

## Some good reasons for turning your heaps

It has been some time since tendencies have become apparent on various compost plants, which nearly completely economise the turning of compost heaps. It has come into fashion to cover heaps with semi-permeable materials which, in combination with airing, seem to kill several birds with one stone at the same time. On the one hand it satisfies the authorities' conditions for a closed intensive rotting system. Companies, which offer these systems, promise a clear reduction of odour emission. On the other hand the reduction of turning processes has always been a powerful argument. On closer examination, however, you will find out that it is especially important to turn the heap, if it is not even the deciding factor, when you are running a compost plant.

Since the beginning of industrial composting in Europe, numerous investigations and examinations have been made on the process-controlled running of compost plants. In special literature they always point out that the course of heap turning has various positive effects on the composting process.

The most important are:

1. Homogenisation of the structure and the moisture contents
2. Gentle, permanent treatment of the material
3. Oxygen supply of the material
4. Mixing the core and rim zones of the heaps
5. Loosening the heap structure ,.

At least point 3. to 5. have to be repeated in regular intervals because after the turning process has created ideal conditions, a resting heap always slips into unfavourable conditions again in the course of time, speak:

Subsidence of the heap, insufficient or uneven oxygen supply

Formation of damp, anaerobe zones

Overheating of the heap core, refrigerating of the rim zones

Can a static heap system guarantee that these elementary basic conditions can be influenced effectively without turning the material?!

Moreover, one side effect of a well functioning turning technique is that ideal starting conditions for the composting process are created by producing homogeneous input material right after the first turning process.

**What kind of effort do compost makers take, who possibly want to bring their input homogeneously below the tarpaulin or into the intensive rotting too, but in a different kind of way?!**

An additional side effect of turning processes is the gentle cutting that starts in the course of time because the material has been made crumbly by micro-organisms. The composting process is sped up by permanently creating new colonisation areas. Moreover, it decreases the overflow that arises with the final ready made compost. This corn is normally transferred into the process again. Each ton of material that has to be transferred through the process more than once, finally diminishes the profit.

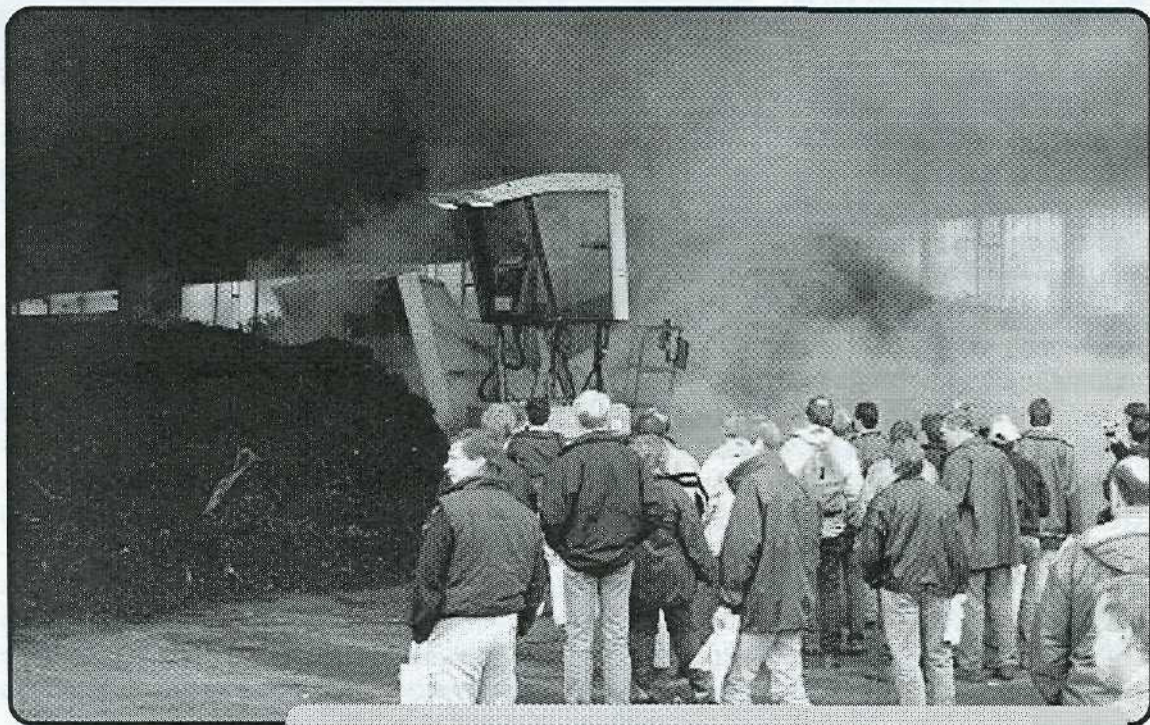


**How much time does it take to finish your composting process?! What is the percentage of your input tonnage, circulating labour- and space-intensively again and again?!**

A further essential point, that justifies the use of turning technology in composting, is the deliberate use of this technology. An experienced compost maker can also influence the ripening process of the compost by observing the heaps and deliberate use of modern turning technology. He does this like a good gardener,

who always keeps an eye on his beds and is at hand with hoe, watering can etc. if necessary. For all this the turning machine is the right tool. With this tool it is possible to adjust the composting process deliberately. If it means to loosen up the heap, to bring in or get out moistness, to add aggregates or to prevent overheating, the turning machine is always on the spot and, if necessary, adjusts the process.

