

# **INTECUS GmbH**

Waste Management and Environment-Integrating Management



## **Cleaner Production in Food Industry – Cleaner Production potentials related to waste and raw materials**

Durango, March 10th, 2011

## **Agenda**

1. Segregation of outputs
2. Reduced bottling losses and improved cleaning
3. Improvement of pipeline cleaning
4. Process optimization by improvement of oil output and reduction of hexane losses
5. Energy-saving air-conditioning of smokehouse by use of ambient air
6. Optimization of the waste management system
7. Generation and utilization of biogas

# 1. Segregation of outputs, to optimize use, re-use, recovery, recycling and disposal (and minimize water use and waste water contamination) in dairies

- disposal of solid waste by water pathway is very common, but causes to high loads of pollutants in the waste water stream

Waste water quality of a Mexican dairy without solid waste segregation

Parameter	International benchmarks	Case study concentrations
COD	500-4,500 mg O <sub>2</sub> /l	16,080-21,880 mg O <sub>2</sub> /l
BOD <sub>5</sub>	450-4,790 mg O <sub>2</sub> /l	10,284 mg O <sub>2</sub> /l
Fat	20-500 mg/l	1,384 mg/l
N <sub>total</sub>	30-50 mg/l	182-335 mg/l
P <sub>total</sub>	10-100 mg/l	227 mg/l
Settable solids	1-2 ml/l	1.2 ml/l

- high extra charges for waste water treatment
- unnecessary treatment efforts and high risk of water pollution

## 1. Segregation of outputs, to optimize use, re-use, recovery, recycling and disposal (and minimize water use and waste water contamination) in dairies

- mechanical segregation by the use of splash protectors, screens, flaps, drip trays and troughs, fitted at processing, filling/packing and transfer lines and next to workstations, such as peeling, cutting and trimming benches



## **1. Segregation of outputs, to optimize use, re-use, recovery, recycling and disposal (and minimize water use and waste water contamination) in dairies**

- organizational measures to collect and transport dry materials, e.g. bones and fat from deboning and trimming meat
- removal of sorted, untreated or partly treated fruit and vegetable residues, peel and cutting residues and collecting spent earth in sedimentation and filtration steps instead of washing it into the waste water stream
- in vegetable oil refining, dust produced during drying of desolventised meal can be added back to the meal

## **1. Segregation of outputs, to optimize use, re-use, recovery, recycling and disposal (and minimize water use and waste water contamination) in dairies**

- in dairy industry, examples of materials which can be collected separately for optimal use or disposal include:
  - drainings of yoghurt and fruit throughout the dairy
  - first rinses of buttermilk and residual fat in butter churning operations, for use in other processes, e.g. for low fat spreads
  - whey, e.g. for making whey powder
  - curd for the use as animal feed
  
- recovery of water diluted materials, e.g. potato starch can be recovered from starch water, whey can be extracted from whey/water mixtures

## 2. Reduced bottling losses and improved cleaning

### Private Brewery Strate Detmold GmbH & Co. KG

- identified potentials after CP-check:
  - cleaning of bottling plant by change of beer type
  - bottling losses
  - optimization of keg cleaning plant



- Measures:

Measure	Investment	Material savings	Cost savings
Cleaning of bottling pipelines with CO <sub>2</sub> instead of water	6,000 EUR	1,100 hl of beer	60,000 EUR/year
Renewing of control system of keg cleaning plant	12,000 EUR	4,200 m <sup>3</sup> fresh water	9,500 EUR/year
Renewing of bottle cleaning system	1,100 EUR	5,000 m <sup>3</sup> water	6,600 EUR/year



### 3. Improvement of pipeline cleaning

#### Schröder Ice Cream GmbH

- identified potentials after CP-check:
  - pipelines must be rinsed with water in case of product change
  - this occur to product losses
  
- Measures:
  - improvement of rinsing system
  - use turbidity sensors
  
- Results:
  - minimization of product losses into the waste water
  - investment of 20,000 EUR/year
  - savings of 80,000 EUR/year



## 4. Process optimization by improvement of oil output and reduction of hexane losses

### Brökelmann & Co. Oil mills GmbH & Co.

- identified potentials after CP-check:
  - impurities causes to production breaks and lowers the oil output
  - an effective separation of the impurities was not possible
  
- Measures:

Measure	Investment	Material savings	Cost savings
Installation of a new sieving device	200,000 EUR	378 tons oil/year	230,000 EUR/year
Improvement of cooling-system and toaster-plant	100,000 EUR	77 tons hexane/year	54,000 EUR/year



## 5. Energy-saving air-conditioning of smokehouse by use of ambient air

### August Strothlücke GmbH & Co. KG

- identified potentials after CP-check:
  - low energy efficiency of the smokehouse of a meat processing company because of condensation of remaining air moisture
  
- Measures:

Measure	Investment	Material savings	Cost savings
Improvement of cooling system of the smokehouse	15,000 EUR	24,000 ltr. heating oil/year 3,654 m <sup>3</sup> water/year	70,000 EUR/year



