Operational Experiences at the MBT plant Wilsum

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Abstract

Due to the paradigm change in waste disposal management in 2005, the switches for the removal of waste were newly placed.

The county of Bentheim decided due to the local and financial basic conditions for the establishment of a MBT. As turned out in practice, it concerns an economically correct decision, however also this recent technology implies for the acting participants substantial challenges with high legal requirements.

Keywords

Mechanical waste treatment, biological waste treatment, exhaust air treatment, landfill

1 Waste management related general conditions

The County of Bentheim, which is the south-western district in Lower Saxony at the Dutch boarder, has operated a landfill (HMD II) in Wilsum since 1985 with an approved filling volume of 1.57 million m³. Currently, approx. 1.1 million m³ are being filled. With the introduction of the Green Container in 1995, a composting plant was put into operation on the landfill site of Wilsum in the framework of a third-party commission and a mechanical treatment plant in the year 2000. Due to the investments made on the landfill site of Wilsum – particularly the extension of the landfill which is conformal to the "Technical Instructions on Waste from Human Settlements" (TASI) – evaluations of economic efficiency concerning the alternatives, which are mechanical-biological waste treatment and waste incineration, were made after the year 2000. The evaluations showed a clear economic advantage for an MBT solution, which is due to the investments made so far and the existing offer of a third-party representative concerning the integration of the compost plant into an MBT. Another argument for the so-called "cold pre-treatment" was the fact that the ecological responsibility and the control of the waste flows would remain with the district. At the same time, a disposal infrastructure belonging to the district from the point of view of that time also meant disposal security for the future, a location factor not to be underestimated for the region.

The organic waste collection in the pick-up system was stopped in the year 2004; the compost plant was rebuilt into a biological treatment stage for the MBT and expanded, so that also the waste amounts from the district of Leer contractually agreed on could be processed. Since the biological stage could not be finished in due time until the 1st

June 2005, the disctrict built a temporary deposit for biologically treatable wastes and surpluses of the high calorific value fraction for the time being. The biological part of the plant went into operation in August 2005.

From the 1st June 2005, the contractual waste amounts from the district of Leer were being delivered to the plant for the first time; altogether, from the County of Bentheim and the district of Leer residual wastes for approx. 300,000 inhabitants are being treated in the MBT plant of Wilsum. The waste amounts from Bentheim as well as those from Leer were only being mechanically processed and brought to the previously mentioned interim stores in June and July 2005.

With the entry into force of the Ordinance on Environmentally Compatible Storage of Waste from Human Settlements and on Biological Waste-Treatment Facilities, a considerable change in waste amounts and waste composition could be detected also in Wilsum. Particularly the share of commercial wastes, which were offered for disposal in Wilsum, increased dramatically. Furthermore, the wastes were composed to almost 100 % of fractions with high calorific value. This led to amount-related problems generally and in particular to a problem with the disposal of the high calorific value fraction. However, these problems could meanwhile be solved in a satisfactory way.

Table 1 Selected structural data (as at 30th June 2006)

	Inhabitants	**area**	**Collection systems**	**Distinctive features**
District County of Bentheim	135,000	980.75 km² 138 inhabitants/km²	MGB pick-up systems Container tarrif	Delivery system Garden waste
District of Leer	165,000	1086.05 km² 152 inhabitants/km²	Bag collection	Tourism

Bulky waste and commercial wastes similar to domestic refuse etc. are not treated in the MBT plant, but only reloaded in Wilsum and from there transported directly to the waste-to-energy plant and to the processing respectively.

2 Plant description

2.1 Plant layout and logistics

The MBT plant, garden waste compost site, reloading points, entrance area, seepage water treatment plant, the disposal surface with an intermediate cover and the emplacement area are to be seen on the photo. Around the plant there are sand mining areas partly with water, forest and agriculture.

