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SYNCOM-Plus – An Optimized Residue Treatment Process

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ABSTRACT

In a large-scale pilot plant, studies on wet-mechanical treatment of bottom ash using the SYNCOM-Plus process were carried out by MARTIN GmbH in the SYNCOM waste-to-energy plant in Arnoldstein, Austria (approx. 11000 kg/h waste throughput). Granulate of > 2 mm and fine fraction of < 5 mm were produced by dry screening, washing and wet screening. Additionally, sludge was separated from the wash water. The fine fraction and sludge as well as the boiler ash were recirculated into the furnace.

In conclusion, the SYNCOM-Plus process meets all requirements which need to be complied with in an optimized and effluent-free commercial residue treatment process for the recovery of industrial products.

This paper documents successful continuous operation of the SYNCOM-Plus process in direct connection with bottom ash discharge as well as the effects on combustion, flue gas composition and residue qualities.

Keywords: Waste-to-Energy, SYNCOM-Plus, bottom ash, residues, wet-mechanical treatment

1. INTRODUCTION

Bottom ash produced during thermal waste treatment accounts for the largest mass flow of the waste input at approx. 25 % by weight. In Europe, this bottom ash is currently used as a building material, e.g. in road and landfill construction, or as a mining filler, e.g. in salt or coal mines. However, a considerable percentage is sent to landfills because compliance with certain quality criteria cannot be ensured.

MARTIN GmbH (<http://www.martingmbh.de>) has developed the SYNCOM process, in which combustion air is enriched with oxygen, so that fuel bed temperatures are considerably higher, thereby causing increased sintering of the bottom ash. To further improve bottom ash quality, the SYNCOM-Plus process was developed, whereby a downstream wet-mechanical treatment process to separate a granulate (Figure 1) is added to the SYNCOM process.

The separated fine fraction and sludge (Figure 1) as well as the boiler ash are then recirculated to the combustion system for further sintering and the destruction of organic compounds.

The goal of the trials was to implement a compact large-scale pilot plant consisting of selected units for the continuous wet-mechanical treatment of bottom ash as well as recirculation of fine particles and boiler ash into the combustion system in the SYNCOM waste-to-energy plant in Arnoldstein, Austria.

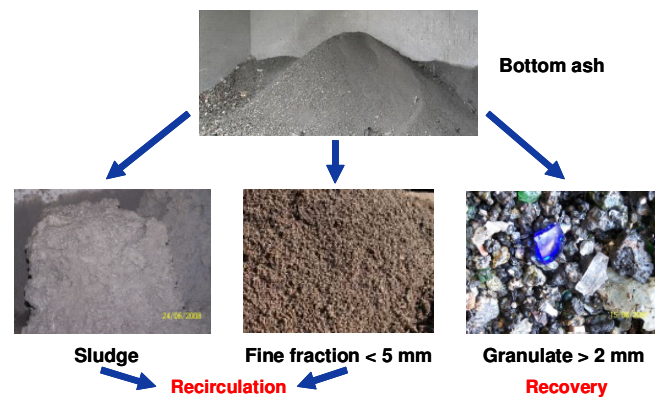


Fig. 1 Material flows

2. CONCEPT / PILOT PLANT / TRIALS

A compact large-scale industrial pilot plant consisting of selected units for the continuous operation of wet-mechanical bottom ash treatment and recirculation of fine particles was implemented and optimized. The concept is shown in Figure 2.

The continuously accumulating bottom ash flow coming from a wet-type discharger was first dry screened to separate a fine fraction of < 5 mm, then washed and wet screened to separate a granulate of > 2 mm and a suspension in a double deck screening machine. Because the wash water was circulated, any particles < 2 mm contained therein had to be completely separated in order to minimize the addition of fresh water. A decanter centrifuge was used for this purpose. The sludge that accumulated was fed into the combustion system; the particle-free wash water was conveyed into a storage tank for washing and wet screening.

