MEMBER OF ELLAKTOR GROUP

WASTE TREATMENT TECHNOLOGIES

- RESIDUAL WASTE TREATMENT
- WASTE TO ENERGY
- STABILAT® PLANTS
- DRY FERMENTATION / BIOGAS
- COMPOSTING OF ORGANIC WASTE
- CONSTRUCTION OF SANITARY LANDFILLS

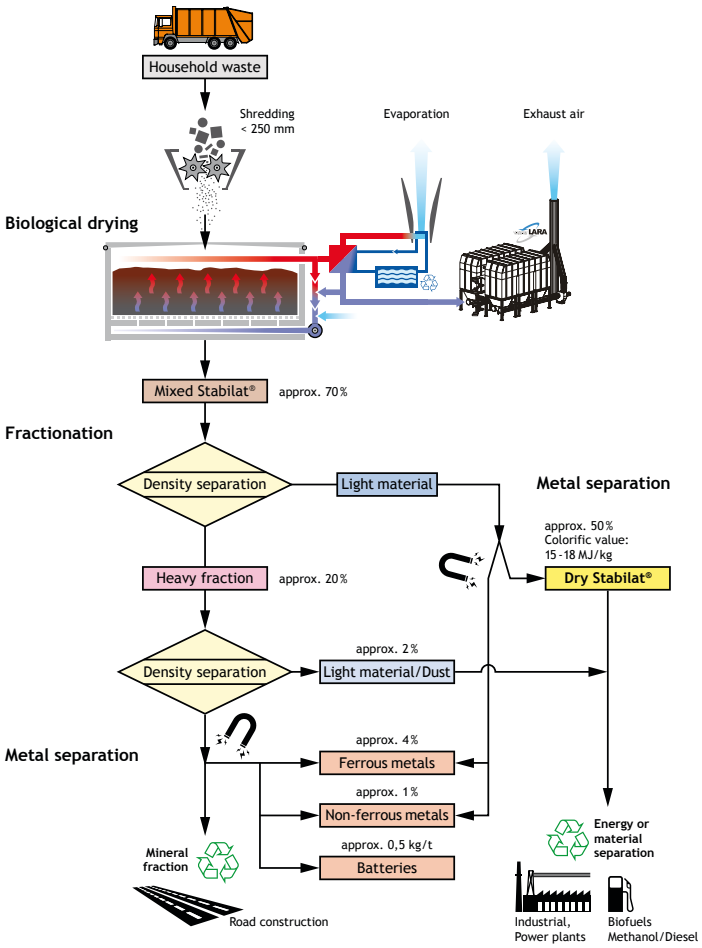
Residual waste treatment

Utilise waste instead of dumping it !

By using Herhof's Stabilat® technology, the volume of residual waste is organically reduced through dewatering. At the end, the water content lies below 15 percent, which significantly improves the mechanical separability of the material. This distinguishes Herhof's Stabilat® process from all other conventional treatment techniques. Reusable material is separated during the process and can be sold as a genuine high-quality raw material and returned into the material cycle. The remaining organic waste fraction is pressed into hygienic, nearly odour-free energy resources known as pellets.

Herhof Stabilat® process in 3 phases:

1. Processing: Extraneous matter and harmful substances are removed from the waste and the latter is then shredded to a maximum grain size of 250 mm and then transported via a fully automatic crane system into the Herhof bio box.
2. Stabilisation: In the Herhof bio box, the waste is dewatered through biological means. This is the vital step to the subsequent pure source separated break down of the waste mixture into reusable material and energy as well as for the storability of the fuel generated.
3. Inert separation: Removal of the mineral fraction (stones, glass, ceramics) and the metals, separated into ferrous and non-ferrous.








Waste is a mixture of very different raw materials. The Herhof Stabilat® technology enables selective separation and utilisation of raw materials.

