Harter GmbH:

Low Energy Sludge Drying with a Heat Pump

Only a few cared about saving energy when drying system manufacturer Harter entered the market more than 30 years ago. The focus, then, was on reducing the weight of the sludge and the operating cost. Presently, all these factors loom large.

Thin sludge arises in quite a number of production processes. Most of the operators dewater this sludge mechanically and then transport it to the disposal contractor.

Industrial companies most often use a chamber filter press for dewatering while municipal wastewater is very frequently dewatered using an auger. Whatever press is used – dewatered sludge on its way to disposal still contains some 75 percent of water. This implies that 75 percent of the transport and disposal cost is spent on water. "We were aware of this situation early on" reports Reinhold Specht, managing owner of Harter. "We wanted to market a technology that did not just reduce the water but did so in a very economical way."

Heat pump drying dries sludge efficiently. This means that the weight and volume are reduced by some 60 percent, and disposal cost likewise. Often cost savings are even higher depending on the sludge properties and the disposal rates. The heat pump, the core of each Harter dryer, is intrinsically efficient and energy-saving, and has been eligible for government subsidy for years.

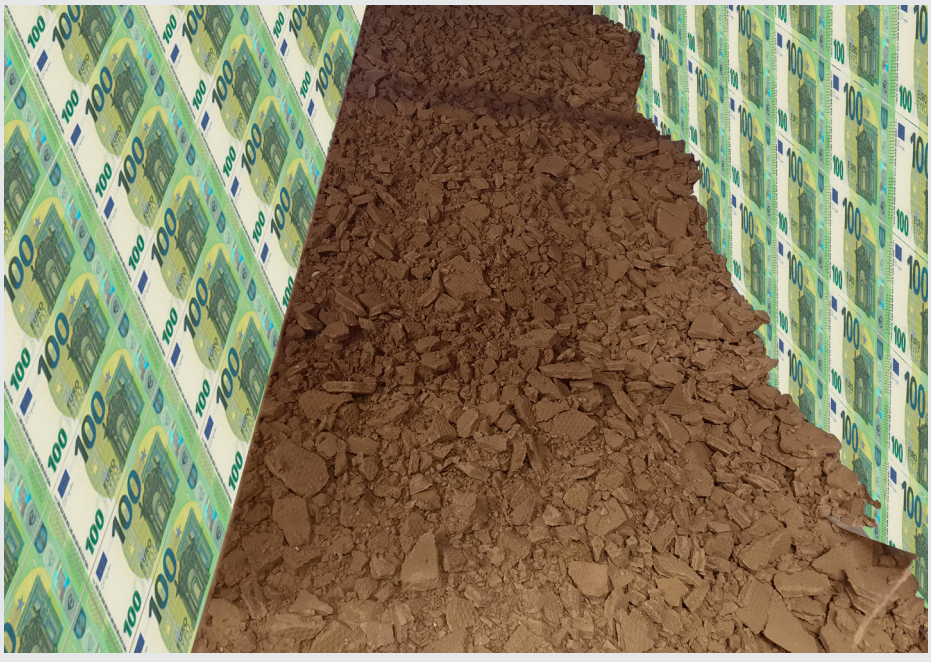

Fig. 1 – Low energy drying is capable of reducing the weight and volume of sludge by some 60 percent. This reduces the operating cost by more than 60 percent.

Source: Harter GmbH

Standard Dryer for Small-scale Applications

There are standard and special solutions for sludge drying. A manufacturer of pumps and turbines uses a standard dryer for their electroplating sludge today. The electroplating processes in their in-house plating shop produce thin sludge. The sludge is dewatered in a chamber filter press and used to be transported to the disposal sight right away. The company, as anyone today, wanted to reduce their disposal cost and invested in a Drymex* M4 heat pump dryer. This dryer consists of a drying cabinet, a heat pump module, and two containers. It is designed to process a daily 1,000 kgs of sludge.

Following pressing in the filter press, the sludge drops in one of the two containers placed underneath. The filter cake has a dry matter content of about 30 percent. A worker moves the container into the drying cabinet, closes the doors and starts the drying process. When the desired dry matter content is reached, the process stops automatically. In this case, the dry matter content is 85 percent, the residual humidity is only 15 percent that is. During this time, the second container stands below the chamber filter press waiting to the filled with sludge. This way, the process is continuous. The containers are emptied using a tipping mechanism.