Therefore, regard the turning machine as a sensible completion of your personal composting strategy, as a tool for moderate control of the process and as a guarantor for a high-quality final product.



Conviction work on the Bavarian compost day



## Application of BACKHUS - Conversion technology in composting

The method of open heap rotting is suitable for composting a number of different organic wastes. Whether biological waste, green waste or sludge, whether outdoors, indoors or in a digestion yard, composting in heaps can definitely be mastered and is a most effective method. The following article describes the necessary machines and equipment and their application in heap rotting.

Individual input materials are separately caught and deposited in the delivery area. Above all, biological waste, commercial waste and sludge must be processed as fast as possible, since this group of materials can emit a very foul smell.

For composting coarse materials like green waste, branches and stems, they must first be crushed in a shredder. The wheel loader fills the material to be crushed into the feeding bin. From here, it automatically enters the crushing chamber. Here, coarse pieces are seized by mallets and broken. The crushed material leaves the machine through a filter basket. The degree of crushing can be determined by selecting the speed of the crushing rotors and the mesh



width of the filter basket.

Pieces of 300 mm are most suitable for composting. A good heap structure can be created because of increased coarseness.

Before guiding into the rotting area, the entire material is

with each other in certain specific proportions. It is also possible to mix the sludge separately with the structured material and its subsequent separate composting. The mixing processor can directly form a heap of the mixture using its self-travel drive and remote control. The



once again crushed in a mixing processor and is mixed with each other. The wheel loader feeds the input material into the mixing chamber. Therein, all components are intensively mixed with each other and defibration of structures takes place. New surfaces are formed, moisture is created and the pH-Value of the mostly acidic input material is lifted to the neutral range. It may become necessary to add lime for supporting these processes. An increase in temperature of the material is noted due to these mixing processes and simultaneously the foul smell is also reduced. Depending upon the end use of the finished compost, the input material can be mixed

heaps are turned upside down at least 1 x week with the converter, aerated and if required, moistened at the same time. With each process of conversion, the entire material deposited in the heap is homogenized, whereby the core and border zones of the heaps are intensively mixed with each other. This helps in maintaining constant optimum living conditions for micro organisms that are involved in the decomposition of organic substances. This accelerates the process of rotting.

Usually, the process of rotting is controlled by monitoring the temperature, moisture and the amount of oxygen. For this purpose, mobile hand-held instruments are used. The optimum temperature range lies between 50 - 65 °C. The moisture must be adjusted in such a manner that the compost can be pressed together manually, but no seepage water comes out from the base of the heap. The heap structure must be constantly loose in order to ensure a sufficient supply of oxygen. This requires regular conversion. As long as these parameters are fulfilled, there is no possibility of the seepage water



various conveyor belts. Through the process of screening and grading, two or more lots are obtained, whereby the finest lot is the

two ways. Firstly, several owners of composting sites make a common investment and use the machines free of cost, or secondly, one owner buys the technology and allows others to use it at a price. This saves on investment costs and the operational cost can be optimized by maximum utilization of the machine capacity.



coming out of the heap or it emitting a great amount of foul smell.

After 8 - 12 weeks, the compost reaches a rotting degree of 4 - 5. Processing is done with the help of a screening machine. The wheel loader clears the compost from the heap surface and fills it into the screening machine. Inside the screening machine, the material is graded and the products separated according to their size leave the machine on

end product i.e. ready compost. Coarse lots can be used in weed control as mulch or are recycled as structural material in the composting cycle. The wheel loader deposits the end products in the storage areas.

It is usual to have mobile machines in the method of heap rotting for designing flexible operational sequences. Besides, the individual pieces of equipment can be used on various composting sites. This can happen in

Thus, the heap rotting method is a cost effective and safe composting method, which represents a simple way of exploiting organic waste for cities, municipalities and private operators.

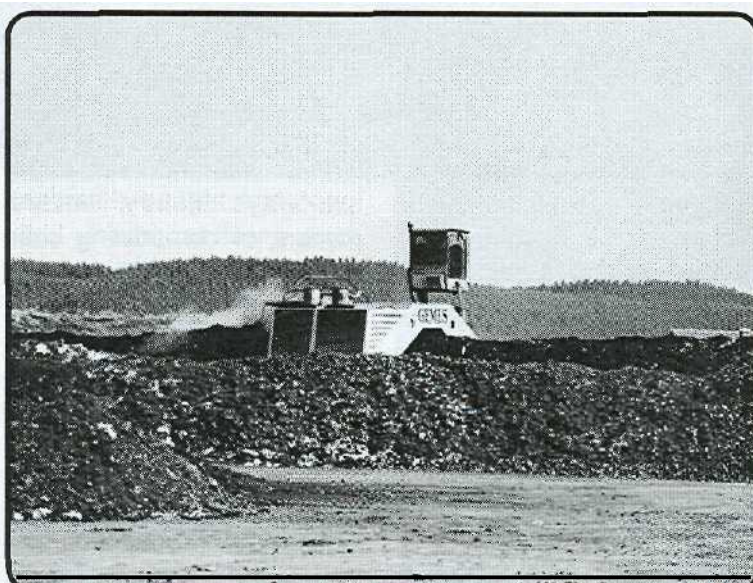


## Using BACKHUS Compost-Technology in micro-biological soil decontamination

Different methods are known for the decontamination of grounds. Wood and mineral material (debris, soil), which is contaminated with organic harmful substances, like mineral oil or aromatic compounds {PAK, BTX), can be cleaned biologically with the method of micro-biological decontamination.

and decontaminated either on site or off site. On site decontamination means that the soil will be filled in again after the cleaning process at the place of origin. Off site treatment means that the material will be ex-changed at the damage location, cleaned and used for other purposes (road construction,

into action. During the first turning process the basic materials are mixed and lumps are comminuted. The result is an ideal heap structure. If necessary, special micro-biological cultures are added to increase the rate of degradation at the initial phase. Additionally, it is possible to control the humidity of the heaps by irrigating them during the turning process.



