The dried sludge is passed through the conveying system to the big bag whose filling level is monitored by sensors. The operation of this system design is absolutely dust-free.
Drying system manufacturer Harter also develops drying systems for automotive, electronics, optical, medical, pharma and food applications.

by Anke Geipel-Kern

PROCESS-INFO

Where does the sludge come from?

Sludge is a result of precipitation, normally induced by sodium hydroxide solution and/or milk of lime, when metals precipitate as hydroxides or oxide hydrates. Occasionally, metals are also precipitated as metal sulphides. The precipitates sediment to form a thin sludge with some three to five percent of solid matter content. Thin sludge also results from hydrometallurgical recovery of battery slurries, for example. When subjected to subsequent mechanical dewatering, e. g. in a chamber filter press, the sludge becomes semi-solid with a dry matter content of about 30 to 40 percent.
Origin of production waste waters:

- Used pickles and metal-containing concentrates/ semi-concentrates from metal finishing and plating,
- Concentrates from the photographic industry,
- Concentrates and waste water from the leather and textile industry,
- Concentrates and waste water from inorganic chemical processes.