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Composting of organic waste

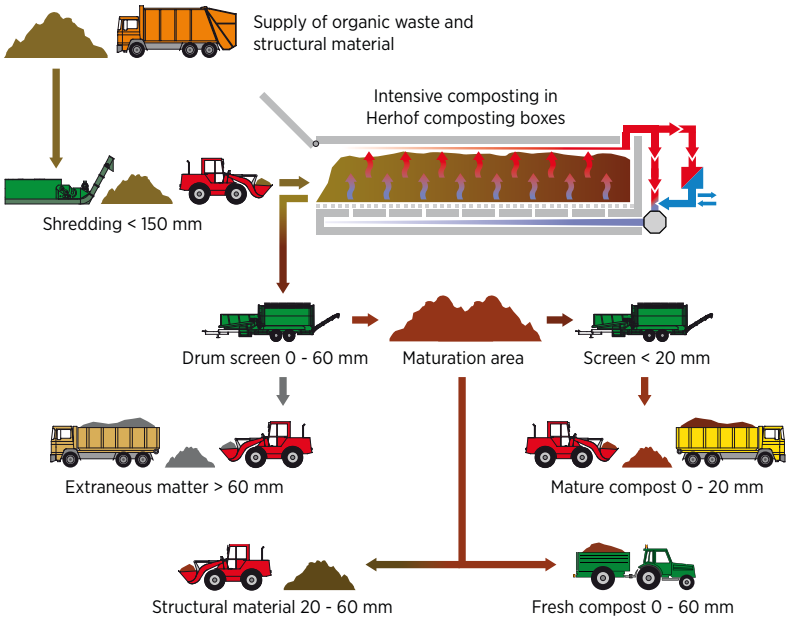
The Herhof box composting system is globally recognized in installations around the world. Over 40 Herhof composting plants operate successfully in all climatic zones. This is a testament to the high quality of the Herhof box composting system. This computerised system processes organic waste into a hygienically sound product within the shortest period of time (about 7-10 days) and it is space-saving. At the same time, the composting process and time are regulated using different control and regulation parameters. In order to be able to ensure a complete hygienic material, the composting material is heated up to 65 °C / 149 °F in the Herhof composting boxes. In this process, negative weather factors are dealt with. In addition, odours and groundwater pollution are managed within the closed system.

Although this sounds simple, it is an engineering feat! There are decades of developmental work behind it.

The Herhof box composting system can be used to produce compost fast and reliably from organic, garden, kitchen waste and from sewage sludge as well as from digestate coming from anaerobic digestion plants. It can be ideal for use in farming or for soil improvement in other areas. We have commissioned independent labs to monitor the nutrient-rich Herhof compost. The RAL quality seal is a proof of its high quality.

Herhof compost – Your soil is alive !

Herhof composting is unique in the world. Its core piece is the computer-controlled, optimised ventilation of the Herhof composting boxes.



The advantages of the Herhof box composting system are:

1. It is independent to ambient temperature
2. Controlled composting process
3. Short processing periods
4. Homogenous compost quality
5. Less land utilisation
6. Less deployment of manpower
7. Automated process
8. Lower transport and implementation costs

Intensive composting in Herhof composting boxes

Filling of Herhof composting box by wheel loader

Processing of compost by means of screening technology

The use of compost as fertiliser for soil improvement

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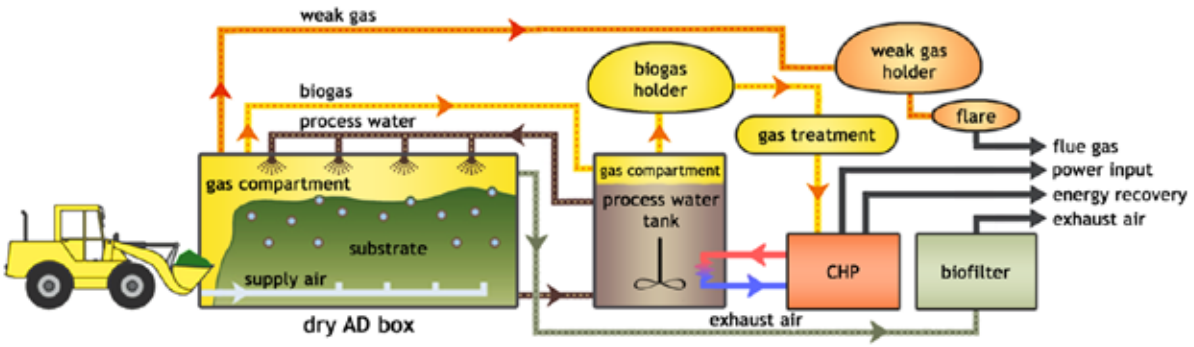
Dry fermentation process/ biogas production



The process (dry-wet-simultaneous) has been developed as a dry fermentation process in order to generate biogas out of biomass with high dry matter content, associated with marginal energy requirement and material wear. The procedure is a discontinuous percolation process where the required material conditions are verified by substrates which are provided by process water circulating through the system.