There are two advantages of this biological treatment. First, the high ecological compatibility of this method through careful use of techniques and naturally running degradation processes. Second, a real elimination of the harmful substances through their conversion into harmless components, like CO<sub>2</sub> and water, via metabolism of micro-organisms.

The success of the sanitation is estimated by the micro-biological degradation of the harmful substances, in dependence of the results of necessary preliminary examinations. The material, which needs to be decontaminated, will be dozed out

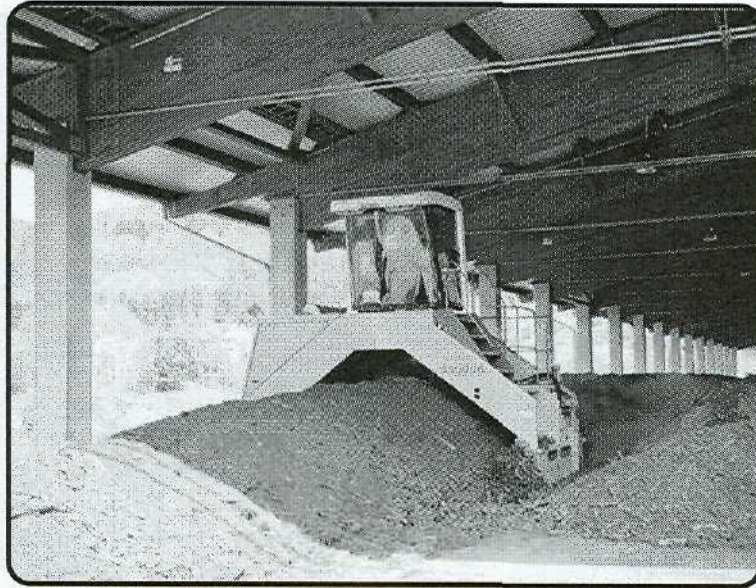
land restoration, etc).

Dozed out material has to be conditioned before its actual decontamination. First it is graded, the screen cutting mostly set at 50 mm. Various examinations have shown that the fines (>50 mm) contain the main part of the contamination. This amount of material is now treated with structural and nutritive additives. For this process it is also possible to use, for example, composts because they add structure as well as nutrients. When the material has been conditioned, it is put up into heaps with the help of excavators or wheel loaders. Now the BACKHUS soil and compost turning machine goes

The conversion from contaminants into harmless substances is, of course, done by micro-organisms like bacteria or fungi, which can be found in the ground. They do this by living from the impurity of the material. The control of the degradation process is limited to creating a milieu, which is favourable for the micro-organisms. Decisive for this are humidity, temperature and the content of nutrients and oxygen in the heaps. Further turning processes are just for the aeration of the heaps, for further homogenisation, for breaking down the material, for loosening the heap structure, and thus for the aim to create the most favourable living conditions for the bacteria, which are necessary to degrade the contaminants. Partly, you can also isolate strains of bacteria from contaminated material, multiply it in the laboratory and then put it back into the heap via the spraying unit at the BACKHUS turning machine.

Thus the BACKHUS turning machine is purposefully used for process control only, when the heap conditions need to be corrected. In this way, an economical and efficient operation regime of the soil decontamination plant is possible, because just as much technology is used as absolutely necessary, and not as much as possible. Experience shows that the turning technology is used according to the content of harmful substances in the material that has to be decontaminated, and according to the decontamination progress. At the beginning of the decontamination process more turning processes will be necessary (several times per week) similar to composting. At the end, however, there will be less. The BACKHUS turning machine makes it possible to keep this flexibility also during continuous operation of the plant, because it is the controlling tool for the progress of the decontamination process.

if you can see from the parallel running examinations on the decontamination progress that the process is finished, the BACKHUS turning machine will go into action one last time. Top-soil, composts or fertilizer are added to the cleaned soil, so that it is conditioned in a way which fulfils the intended use (recultivation, road construction, etc). The BACKHUS turning machine provides for homogeneity and thus for the quality of the soil which shall be delivered.



The BACKHUS turning machines of the series 5 have some decisive preconditions for the use in soil sanitation:

**Sturdiness:** By using long proven components for propulsion, power train and undercarriage, a turning machine with the character of building machinery has developed, it is able to bear loads and it is sturdy.

**Stability:**

We guarantee that our product is a match for the requirements of soil decontamination because we are using a special frame construction. This frame construction has been developed with the help of CAD-3D-construction and computerized FEM calculation.

**Weight:**

All BACKHUS turning machines, used for soil decontamination, have an operational weight of 11 t up to 24 t. And the weight of the machine is not replaceable when you are dealing with soil!

**Traction:**

Using crawler tracks results in good traction and the possibility to place the heaps directly adjacently because no track is necessary between the heaps, thanks to applying small track clearers.