* Drymex – registered trademark

Fig. 2 – Filter pressed sludge is dried to a residual humidity of about 15 percent. The integrated heat pump lowers the power demand for the drying process, thus adding to the cost savings.
Source: Harter GmbH

Dry Air – Closed Circuit

Standard dryers have a compact design, i. e. drying cabinet and heat pump module form one unit. The heat pump module conditions the required process air and is also responsible for the condensation process. Unsaturated air is used for drying. It is dehumidified to such an extend as to thoroughly and quickly absorb the humidity contained in the sludge. The saturated air is then cooled in the heat pump module so that the humidity condenses to form water which is drained off the system. In a closed system, the air is reheated and returned to the drying cabinet. The air circuit is thus closed, the drying process is efficient and exhaust air free. There is no unpleasant smell or detrimental vapour.

Besides air conditioning, air routeing is important. "The air always seeks to follow the path of least resistance," explains Specht. "It is critical to evenly pass the air through all places in the sludge in order to obtain uniform sludge drying. We developed a special air routeing provision to ensure this." It comprises an air recirculation system inside the drying cabinet and a special ventilation bottom of the containers. This ensures ideal distribution of the air, and complete and uniform drying of the sludge. The drying temperature is about 50 °C, the drying period is about 20 hours. The power rating of the Drymex M4 in production operation is 8.3 kW. The low 0.4 kW required to extract one litre of water is certainly also worth mentioning.

Special Solutions for Larger-scale Applications

An entirely different application was that of a supplier of noble metal services and products. They produce and recycle precious metals from palladium to gold offering supplies and services to a number of major industrial sectors. Sludge drying is required to allow recycling in a furnace. This may sound inconsistent at first glance because low temperatures are characteristic for heat pump drying while quite the opposite applies to furnace processing. Putting sludge with a high water content into a furnace would create an explosion hazard. The sludge must therefore be dried. And this is what the said company intended to do in an energy-saving way.

Initially, Harter conducted tests in their in-house Test Center. Various types of sludge with largely dissimilar dry matter contents were tested for their properties. Subsequently, the operator performed drying tests at their premises using a dryer provided by Harter on loan. Following

Fig. 3 – The fully automatic facility consists of two drying containers, two heat pump modules, and a screw and belt conveyor to the big bags. Following drying at 50 °C for about 20 hours, the dried sludge is placed in the furnace for recycling.
Source: Harter GmbH

instruction by a Harter engineer, the noble metal specialist was able to run extensive tests on their own. Based on the outcome of these tests Harter devised a customised solution which consists of drying in large containers plus screw and belt conveying for final automatic filling in big bags. The system was designed to match with the existing chamber filter presses and the local circumstances.

Low: Temperatures and Power Demand

The chamber filter presses dewater 3.75 tons of sludge per working day. Upon completion of pressing, the outlet shutters of the presses open and the sludge automatically drops into the containers placed underneath. The containers are made from stainless steel, have a useful volume of five cubic metres, and feature a special multifunctional bottom developed by Harter. This bottom is the intersection between the container and the conveyor belt. A sensor monitors the filling level in the container. When filling is completed, the pneumatic lids close automatically. The lid systems ensure that the precious heat is contained in the system during drying. A programmable logic controller starts the drying process. Recipes for all individual types of sludge with largely dissimilar humidity contents are stored in the PLC. The drying process is also stopped automatically when the residual humidity content stored in the specific recipe is reached. Then, a screw conveyor moves the dried sludge on a conveyor belt for transport to the big bags underneath. The belts have three exits for the sludge to drop in the three transport bags. This part of the process is also under automatic control. Subsequently, the big bags are moved to the furnace for the next operation.

Other than the standard dryers, this system features drying containers and separate heat pump modules connected through insulated piping. The operation of exhaust air free condensation drying, however, is always the same: air conditioning in the heat pump module and specific air routeing in a closed air circuit. The large system of the noble metal recycling company shows a water extraction rate of about 200 litres/hour depending on the humidity level in the individual sludge. Harter designed the drying system to follow the rhythm of the chamber filter press. The drying temperature in this application is also 50 °C. The power rating of this system is about 44 kW.

■ ***Harter GmbH***
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