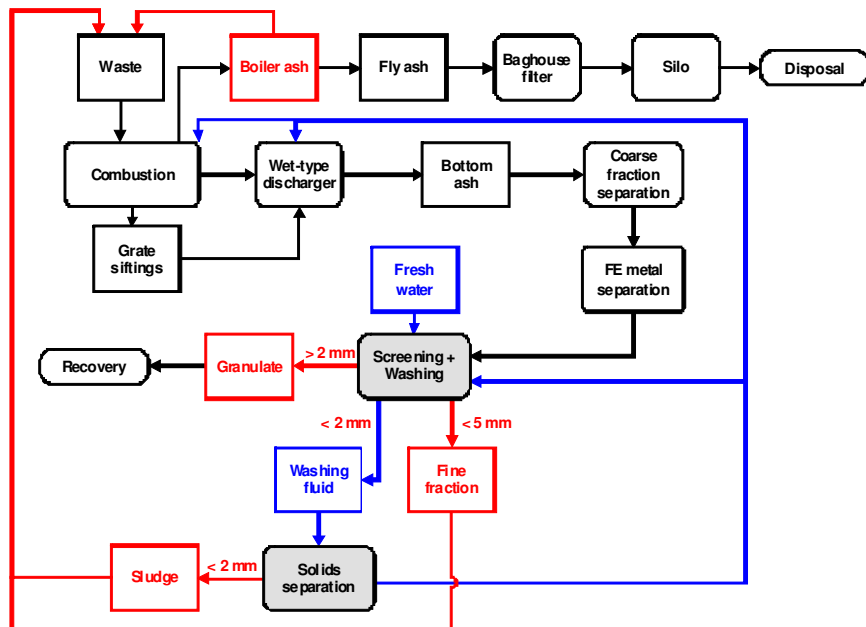


Fig. 2 SYNCOM-Plus concept

The pilot plant (Figure 3) operated continuously for 3 weeks (24 hours / 3 shifts / including weekends) and was always directly connected to the bottom ash discharge.



Fig. 3 SYNCOM-Plus pilot plant

During continuous operation, representative samples of the following material flows were taken in 3 8-hour series of measurements:

- Bottom ash total
- Granulate
- Fine fraction < 5 mm
- Sludge < 2 mm
- Wash water
- Boiler ash

The solids and leachates were then analyzed, and the suitability of the granulate for use in construction assessed. Selected flue gas parameters were continuously assessed at the boiler outlet.

3. RESULTS / DISCUSSION

Figure 4 shows the fine fraction, sludge and boiler ash material flows that were recirculated via the refuse pit during continuous operation.

An average of 428 kg/h fine fraction, 180 kg/h sludge and 58 kg/h boiler ash were recirculated. In total, this amounted to approx. 6.5 % of the entire hourly waste input. No significant accumulation of the fine fraction in the bottom ash total as a result of recirculation could be detected after determining the screening curves (comparison of particle size distribution with / without recirculation).

Analysis of the combustion parameters (steam, fuel bed temperatures, etc.) and the raw gas measurements at the boiler outlet indicated no significant influence being exerted by SYNCOM-Plus operation.

Figure 5 shows the granulate quality using the parameters for solids as well as leachate for recovery (blue bar) and landfilling (red bar) in accordance with German regulations. The measurement values were referred to the limit value and are shown as percentages.

Compliance with all limit values was shown to be consistent. This granulate consequently meets the criteria for solids and leachates laid down by the recovery regulations.

Additionally, the SYNCOM-Plus granulate meets all requirements pertaining to aggregates for unbound materials and anti-frost layers for use in civil engineering and road construction.

Comparison of the organic contents (Loss On Ignition, Total Organic Carbon, Dissolved Organic Carbon) of the bottom ash total produced by conventional operation and when the combustion plant is in SYNCOM mode with the SYNCOM-Plus granulate shows a significant improvement (Figure 6). Not only is sintering of the bottom ash in the fuel bed improved during SYNCOM operation, uncombusted fine fraction is additionally separated by SYNCOM-Plus.