**Manoeuvrability:**

Additionally, the BACKHUS turning machine is able to turn on the spot when required. This makes it easier to use the machine in closed plants and on narrow places.



**Reliability:**

Our references prove: the user relies on BACKHUS turning machines which offer operator convenience, low-maintenance and reliability.

Especially for soil decontamination, we offer further useful optional features beyond the usual scope of delivery for our compost turning machines:

- armoured rotortools (minimized wear)
- rubberized tunnel space (minimized wear and noise)
- especially adapted protective ventilation (ABEK-filter)
- concentrate spaying unit with storage vessel

If you are interested in our machines for the use in micro-biological soil decontamination, please feel free to ask us for detailed information material. We offer our BACKHUS turning machines for soil decontamination in different sizes, for 4.5 m to 7.5 m wide heaps.

The BACKHUS machine provides:

- quicker achievement of the objective of decontamination, saving time and money
- flexible application, also at various plants, on site and off site
- purposeful use of technology only if necessary
- efficiency, sturdiness, stability and reliability
- economic efficiency

The BACKHUS transposing machine is used in the field of mechanical-biological treatment of residual waste (MBA) for composting this waste through heap rotting. During its dwell time of 2 to 4 weeks the waste is intensively treated, mostly in a closed rotting system. Afterwards the material is set out for after rotting, preferably in a tabular heaps. The intensive management of residual waste heaps is the working field of BACKHUS-Technology.

Composting residual waste means that heap rotting takes place on reinforced and roofed areas. In this way it is possible to control the humidity during the rotting process among other things. As an exception, after rotting can directly be done on the body of the dump ground. The heaps are set out with a wheel loader. With the first turning by means of the BACKHUS transposing



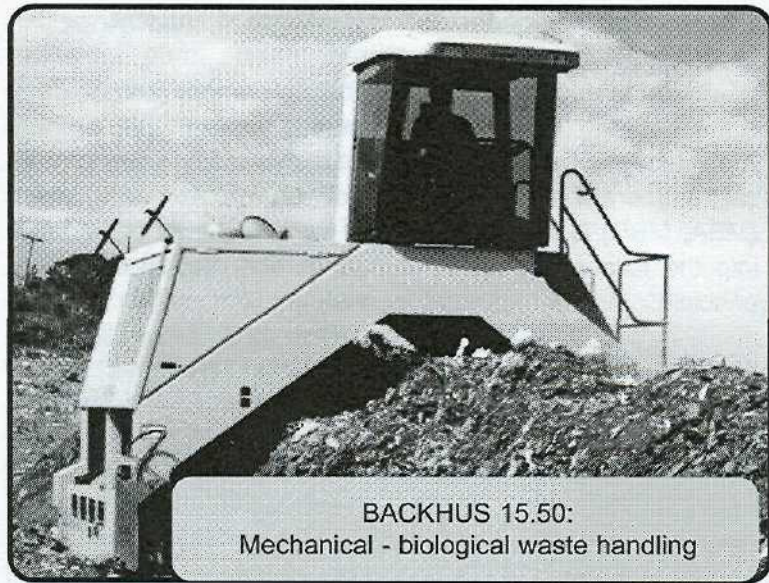


# Mechanical-biological treatment of residual waste

machine the homogenization of the material will be effected. Within a short time the input material starts its micro-biological degradation. During the rotting phase the temperature is about 40-50°C.

The BACKHUS transposing machine drives through these heaps approx. once a week, depending on the rotting progress and the condition of the material. Due to this, the heap will intensively be loosened, core and hm zones will newly be mixed, lumps will be broken up and the material will be irrigated if necessary. CO<sub>2</sub> and steam escapes because of the work of the microbes in the heap. The material decreases through rotting.

If the rotting proceeds optimally, the material can be screened after about 8 - 12 weeks. Remaining light-density matehals, like films and wrappings, are removed

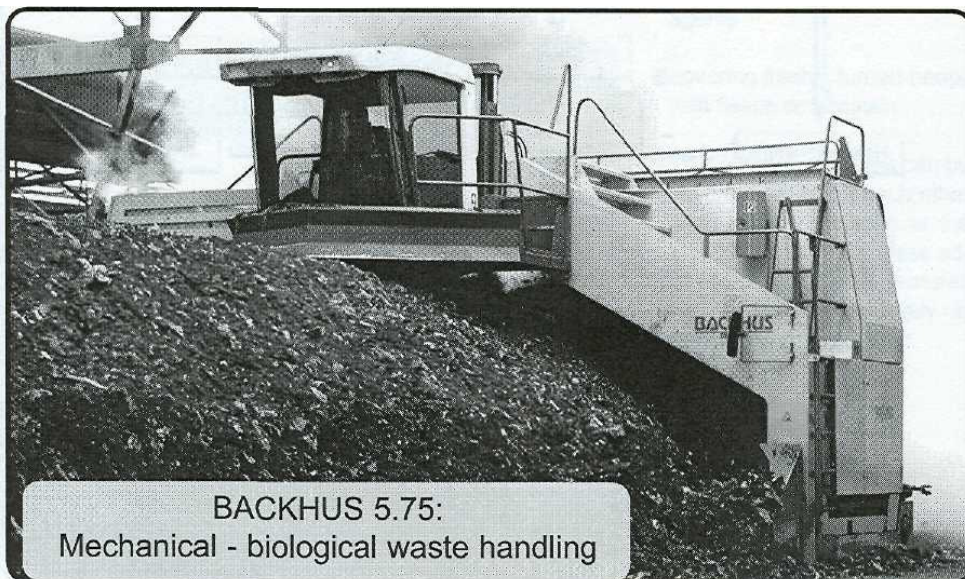


BACKHUS 15.50:  
Mechanical - biological waste handling

cess. Afterwards the stabilized material can directly be put in.