Figure 1 Disposal centre Wilsum from a bird's eye view

The mechanical treatment plant was laid out in 1999 for the waste amounts to be treated from the district County of Bentheim in the order of approx. 35,000 tons a year. With the decision concerning the takeover of amounts from the district of Leer, an expansion of the capacities to altogether 63,000 tons a year including the construction of a biological stage was put out to tender. The complete plant was finished in August 2005.

Table 2 Guideline data concerning the area of the MBT plant Wilsum

	length (m)	**width (m)**	**Floor area (m²)**
Delivery hall	40	25	1,000
Machine hall	30	34	1,020
Dome intensive rotting	20	75	1,500
Intensive rotting area left	30	64	1,920
Intensive rotting area right	34	35	1,190
Biological post-processing hall I Biological post-processing hall III Biological post-processing area IIII	52 28 34	80 74 34	4,160 2,072 1,156
RTO	30	13	390
Scrubber	18	6	-108
Free space	35	36	1,260
Office & Social	22	11	242
total			15,802

The waste amount placed in the disposal centre of Wilsum is composed as follows: domestic refuse (approx. 51,000 Mg/a), wastes similar to domestic refuse (approx. 3,000 Mg/a), bulky waste (approx. 3,500 Mg/a) and commercial wastes (approx. 5,200 Mg/a).

The floor area of the MBT plant Wilsum is listed in Table 2. Approx. 0.25 square meters of floor space are required per each ton of MBT input.