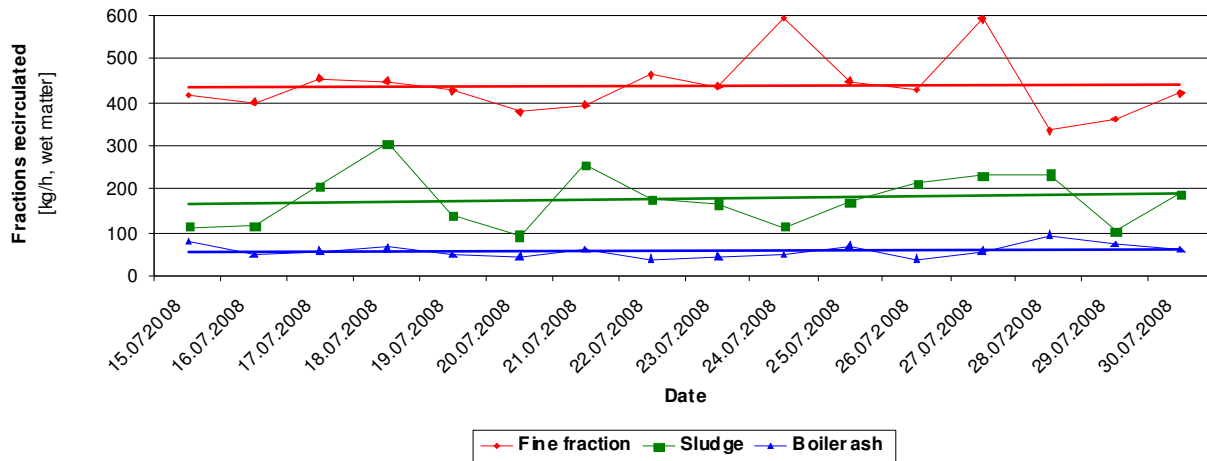


Fig. 4 Recirculation flows

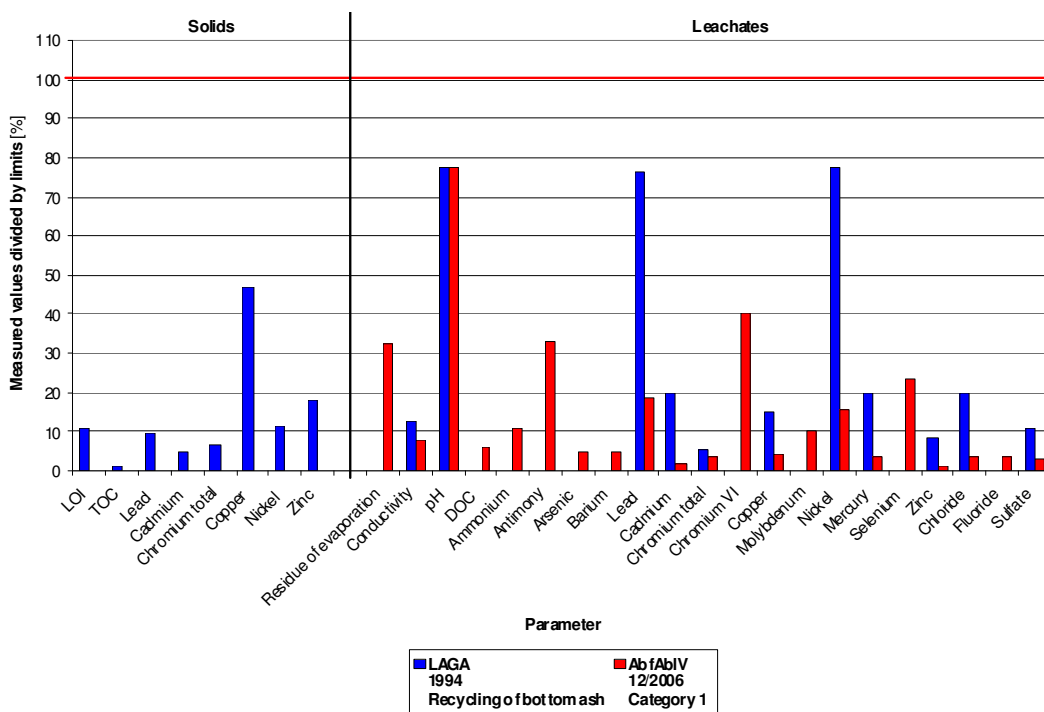


Fig. 5 Granulate quality

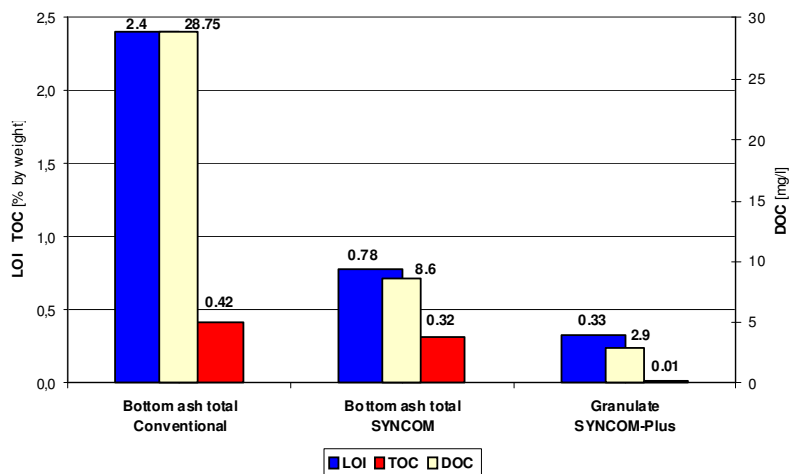


Fig. 6 Organic contents

Figure 7 shows the entire input and output mass flows in the SYNCOM-Plus process for the SYNCOM waste-to-energy plant in Arnoldstein, Austria.

The greatest residue mass flow is the bottom ash output (3.0 Mg/h). Of this, the SYNCOM-Plus process produces 2.82 Mg/h of a granulate with good recovery qualities. Fine fraction, sludge and boiler ash are recirculated; the filter ash contains additives from flue gas cleaning and must therefore be disposed of.