The dry fermentation process is efficient and established in many cases

- Weak gas management system
- Optimal biogas yield at low retention time
- High annual throughput of substrates up to 16.5 times of the useable volume of dry fermenters
- Minimal electric energy requirement
- Low thermal energy requirement
- Secure degasification and greatest possible deodorisation of fermentation residues
- Maturity level of the digestates III to IV
- No excess water
- Flexible integration in existing plants at low fixed costs

The advantages of dry fermentation in comparison to wet fermentation

- Less water demand, no mashing required
- Lower process energy, no mixing device required
- Less material wear, because of fewer movable machine parts
- Lower susceptibility to impurities and acidity
- Modularly upgradeable plants
- Smaller digesters because of higher energy contents of the used substrates
- Synergy effect in using waste collection and agricultural equipment
- Easier stackable storage of the digested material

The process steps:

Optional substrate preconditioning (e.g. milling, mixture in relation to the substrates)

1. Disposal of the substrates into the empty dry fermenter (e.g. wheel loader)
2. Optional pre-aeration at closed dry fermenter to increase the temperature
3. Anaerobic treatment by percolation with process water
   - 3.1. Primarily hydrolytic phase
   - 3.2.Primarily methanogenic phase
4. Post-aeration
   - 4.1. Deaeration of the biogas, aerobisation of the digested material, deodorisation
   - 4.2. Optional aerobic aftertreatment to reduce the water content
5. Removal of the digested material (wheel loader) Optional aftertreatment of the digested material (e.g. maturation, screening depending on application of final product)

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Biogas and Compost

Our ideal solution for biowaste

The most advanced product of the Herhof GmbH is the combination of the two renowned products:

- Dry anaerobic digestion box (dry AD box) and
- Herhof-Rottebox®

into one matching system: Production of energy-rich biogas as well as nutrient-rich compost. Arising synergy effects further increase the efficiency and environmental sustainability of the overall facility.

The concept – "Innovation through Combination"

The delivered biogenic waste is loaded batchwise into the dry AD boxes of the system, where it is fermented for approximately 3 weeks. During this period biomass is irrigated with process water from the process water tank in order to guarantee optimal milieu conditions for a productive digestion throughout the process. The biogas that is produced simultaneously in both dry AD boxes and process water tank is used to generate electrical and thermal energy.

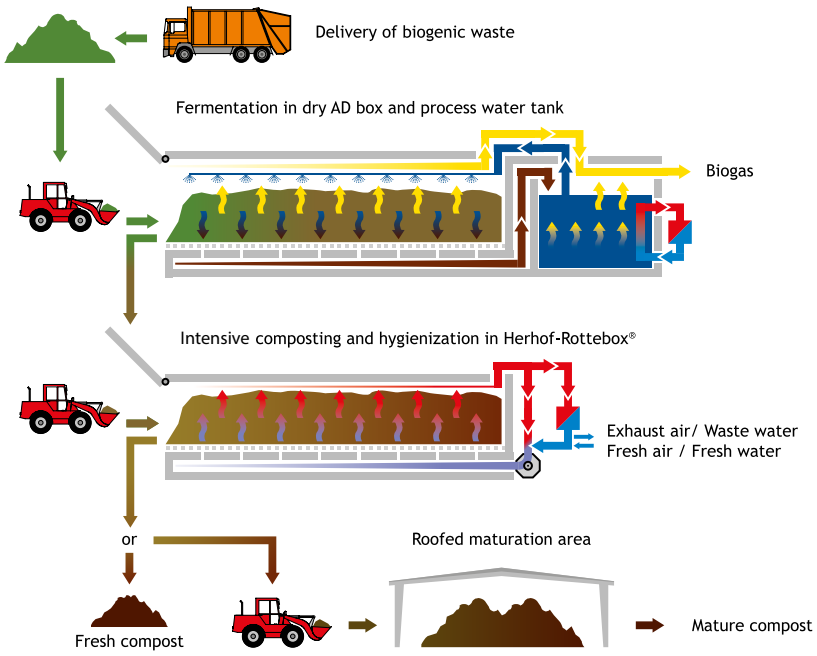
In the next step, the digestate is removed from the dry AD boxes and placed into the Herhof-Rottebox® for composting. Depending on the desired dry matter content and the compost quality of the end product, the waste is processed for approximately one to two weeks. Usually, hygienization and conditioning take place in this time period.