Efficiency and reliability of BACKHUS transposing machines guarantee continuous processing of arising quantities, even with increasing amounts of residual waste. It is no problem for these mobile, sturdy and manoeuvrable machines to cope with fluctuations in quantity and composition of the material. When the BACKHUS trans-

posing machine is used for mechanical-biological treatment of residual waste, it proves to be a machine which is extremely flexible in use and accompanies and pushes the rotting process till the humification of the material.



BACKHUS 5.75:  
Mechanical - biological waste handling

during the screening pro-



## Plants for mechanical-biological treatment of residual waste

A plant for mechanical-biological treatment of residual waste (MBA, MBR) is to be divided into the following sections in principle:

### Mechanical preparatory treatment

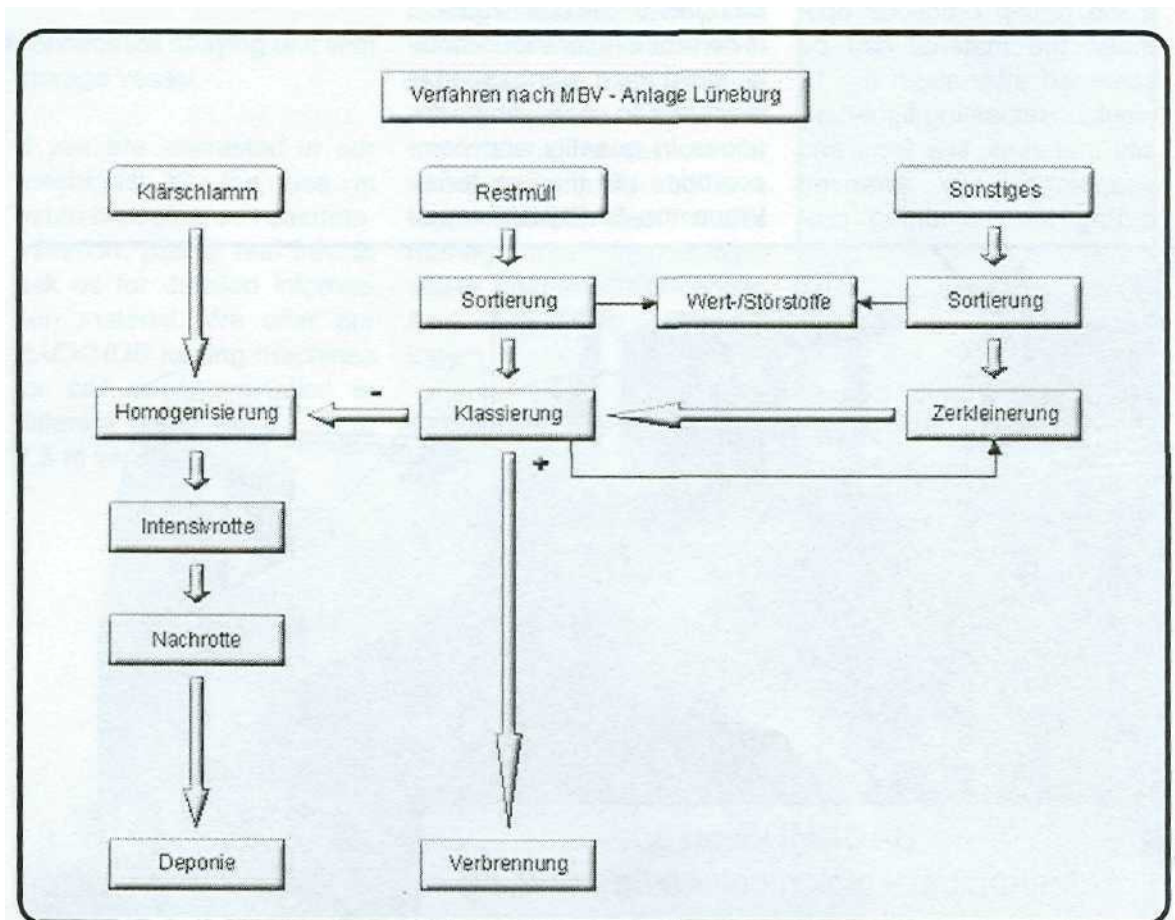
Separating the coarse waste fraction with high thermal value from the residual waste, usually at sizes of about 100 mm  
 Sorting out disturbing substances and contaminants  
 Reducing the size of bulky refuse and coarse ingredients {optional, if necessary}  
 Homogenization of the different kinds of waste for setting optimal rotting conditions

## Biological treatment

Rotting process (aerobe treatment), mostly split up into intensive rotting (reactor, tunnel, drum, box composting) and after rotting Fermentation (anaerobe treatment, optional), in combination with the rotting process usually fermentation, intensive rotting/after rotting

### Mechanical subsequent treatment

Separating a further fraction of high thermal value to burn or split off coarse disturbing substances before using the manufactured compost for covering disposal sites  
 The following flow diagram shows an example for a possible process variant.