2.2 Procedure scheme

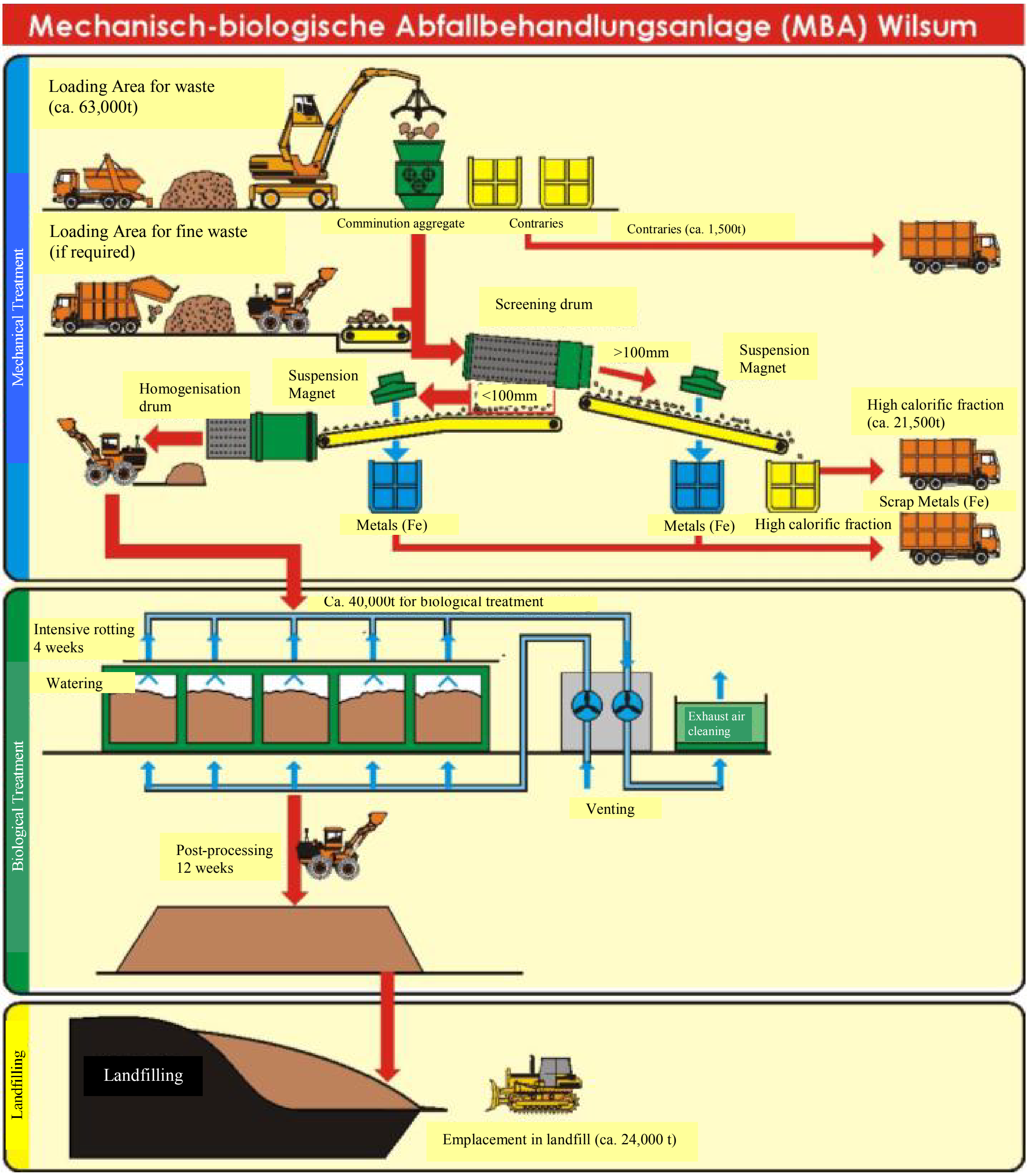

Figure 2 Mechanical-biological treatment (MBT) plant Wilsum

2.3 Mechanics

The comminution with the two-shaft comminutor of the company AMB and the screening drum with a perforation of 100 mm are the principal aggregates as regards mechanics. The set throughput rate lies at max. 23 Mg/h, in practice, in 1998 machine running hours (comminutor) approx. 54,000 Mg were being implemented (27 Mg/h). The feeding of the comminutor is carried out with a grab dredger. A wheel loader supports the waste input storage. The waste is delivered between 8 AM and 4 PM in the regular opening hours; waste processing is being done shortly after. The flat bunker was designed for an annual amount of 35,000 Mg in the year 1999, which seems extremely restricted from today's point of view. Particularly the unloading of the trailer trucks from Leer is difficult, since the trailer trucks deliver simultaneously between 7 AM and 5.15 PM. The comminutor, apart from the screening drum, restricts the throughput; its task is to shred inert components (e.g. glas bottles) and to decompose potential rotting fractions mechanically. Sometimes, there are minor damages or disturbances und thus to standstills, but on the whole, the machine has been working in a satisfactory way for 7 years with 8,500 operating hours. The electrical connected load for the comminutor is 200 kW. As the comminutor, the screening drum is designed for a throughput rate of 35,000 tons per year in a one-shift operation. Thus, a higher throughput rate here, too, is only possible by means of a two-shift operation. The homogenisation drum planned for sewage sludges admixtures is currently being traced out in the practical operation. An adjustment of the moisture content of the rotting material is currently not required.

Figure 3 Screening drum

Recent random test samples show that approx. 29.1 ± 4.2 % as high calorific value fraction from the input of Leer and 23.2 ± 3.5 % from the input of the County of Bentheim are being discharged for incineration, on a yearly average, this figure reaches altogether 25.6 %, with the random samples giving reason to expect 26,8 %. An examination of the non-comminuted RHM shows that 33.65 % are bigger than 180 mm. According to the analysis of the FH Bingen, approx. 64 % of the plastics, 23 % of the decomposable carbon and 9 % of the inert substances go into the oversize in Wilsum. There is no briquetting during the container loading; this would require a refilling with the trailer truck in order to work to full capacity. Comminutor and screening fulfil their goals.

The discharge of metals with the suspension magnet with 0.2 % of the input or 39 % of the potential is not very efficient.

With a tubular belt conveyor the potential rotting fraction is being transported from the mechanical processing over a free area of approx. 80 m into the flat bunker of the biological part of the plant. The tubular belt conveyor does not cause any problems and has proven its worth particularly with regard to the minimizing of odour emissions.