For the latter, significant amounts of water are stripped from the substrate due to the continuous aeration in the Rottebox®.

If requested, it is possible to add a downstream roofed maturation area to obtain further quality improvements retaining the highest quality standards.

The benefits of a combined system

- Optimally harmonized system
- Maximization of potential income
- Simple and clear plant control in a combined and interworking process control system
- Optimized operation procedure:
  - › defined retention times
  - › low specific space requirements
  - › low-emission due to exhaust air system and weak gas management
- Cascade use of biowaste (energy and material utilization of the full potential)
- CHP-waste heat used to support actively the hygienization step
- Modular design with extension possibilities
- Synergy effects for wheel loader operations



Reference

Our progressive concept, arranging our biogas production in series with our Rottebox®-process, has been successfully implemented at the plant in Doerpen and Heppenheim. Through our R&D policy the system is permantely under research for improvement and optimization. A very high demand of our latest product is currently shown by a remarkable number of customers worldwide. "Biogas and Compost" will be our highest selling product the following years.

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Waste treatment plant Larnaca

The plant in Larnaca handles the MSW and source separated green waste produced in the region Larnaca / Cyprus. The yearly amount of MSW going into the plant is approx 210,000 tons delivered on six days a week.

The waste-technology is an automated sorting plant for paper, cardboards, PET, Metals and films combined with a biological composting process with the target of creating a compost (fertilizer). Thereby the plant is able to produce different kinds of secondary fuels.

By means of a computerized biological composting process plus a subsequent fully automatic separation system the MSW is completely split into RDF, Paper, Cardboards, PET, PVC, Metals, Compost and Inerts.

Time schedules

Construction time	22 months
Status	in operation since April 2010

Contract duration:

turnkey delivery to holding company Helector S.A., Helector Cyprus LTD operates the plant for 10 years.

Size

Surface area building:	14,984 m²
Total footprint of plant:	105,763 m²
Volume of bunker:	3,750 m³
Height of buildings:	12.5 m / 14.5 m / 17.8 m
Height of stack:	30.0 m

Operating data

Workdays per week:	6
Employees:	20
Number of shifts:	2

Waste reception

Baling Press

Air treatment LARA®

Machinery

- Reception bunker with negative pressure
- Grab crane for bunker management and charging the bag openers
- Drum Screens for sorting the correct sizes
- Ballistic separators for sorting in heavy and light fraction as well as cubic and flat fraction
- Enclosed conveyor system interfaces for dedusting
- Separation of specific materials with infrared sorting machines
- Eddie current separators and magnets remove ferrous and non-ferrous metals from the fuel fraction
- 10 Herhof Boxes with air and liquid tight lids with feeding / discharge by automated crane
- 10 day biological composting process with the Herhof technique
- Ventilation to assist the biological processes by heat exchangers and cooling towers
- Dust removal with baghouse filters, pelletising
- Exhaust air treatment with RTO system
- Maturation area with windrow turner
- Refinery with screens and backing station for marketable compost products

Operator:

Helector Cyprus LTD
Vass. Friderikis 33
1066 Nicosia, Cyprus

Responsible authority:

Ministry of Interior of the Republic of Cyprus

Recyclingcenter Osnabrueck

The plant in Osnabrueck processes all municipal solid waste of the city and the district of Osnabrueck. The annual throughput amounts to 105,000 t collected on five delivery days a week.