## Possibilities for odour reduction during the composting process by using BACKHUS Technology

Clouds, vapours and therefore odour flows, released during composting, are part of the natural composting process. In the past, little attention was paid to these side effects, but just recently they have become an important criterion for composting, as they are part of a process that runs largely independently. These effects become especially important when a compost plant is threatened to be closed because of odour pestering.

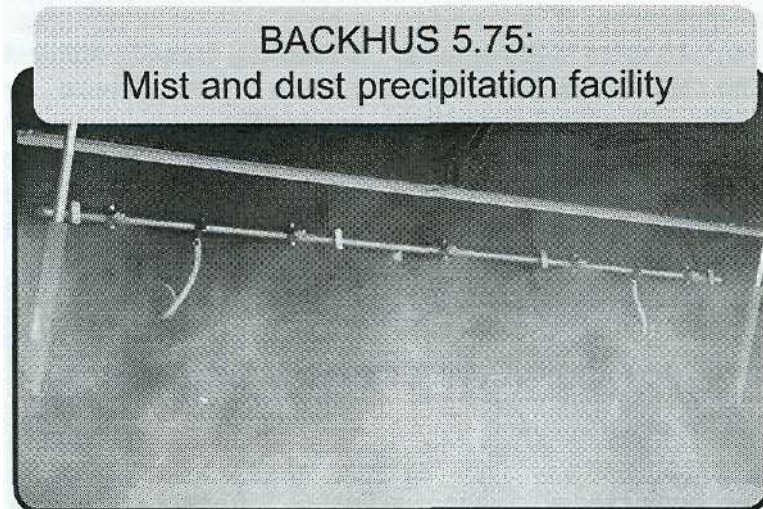
In the article "odour emission - odour deletion in the practical use of compost plants" you will find expositions about the formation of odours and the basic knowledge of odour reduction (ask your contact at BACKHUS).

The following article shows possibilities, how BACKHUS can help you to gain control of the odour problem on your compost plant.

During normal operation on a compost plant, more than 90% of the total emission is emitted by the resting heap. Only about 5 -10% of the total odour escapes into the ambient air during the turning processes. Nevertheless, the emitting odour units per time

For the period of time during and shortly after the turning, when the odour is very strong, BACKHUS offers the following measures for fighting the odour:

- mist precipitation facility for minimisation of cloud forma-



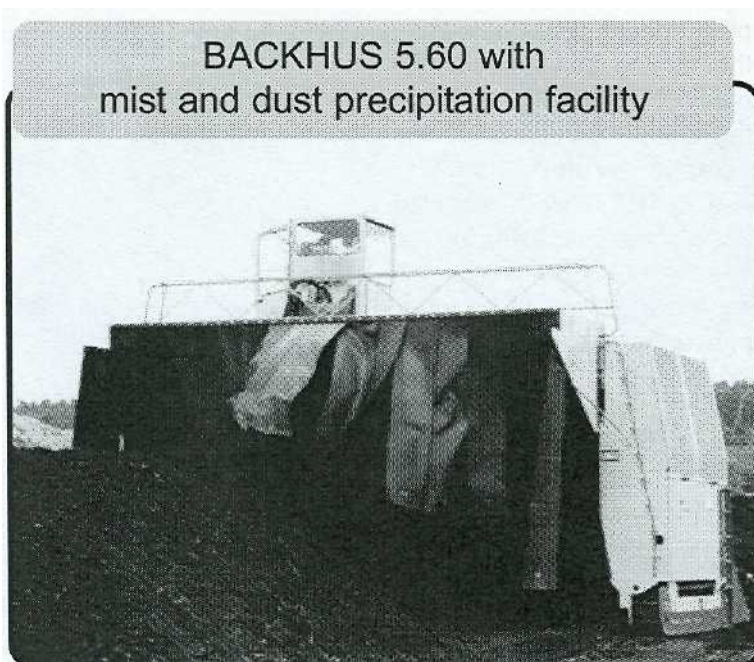
unit during the turning process are very high. Thus it may come to odour pestering during the turning process or in the following hours. No odour pestering is to be expected in the time remaining, if the heap is correctly turned in time.

tion

- spraying odour neutralising agents

- covering freshly turned heaps with fleece or tarpaulin

These three measures can be used separately of each other or in any combination at the same time, although these ad-on-units or optional features are explained separately in the following description.





### Mist and dust precipitation facility

A spray unit is on the transposing machine. Additionally, the area, in which the heap is cleared away and newly set up, will be covered down to the body of the heap with rubber stripes. The result is a tent-like room that surrounds the main source of emission at the rotor. A fine water mist is now sprayed into this room with jets. The size of the mist drops can be determined via

into operation to either mix the substance into the heap, put it onto the fresh heap surface or to spray it into the escaping clouds. Thus the different active mechanisms of the odour neutralising substances can be taken into account.

### Covering freshly turned heaps with fleece or tarpaulin

It might be an advantage to cover the heap with a fleece or tarpaulin, to reduce the

during one process.

Fleece-like materials (e. g. Toptex) or semi-permeable tarpaulin (e. g. Goretex) are recommended as cover. Depending on the coating or the structure of the layers these materials can fulfil various purposes. Some producers promise that vapours or odours are kept back in the heap, while at the same time the material is supplied with fresh air. Additionally the materials show different durability.