Figure 8 is a graphic illustration of the energy flow for the SYNCOM waste-to-energy plant in Arnoldstein, Austria, showing complete conversion of the waste input into electricity and specifying a value of 2.25 MW for in-plant consumption. However, the components of the SYNCOM-Plus process make only a small contribution in this respect. As an option, heat for district heating and process steam can also be generated. However, this has no influence on the in-plant electricity consumption.

4. CONCLUSIONS

The SYNCOM-Plus trials at the SYNCOM waste-to-energy plant in Arnoldstein, Austria demonstrated successful results in continuous operation mode and therefore proved that this process is ready for the market. Both wet-mechanical treatment and recirculation in continuous operation are feasible. No influence on combustion or the raw gas could be detected. The granulate was of an optimized quality, as a result of which it can also be used as a building material. The removed material flows (fine fraction and sludge) and the wash water can be recirculated within the process so that SYNCOM-Plus produces no residues for disposal and the entire process is effluent-free.

In conclusion, it can be said that the SYNCOM-Plus process meets the requirements of an optimized residue treatment process for the recovery of industrial products.

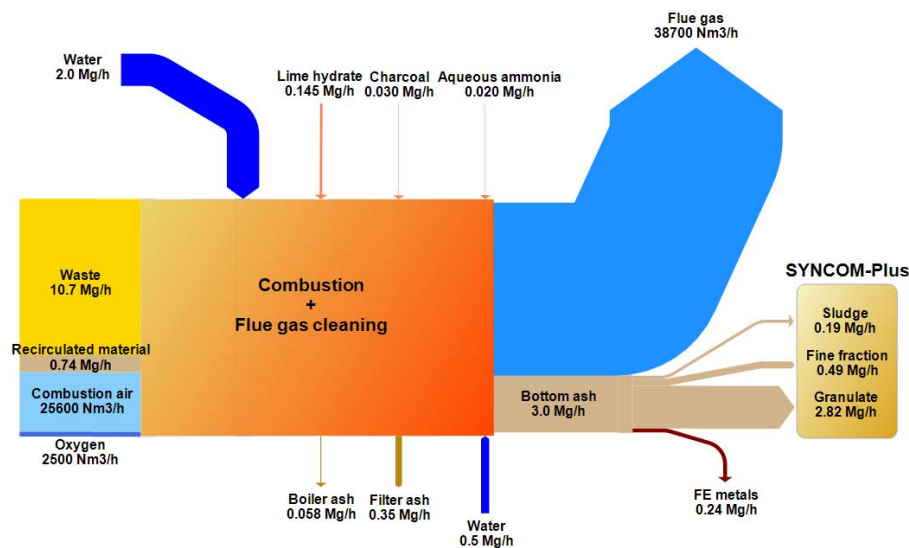


Fig. 7 Mass flow

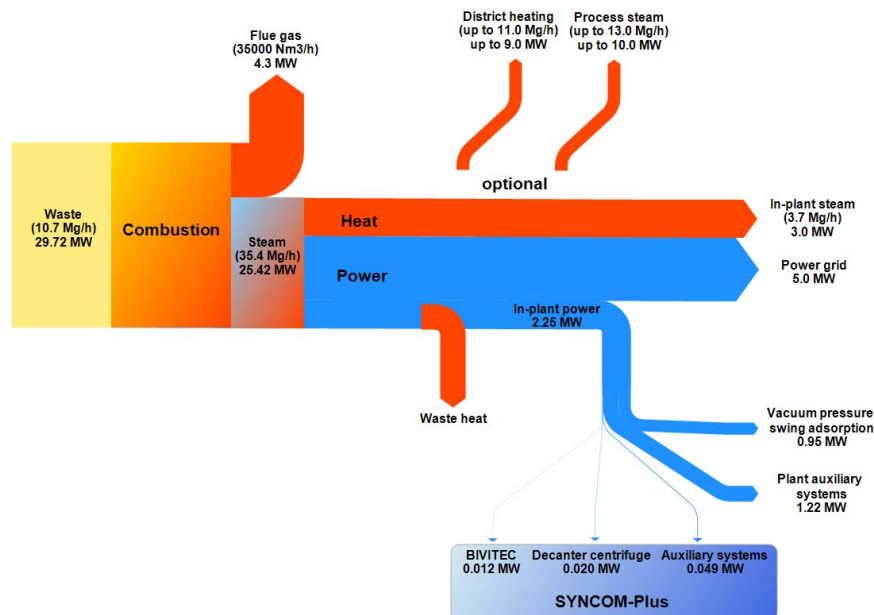


Fig. 8 Energy flow