

# Biogas From Waste Material

## Experiences From a Biogas Plant Operator

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Experiences in operating a biogas plant

## Introduction

- BioPower Bernau GmbH & Co. KG in Bavaria/Germany
- Biogas plant is running since the year 2000
- Treating 6000t/a food and kitchen waste
- Cogeneration unit with 250kW electrical power
- Reduces the emission of 700t/a CO<sub>2</sub>



## Introduction

Operating this plant is innovative concerning several aspects:

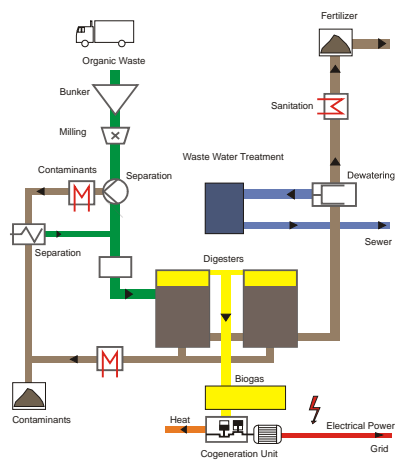
- The waste collecting system
- The separation of contaminants
- The sludge treatment after digesting



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## Flow Chart



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## The waste collecting system

The Common way is changing the waste bins cyclical



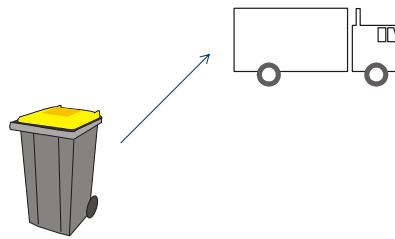
Labor



Logistic



Energy



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## The waste collecting system

Transporting only the waste



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## The separation of contaminants

### The Input Material



Contaminants like bones, package, dishes, cutlery etc.

leads to damages for the equipment.



## The separation of contaminants

### Damages

Pump wrapped in plastic foil and



blocked by a spoon.



## The separation of contaminants

### Damages

Broken Agitators



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## The separation of contaminants

### Damages

Destroyed Rotary Lobe after pumping organic waste for about 10 hours.



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## The separation of contaminants

### Strategy in treating contaminants

1. Protecting the process from incoming material.
2. Getting the contaminant out of the digesters.

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## The separation of contaminants

### Protecting the process from incoming material

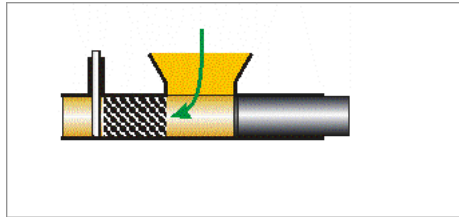
Contaminants, coming in with the waste, are separated using a modified piston pump.



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## The separation of contaminants

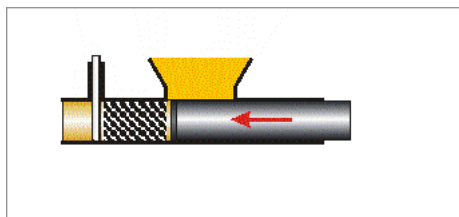


Filling with conditioned waste

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## The separation of contaminants

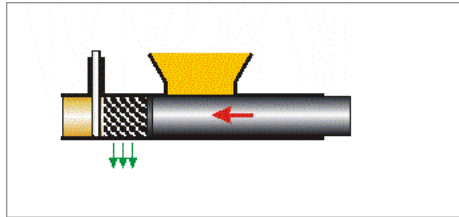


Closing the pressing zone

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## The separation of contaminants

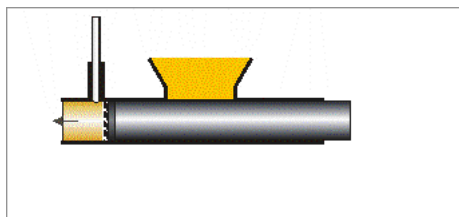


Pressing the pasty organic fraction through the filter

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## The separation of contaminants



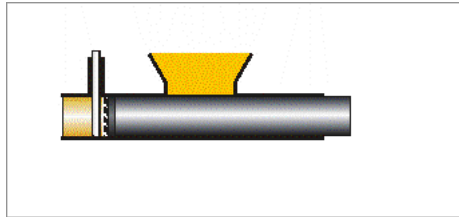
Pumping the remaining particles

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## The separation of contaminants

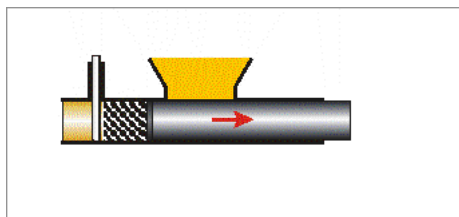


Closing the gate

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## The separation of contaminants