BACKHUS 6.50 in use

different jet sizes and they should be a multiple of the drop size of the compost clouds that must be absorbed. Thus the drops of the clouds settle down on the artificially produced mist drops. These water particles grow quickly and parts of the clouds rain down. Therefore no odour emission will arise.

### Spraying odour neutralising agents

The spray unit described in paragraph 1 can also be used to spread out deodorising agents. Depending on the kind of deodorising agent that will be sprayed in, different jet girders can be put

increased cloud production that abates during the time after the turning process or to hold back increased escaping odours. Before starting the turning process the tarpaulin or fleece is pulled off the heap by means of the external tarpaulin spooler BACKHUS 6.50. It is rolled up into the magazine of the spooler. Up to 8 rolls can be separately stored in an intermediate storage. During the following turning process the cover is unwound from the spooler and, at the same time, pulled over the heap and put down by the transposing machine. It is possible to transpose up to 8 heaps and to cover them simultaneously

Well then, if you have odour problems at your compost plant contact BACKHUS. Together we will certainly find the right solution for your problem.

BACKHUS - to keep your compost plant from becoming absolutely appalling!

### Composting bio-waste

For composting bio-waste a powerful transposing machine is necessary that facilitates to transpose large amounts within a short time. Only this guarantees to keep a stable aerobic heap regime and to avoid annoyance through smelling.

It is absolutely necessary to have a sturdy, stable and reliable machine for all the different foreign substances in the bio-waste. BACKHUS transposing machines have the features of building machinery and a fundamental mechanical engineering design. This and the proverbial BACKHUS quality guarantees reliability and sturdiness when the machine is used in compost milieu.

Several optional irrigation fittings at the machine guarantee control of the water balance in the rotting material even with flexible use of the machine.

### Sludge composting

Sludge composting needs good control during the rotting process to save time and to avoid annoyance through smelling. If the heap contains little textured material, frequent transposing is necessary (up to twice a day) to avoid anaerobic conditions.

This is the opportunity to use the powerful BACKHUS Technology. Even large amounts of compost raw material can be transposed, irrigated and aired swiftly and exactly at the right moment. An injection unit respectively a smog and dust precipitation unit decrease cloud and soot emission. Thus soot concealment or soot stoppers can be used during the transposing process.

### Soil and substratum production

In a soil plant the BACKHUS transposing machine is used to homogenize the different materials used for special soil blending.

By means of a wheel-loader the heaps are stacked up either unmixed or coarsely blended. After that the BACKHUS transposing machine drives through the heap once or twice. By doing this the transposing machine supplies intensive blending of the initial substrata. Through such homogenization the quality of the manufactured substrata can keep up with all industrially manufactured substrata for horticulture and landscape gardening without any complaint.

After having sift it to the required grain size, this manufactured substratum is certainly also suitable for being soaked into peaking drums.



BACKHUS 15.50  
composting bio waste

Several thousand tons of special soil are guaranteed daily, due to the high throughput capacity and high reliability of the BACKHUS transposing machine.



## Cultivation of disposal sites

Sanitation of disposal sites with mineral-organic covering materials requires to manufacture large amounts of mixed substrata made of various basic material. In some cases these substrata are manufactured directly at the disposal site and used for covering there and then.

The BACKHUS transposing machine guarantees good traction and torsion stiffness even on loose grounds. High sturdiness and reliability are granted due to the building machinery feature of the machine. Production of large amounts of high-quality top substrata is always guaranteed because of its efficiency. Broken clay is partly needed to produce clayey substrata for disposal site coverings. This is necessary to give the covering substrata specific characteristics with regard to water permeability and solidity at the disposal site.

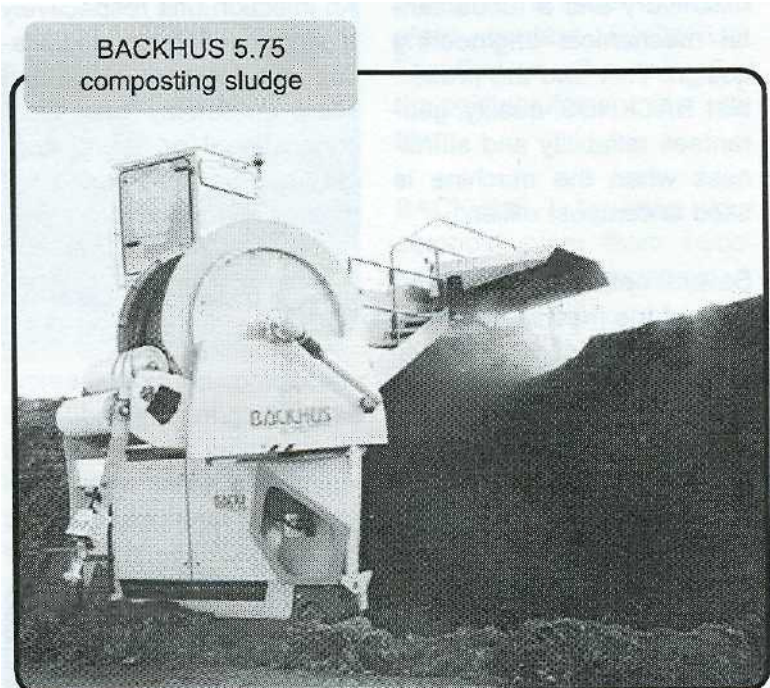
The BACKHUS transposing machine can also be used to manufacture broken clay. For that freshly produced clay is shaped into a triangular heap. The transposing machine drives through this heap approx. two or three times, to get sufficient fine clay for being processed into covering substrata. Stones, included in the clay, will not be cut up but can be sift out. Micro-biological soil sanitation

Contaminated material in micro-biological soil sanitation

plants shows a high specific density. Mostly the ground increases wear and tear because it is infiltrated with big stones or other foreign bodies, thus not an easy task for a heap transposing machine.