2.4 Biology

2.4.1 Intensive rotting

2.4.1.1 Rotting tunnel

The automatic feeding of the tunnel and the emptying with conveyors before the take-over and reconstruction of the composting plant to a biological treatment plant (BT) had been prone to disturbances. This is why all these facilities were removed in the course of the reconstruction measures. The filling and emptying of the tunnel is now being done with wheel loaders. The load capacity of the aeration plate (length approx. 24 m) restricts the size of the wheel loader. For historic reasons there are 7 tunnels which have a length of 30 meters and which can take up exactly one daily batch. The dumping height is then at about 2.20 meters. The rotting material comes from the homogenisation drum with sufficient humidity (water content of approx. 50 %) and is being positioned during the course of the day. After 6 to 7 working days, i.e. maximum 10 retention days, the tunnel must be cleared; the rotting fraction is then stored in the next free tunnel on the other side of the hall. These 13 tunnels have a length of approx. 24 metres, and the average retention time is approx. 17 days, if one tunnel is filled per working day. The planning target retention time of minimum 28 days is thus almost reached.

There is no cooling of the recirculated air, as shows the temperature course and the balanced heat removal. In warm weather, there is a relativeliy high risk that the windrow might overheat; there are only restricted possibilities to control and reduce this development and to reduce the temperature (air flows and moistening). The air flow was increased with continuous rotting time from 2,700 to 3,100 m^3/h in the tunnel.

2.4.1.2 Feeding and evacuation

A wheel loader bucket holds approx. 3.6 m^3 or 2.3 Mg rotting input. A tunnel filling takes ca. 4 hours, as does the rearrangement from intensive rotting A to intensive rotting B.

2.4.1.3 Cleaning of the tunnel floor

A great amount of time is needed for the cleaning after the clearing of the tunnel. Most of the clearing is being done with the big wheel loader; afterwards, residual amounts are removed with a small wheel loader. The tunnel is being swept with a road sweeper, and then follows a manual cleaning and exposing of the vent holes. Depending on the degree of soiling, 2 1/2 to 4 man-hours must be estimated for this. In order to restrict the total effort, a careful cleaning after each use of the tunnel is mandatory. Beneath the aeration plate, trickled or rinsed inert materials accumulate through the vent holes as sludge, which is to be cleared twice a year, e.g. by means of a suction and flushing vehicle.

2.4.1.4 Watering and dewatering

Around 100 cubic metres of water are to be sprayed into the rotting tunnel throughout the rotting time over nozzles which are fixed on the ceiling. The pouring of water is necessary for the biological degradation in the aqueous phases and for temperature reduction (evaporative cold).

2.4.1.5 Venting

From the mechanics, altogether 21,000 m^3/h of air (delivery hall/ flat bunker 11,000 m^3/h, processing hall 10,000 m^3/h) are being sucked out. From the rotting tunnel vestibule approx. 17,000 m^3/h and from the tunnel roofs approx. 4,000 m^3/h are being sucked out. This sucked out air (approx. 42,000 m^3/h) is blown over registers into the rotting tunnel over the floor, sucked out above, partly returned as recirculated air and a partial flow is exhausted over the scrubber of the RTO.

2.5 Exhaust air treatment and RTO

2.5.1 Description of the procedure

2.5.1.1 Scrubber

Before the RTO, an acid scrubber is built in. By means of sulphuric acid, a pH-value of around 4.5 is being set. Up to now, no problems have occured with the scrubber. However, the problem of the utilisation of the ammonium sulphate solution has not yet been solved, since we have not yet succeeded in reaching the concentration required by the customers.

2.5.1.2 RTO

The regenerative thermal oxidation facility is designed as a two-line construction for 120 % of the nominal output. It is thus secured that e.g. in the case of the break-down of one line at least 60 % of the nominal performance is available. The designed volume flow lies at around 42,000 Nm³/h. The use of natural gas as a carbon carrier is compulsory. The fuel demand per year lies at around 620,000 m³/a at maximum utilisation. The exhaust gas measurements carried out in accordance with the 30th Ordinance on the Federal Emission Protection Law did not point out an exceeding of the limit values.