Annual throughput

Municipal solid waste (MSW): 105,000 t/y (tons per year)

Types and quantities of products produced

Stabilat® fuel:	approx. 45,000 t/y
Water:	21,250 m³ reused as cooling water
Metals:	0.850 t/y mixed non-ferrous plus 3,400 t/y ferrous metals recycled
Inerts:	11,050 t/y inerts e.g. as ADC on the landfill or for road construction
Dust:	1,700 t/y
Batteries:	0.5 kg/t input

Time schedules

Construction time:	18 months

Status:
in full scale commercial operation since 01.02.2006, complete building measure completed in 08/2008, contract duration 17 years

Size

Surface area buildings:	6,063 m²
Total footprint of the plant:	20,210 m²
Volume of bunker:	1,800 m³
Number of Boxes:	5; each 30 x 5 x 6 m (L x W x H)
Height of buildings:	boxhall, 20.13 m machinery hall 13.00 m
Height of stacks:	60 / 65 m

Operating data

Workdays per week:	5
Employees:	12
Number of shifts:	2

Exhaust gas purification via LARA®

Dedusting of the box hall

Dedusting of the machinery hall

Technology

The Herhof Stabilat® technology is a mechanical-biological waste treatment (MBT) process with the target of creating a high quality fuel (trade name: Stabilat®) plus a high recycling rate. By means of a computerized biodrying process plus a subsequent fully automatic separation system the MSW is completely split into:

- Stabilat® fuel fraction for industrial use (e.g. energy production),
- minerals e.g. for use in road construction,
- metals and batteries (reduces concentration of heavy metals up to 95%),
- process water is cleaned and reused as cooling water,
- exhaust air treatment according to 30. BImSchV.

Climate protection

The use of Stabilat® replaces fossil fuels like coal, petroleum and natural gas. Because of its high organic components Stabilat® releases less than up to 80 % CO_2 as usual fuels.

Operator

Helector Recyclingcenter Osnabrueck GmbH

Fuerstenauer Weg 73
D-49090 Osnabrueck, Germany

Phone: +49 (0) 5 41/34 9 79 - 0
Fax: +49 (0) 5 41/34 9 79-49

Mail address:
Kalkgraben 2 · D-35606 Solms

Responsible authority

Entsorgungsgesellschaft Stadt und Landkreis Osnabrueck GbR

P.O. Box 11 24
D-49109 Georgsmarienhuette, Germany

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Fax: +49 (0) 54 01/36 55 - 33

Reference facilities

The Herhof technologies have been successful for several decades and were used worldwide in more than 40 composting, more than 10 Stabilat® and more than 5 biogas facilities. Each one of these facilities works reliably, efficiently and economically. Below you can find some reference facilities.


1


2


3


4


5


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9


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11


12

Location	*Capacity*	*Start of operation*	*Contractor*
1. Osnabrueck, Germany	105,000 t/a	February 2006	Entsorgungssgesellschaft Stadt und Landkreis Osnabrueck
2. Niederlehme (Berlin) Germany	135,000 t/a	June 2006	ZAB Zweckverband Abfallwirtschaft Nuthe-Spree
3. Trier, Germany	220,000 t/a	June 2007	Zweckverband Regionale Abfallwirtschaft Trier
4. Larnaca (Cyprus), Greece	210,000 t/a	April 2010	Ministry of Interior of the Republic of Cyprus
5. Kassel-Lohfelden, Germany	30,000 t/a	November 2011 Expansion in 2015	Abfallentsorgung Kreis Kassel
6. Uelzen, Germany	18,000 t/a	November 2011 Expansion in 2015	Landkreis Uelzen Abfallwirtschaftsbetrieb
7. Dörpen, Germany	14,000 t/a	September 2012	Abfallwirtschaftsbetrieb Landkreis Emsland
8. Heppenheim, Germany	31,000 t/a	July 2014	Zweckverband Abfallwirtschaft Kreis Bergstraße
9. Mariscina (Rijeka), Croatia	100,000 t/a	August 2015	Ministarstvo zaštite okoliša i prirode, Ulica Republike, Zagreb
10. Kastijun (Pula), Croatia	90,000 t/a	October 2015	Ministarstvo zaštite okoliša i prirode, Ulica Republike, Zagreb
11. Sofia, Bulgaria	400,000 t/a	September 2015	City Sofia
12. Timisoara, Romania	23,000 t/a	approval planning	RETIM Ecologic Service S.A.