Because the basic material is mostly poor-textured or texture-free, the oxygen, necessary for bacteria in the heap, can only be supplied through energy costly ventilation installations or just through continuous transposing.

Therefore, using the BACKHUS transposing machine means to save time and energy with the sanitation. When fulfilling sanitation orders, flexibility and reliability are guaranteed by the building machinery feature of the machine. With regard to sturdiness it fulfills highest standards. In addition, quick transport of this powerful technology is possible from one plant to the next. An optional irrigation system allows treatment of the heaps with various liquid additives.





# Estimated capacity computation of a composting site

The capacity (in t) of a site depends upon various factors:

weight per m<sup>3</sup> of the input mass and the final mass,

anticipated residence time of the material to be composted or runs per year,

cross-section of the heap as well as that of the heap areas,

turning space requirement of the conversion machine in front and behind a heap and the heap offset in a longitudinal direction during conversion,

rotting shrinkage during the period of composting,

distance between two heaps as well as from the walls of the plant or supporting columns,

time required for building and demolishing a heap.

We recommend a formula for a quick estimate, which does not take into account the rotting shrinkage and the time debit for building and demolishing.

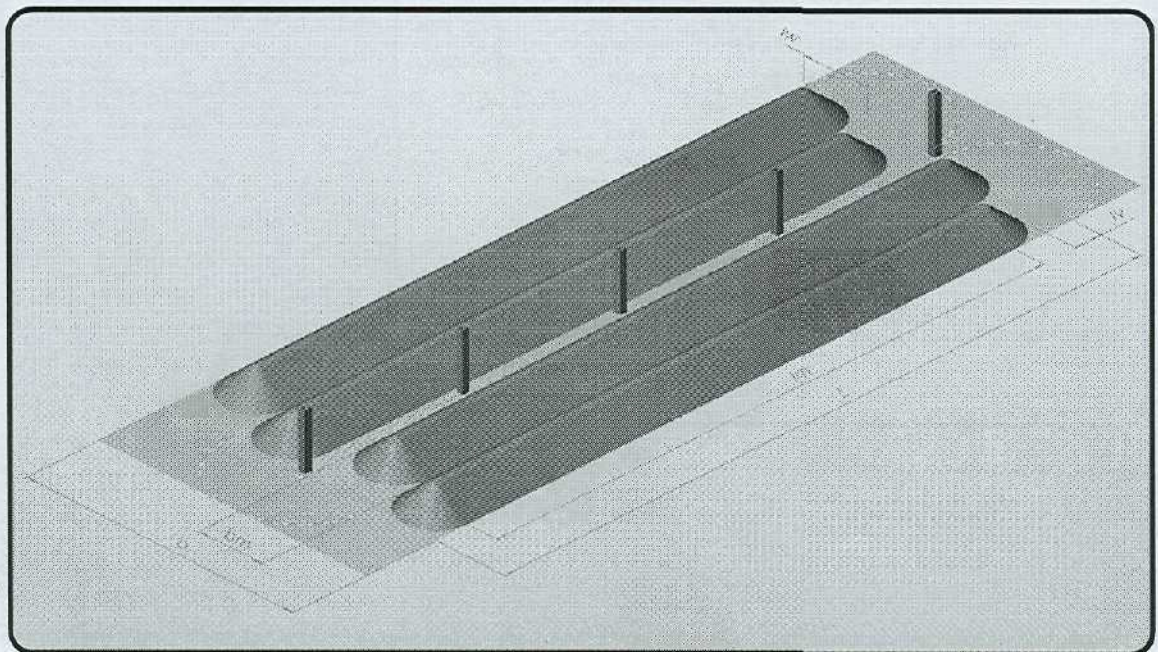
**Capacity (m<sup>3</sup>/a):**

$$\text{Capacity} = \frac{(l - 2 \cdot lw - lv) \cdot m \cdot A \cdot 52}{tv}$$

**Capacity (t/a):**

$$\text{Capacity} = \frac{(l - 2 \cdot lw - lv) \cdot m \cdot A \cdot p \cdot 52}{tv}$$

l	=	Total place length (m)
lv	=	Longitudinal offset during conversion (m)
lw	=	Turning space requirement (m)
m	=	Number of heaps
A	=	Heap cross section (m <sup>3</sup> )
tv	=	Residence time in weeks
r	=	Density (t/m <sup>3</sup> )
bm	=	Heap width (m)
lm	=	Heap useful length (m)





**BACKHUS**

Kompost-Technologie e.K.  
Wischenstraße 26, 26188  
Edeweicht

Fon: +49 (0) 4486 9284

Fax: +49 (0) 4486 2424

[www.backhus.com](http://www.backhus.com)

***AS J.I.T.***

Lastekodu 4-4  
70101, Viiratsi,  
Viljandimaa, Eesti  
Tel +372 43 94 105  
Fax +372 43 94 108  
e-post [jit@hot.ee](mailto:jit@hot.ee)