Compared to other plants, disturbances during the RTO in Wilsum are not outstanding. Smaller break-downs of drives and measured value recording devices are more time-consuming. Closures of the honeycombs due to silicates as seen in other RTOs could not be detected in Wilsum so far. Up to now, a regular cleaning of the honeycombs takes place at least twice a year.

2.5.1.3 Post-processing

The rotting fraction comes from the intensive rotting after approx. 28 days and is being piled on windrows with the wheel loader. Once in a week the windrows are mixed with a converter and newly drawn up. The weather (wind direction, air pressure etc.) prescribes when windrows can be drawn up. These boundaries must be observed particularly with regard to the avoidance of odours (neighbourhood complaints etc.). Practice showed that in the past sometimes neighbour complaints due to odour nuisances were filed.

2.6 Storage, transfer to landfill, insertion

2.6.1 Storage, sampling, release

Along the boundary wall of the biological post-processing area, the deposit is being collected over a length of 140 metres, a width of 7 metres and a height of approx. 3 metres and stored until its relase for insertion in batches of approx. 2000 mg. The deposit, which complied with the criteria of the German Waste Storage Ordinance, was being inserted for the first time on 12th December 2005. Until the end of December 2006, a balanced deposit of 31,691 Mg was delivered to the landfill on 34 days. Once a month on the average, a transfer cyclus took place.

The sample collection and analysis was carried out in accordance with the recommendations published by the Registered Association for Material Specific Waste Treatment (ASA e.V.). The analyses were carried out by an acknowledged competent laboratory. In accordance with the results from the analyses, the release for the insertion in the landfill is being issued.

Currently, attempts are underway to install an internal controlling with a corresponding allocation of responsibilities. A certified engineer from the faculty of chemistry is available for this effort.

2.6.2 Transport and insertion

Loading is carried out with a wheel loader, and the transport with a tractor with a dump truck, which is a service that is put out to tender and carried out by a third party.

Figure 1 MBT plant Wilsum

The deposit unloaded on the landfill surface is currently being spread out superficially with a landfill compactor and inserted. The actual compaction is then being done with a smooth roller. The requirements according to Appendix 3 of the German Waste Storage Ordinance are being observed through this method.

3 Summary

After approx. 1 ½ years of operational experience we can state that the MBT plant in

Wilsum – apart from a few weak points – generally fulfills the operational requirements sufficiently.

An optimization of the MBT plant and ultimately also of the waste disposal centre of Wilsum is necessary. For this reason, Prof. Dr. Scheffold was charged with making an analysis of critical points within the framework of a student project of the college (FH) of Bingen, which was done in coordination with the political bodies of the district County of Bentheim. First results will be discussed with Prof. Dr. Scheffold on the occasion of his lecture concerning the weak-point analysis on the example of the MBT plant of Wilsum.

From the point of view of the plant managers and the technical management the introduction of the MBT technology means a special challenge for all participating actors. In the district County of Bentheim the problem was that relatively shortly after the political goals setting the MBT plant had to be built and put into normal operation. Due to the completion of the plant in August 2005, a trial and service run could only be made under full-load working conditions. From this, the inevitable consequence was that an optimization of the MBT plant could only take place during normal operation – hence under aggravated conditions. The waste management plant is being supported, as previously mentioned, by Prof. Dr. Scheffold and the students of the college of (FH) Bingen. The weak-point analysis also contains optimization proposals for working schedules and organizational as well as technical regulations of the entire disposal centre of Wilsum. Also internally, procedure optimizations (e.g. analysis, volumetric flow etc.) with the participation of the controlling which is currently being built are being aimed at. The authors assume that the implementation of optimization proposals can already begin in the running financial year 2007.

4 Literature

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