



# Efficient Drying of Sludge from Flue Gas Cleaning

Foto: KVA Linth

Cleaning of flue gas accrued in waste combustion plants does not only produce recyclable gypsum but also waste sludge. Disposal of the latter is a cost factor for plant operators. Drying this sludge is an effective measure to reduce running expenses.

**E**xhaust gas is accrued wherever waste is incinerated. Such gas must be cleaned pursuant to the German TA-Luft (Technical Instructions on Air Quality Control), an air pollution control regulation in effect for decades. Flue gas desulphurisation in waste incineration plants is frequently accomplished using a gas washer. Flue gas cleaning does not produce gypsum, which may be directly recycled, but also waste sludge containing heavy metals. Such sludge must be disposed of properly unless the amount of heavy metals present is high enough for metallurgical plants to separate and reclaim them. What pushes cost in either case is the amount of water in the sludge – the lower the water content the lower the cost incurred for sludge processing or disposal.

## Weight Reduction by as much as 60 Percent

Mechanical dewatering, most often by filter pressing, is a standard procedure in wet flue gas cleaning. After pressing, however, the sludge still contains some 60 to 75 percent of water. Additional drying is therefore profitable for plant operators. This is particularly true for heat pump based condensation drying, a method offered by drying system manufacturer Harter based in the southern German Allgaeu region. They developed the technique more than 25 years ago. What they

promise is a sludge weight and volume reduction by as much as an additional 60 percent. The benefit for plant operators is obvious – disposal cost may be lowered by a proportionate 60 percent maximum.

This prospect appeared convincing to the operators of the Linth waste incineration plant in the Swiss canton Glarus. While tradition is being upheld in this canton – there is still open balloting at regular cantonal assemblies – the plant operator's policy is to keep abreast with the state of the art. It was "a short step towards sludge drying" the operator says. Ever since mechanical dewatering is complemented by condensation drying the dry matter content of the hydroxide sludge resulting from flue gas cleaning and fly ash washing is about 85 percent. This amounts to a considerable reduction of the water content because the dry matter content is merely 28 to 32 percent prior to condensation drying. Given some 1,500 tons of wet post-chamber filter press sludge the drying system will have paid itself off after no more than three years.

## Low Temperatures, High Dry Matter Content

To ensure this performance while providing flexibility in use, the sludge drying system for the Linth waste incinerator was designed as an in-container type. It includes five special drying/transport containers with a useful volume of 22 cubic metres each and one Drymex S9 dehumidification module with a water extraction rate of 200 to 240 litres per hour. One container is placed below the automatic diaphragm filter press, which was installed on a raised platform, and filled with filter cake. The amount of filter cake leaving the press is about five tons a day, so it normally takes three days to fill a container. Once filled, the container, which rests on a transport trailer, is moved to the drying station and connected by air piping/hosing with the dehumidification module. Now, the drying process can start. The sludge is dried using recirculation air at 45 °C for about two days. The dry

matter content has reached 85 percent approx. by then. 8,000 to 12,000 litres of water are extracted in the process. While two full containers in tandem are being transported to the recycling company, another container is filled with filter cake from the diaphragm filter press or is ready to be transported to the drying system.

The technology employed has two critical features. Firstly, there is the Drymex dehumidification module. It supplies the container with extremely dry and thus unsaturated air. This air quickly absorbs humidity from the filter cake. The humidity laden air is cooled, and the water condenses. Subsequently, the air is reheated and returned to the container in a closed circuit. Secondly, an effective air routing system is integrated to ensure uniform and effective absorption of humidity throughout the filter cake. For this purpose, each container has a purpose-built perforated bottom and a customised air routing system. The fans used are also custom made. Additionally, each container has a hydraulic double hinged lid system which is open upon filling and closed upon drying. This allows air to evenly pass through 1.6 m high fill levels so that uniform and reliable drying is ensured. The closed circuit of the process air safely prevents ambient smell and dust pollution.

### Simple and Flexible Loading

Given that a drying container has a useful volume of more than 20 cubic metres, it is obviously not that easy to position it exactly below the drying system, especially when full. To ease the situation, the container is connected to the dehumidification module through PPS piping and flexible hosing, which provides a positioning allowance of one metre. Also, the hoses may be connected without much effort because the total weight of the hose & fitting assembly is compensated by a ceiling mounted balancer system. The hosing system is designed such that two entry hoses feed the dry unsaturated air to the bottom of the container. The humid saturated air leaves the top of the container through two exit hoses.

Containers holding 22 cubic metres of sludge are used for drying and transport.



Foto: KVA Linth

The drying system includes a programmable logic control (PLC) for continuous control of major parameters such as inlet and outlet temperature, air speed, airflow rate and cooling capacity. A filtering system ensures that the heat exchangers are always kept clean. As the operators of Linth waste incinerator desired as much operational flexibility as possible the original number of containers (four) was raised to five after two years of operation. This way, one container may be positioned below the chamber filter press and another one below the condensation drying system while two containers are on the road to and from the recycling company. The fifth container is a backup to allow flexible planning of collection times and to ensure availability of sufficient volume even in times of high demand such as around the Easter or Christmas holidays.

„Using this effective and economically reasonable drying technology has added to reducing our cost while at the same time integrating a state-of-the-art process component which also attracts friendly operators' interest“, says Stefan Ringmann, member of the plant management.

*Marius Schaub*

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## REDUCING COST, PROMOTING RECYCLING

Disposal cost is key to operators when it comes to sludge drying. Following mechanical pre-dewatering, sludge still contains a lot of water. So the better part of the disposal cost incurred is for water. Heat pump based condensation drying offers ample opportunities for cost reduction, material reclassification and recycling.

The technology developed by Harter saves energy because the integrated heat pumps ensure efficient air dehumidification. An estimated 0.4 kWh is required on average to remove one litre of water. The system is closed; there is no air discharge involved in the process. A lid system retains energy inside the system. The technology is flexible and may be used both for batch and continuous operation. The type of

drying system used depends on the amount of sludge to be dried, the existing process and the space situation. Harter offers to conduct drying tests in their pilot plant station to determine the drying properties of the sludge. These tests are used to identify the relevant drying parameters for further system design.

Drying reduces the weight and volume by as much as 60 percent, as applicable for the specific sludge. Drying will thus also reduce disposal cost. If disposal cost is high the sludgy drying system will quickly pay itself off. As the case may be, sludge may obtain a better classification when dried – which will add to cost reduction. Plus, drying may be requisite for extracting and recycling valuable substances contained in the sludge.