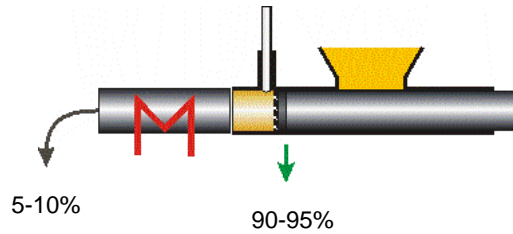


Returning the piston for the next cycle

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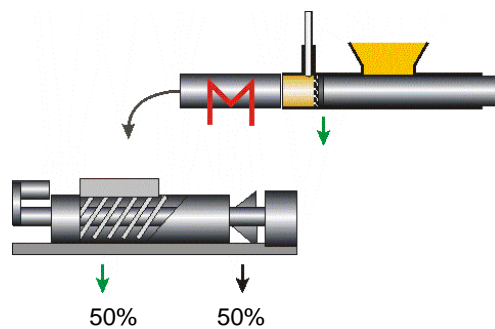


## The separation of contaminants



The contaminants, which are about 5 to 10 % of the waste, remain in a pipe and are heated up and hold at 70°C for one hour.

## The separation of contaminants



The Material is pressed and dewatered a second time by a screw press, reducing the weight by 50% again.

## The separation of contaminants

After these two separations the remaining liquid to pasty material which goes to the fermentation process holds less than 1% of contaminant.

Mostly composed of small particles from packing foil, eggshell, broken glass and other material, small enough to pass the screens.

To keep the digesters from silting with these sediments or plugging with the floating material there are also two units build in.

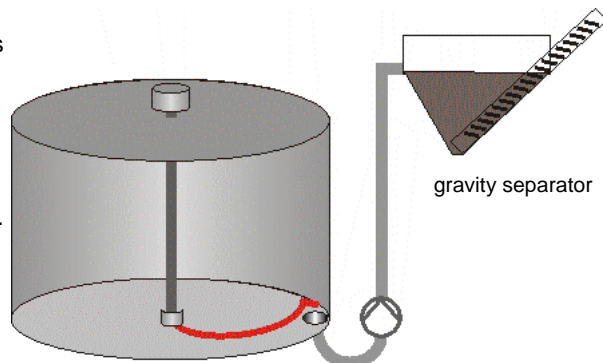
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## The separation of contaminants

Getting the contaminant out of the digesters.

A special wiper is pushing the sediment into a suction pump, which brings the material to a gravity separator. There the sediment is carried out by a screw conveyor.



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## The separation of contaminants

Getting the contaminant out of the digesters.



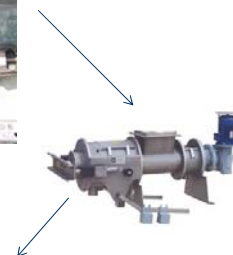
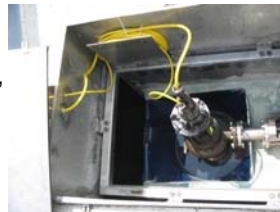
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## The separation of contaminants

Getting the contaminant out of the digesters.

The floating material is pumped into a screw press, which is dewatering the foil and fiber swimming on the surface of the sludge. The Pump has to get just the upper layer of the surface and may not let the gas out of the tank. Therefore it has a self regulating discharge system.



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## The sludge treatment after digesting

The food and kitchen waste brings a lot of protein and fat into the biogas process. This leads to a high amount of nitrogen and carbon in the sludge. A lot of carbon is carried out by the biogas, the nitrogen stays in the sludge.

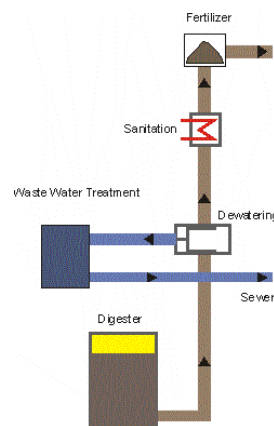
Since nitrogen compounds are good fertilizers they are wanted by the agriculture.

In Germany there is a law against over-fertilization of the agricultural soil. Therefore the farmers have to account the fertilizers brought on their land. This is the reason why we have to reduce the nitrogen in our process.



## The sludge treatment after digesting

The remaining sludge out of the digesters gets dewatered. The liquid phase, which holds a very high amount of nitrogen, is cleaned in an aerobic waste water treatment plant (sequential batch reactor system). The solid phase is a good compost fertilizer for agricultural purposes.



## The sludge treatment after digesting

The two Sequential Batch Reactors of the water treatment are build very compact. They consist of two concrete tanks, 70 m<sup>3</sup> each. Together they are able to treat the waste water equal to a municipal facility for about 800 residents.

The water getting into the treatment has a COD (Chemical oxygen demand) of about 12000 mg/l. In the outlet the COD of the water is reduced to about 4000 to 7000 mg/l. With this quality it may be lead into the sewer.



Waste water treatment



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## Conclusion

It is possible to run the AD continuous over several years.

Main problems we had to solve were caused by the contaminants

Processing the material used in this plant is not possible without a good strategy to handle the contaminants. Future owners and operators of biogas plants should direct their attention on these facts.



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Thank you for your attention

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