## 6. Optimization of the waste management system

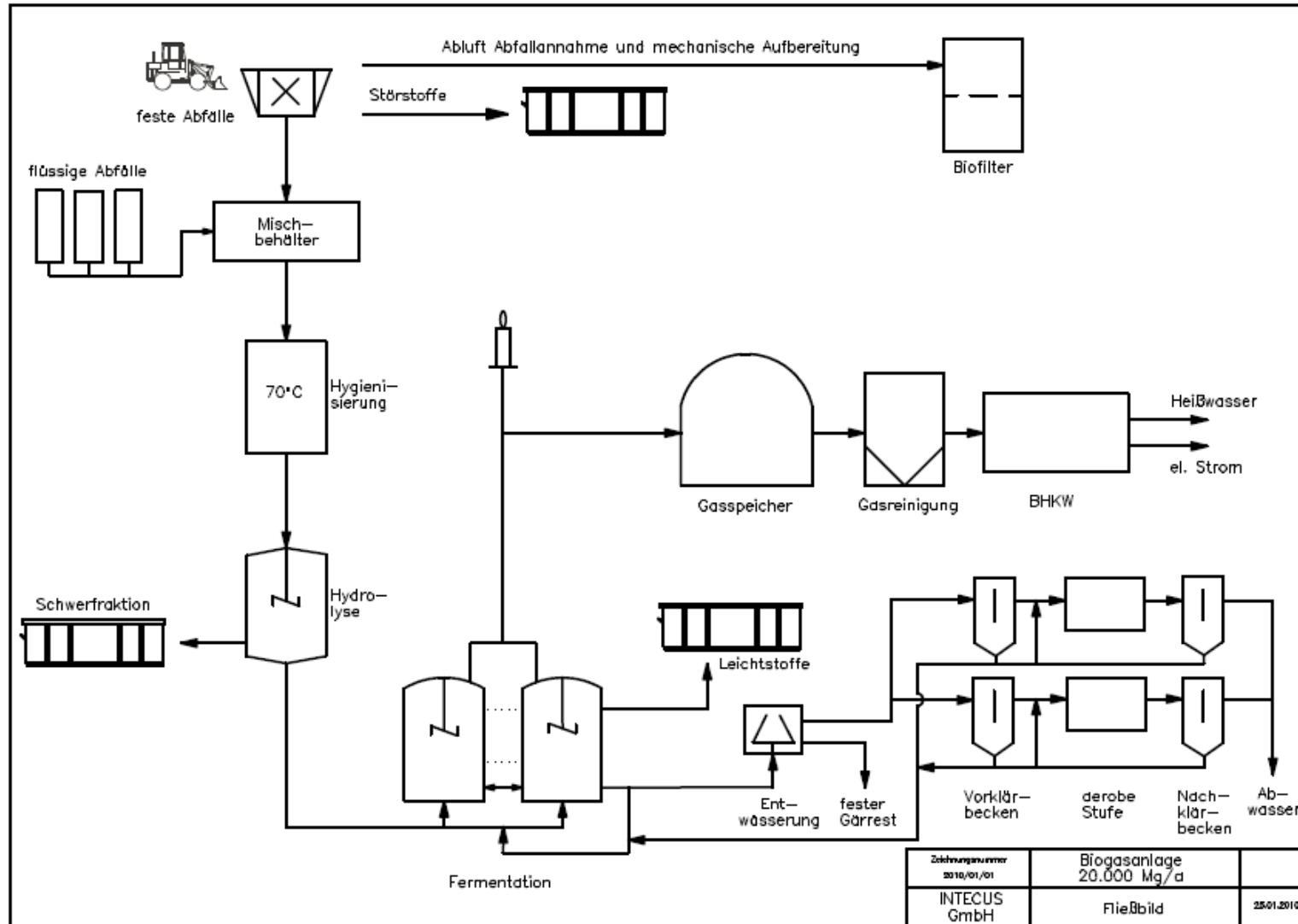
### Superweck Sandwich Vertrieb

- identified potentials after CP-check:
  - high costs for the disposal of packaging material
  - no separate collection of recyclables
  
- Measures:

Measure	Investment	Cost savings
Separate collection of packaging material and residual waste	0 EUR	<b>1,800 EUR/year</b>
Use of a press for foils and paper and cardboard	0 EUR	
Use of a 5.5 m <sup>3</sup> -container for residual waste	0 EUR	
Sale of vegetable waste to poultry farmers	0 EUR	



## 7. Generation and utilization of biogas



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- digestion of food residues mainly needs co-digestion of other substrates to ensure the optimal pH and to adjust the right share of nutrients
- for products with high amounts of fatty acids a two-stage process is recommended in order to decouple the hydrolysis from the digestion



## 7. Generation and utilization of biogas

- reception hall



## 7. Generation and utilization of biogas

- Planning parameters:
  - input: 20.000 ton/year (33,3 % dairy residues, 66,7 % sewage sludge)
  - dry mass content: 10 %
  - organic dry mass: 85 %
  - hydraulic residence time in the methane digester: 30 days
  - 2 digesters á 850 m<sup>3</sup>; plus hydrolysis reactor á 200 m<sup>3</sup>
  - degradation rate: 70 % of organic dry mass
  - gas quantity: approx. 0.5 m<sup>3</sup>/kg input organic content of dry mass;  
2.300 m<sup>3</sup> gas/day maximum → 1,500 m<sup>3</sup> gas/day normally,  
with 2.0 kWh/m<sup>3</sup>  
→ 1.1 GWh/year electric energy production (thermal energy at the same level)  
(8,000 m<sup>3</sup>/day biogas generation is possible with energy-rich input material)
  - methane content: 55%
  - sulphur content: approx. 3,000 ppm
  - space requirements: 6,000-8,000 m<sup>2</sup>

## 7. Generation and utilization of biogas

- Shares of investment costs:
- investment costs 7-8 million EURO

<b>Investment positions</b>	<b>Share in total costs</b>
Mechanical processing incl. hygienization part	<b>16%</b>
Fermentation part	<b>27%</b>
Waste water treatment part	<b>6%</b>
Exhaust air treatment part	<b>11%</b>
Power supply and control part	<b>6%</b>
Buildings and surround facilities	<b>26%</b>
Planning costs incl. fees	<b>7%</b>
<b>Total</b>	<b>100%</b>

## 7. Generation and utilization of biogas

- Shares of operational costs:

<b>Cost positions operating costs</b>	<b>Share in total operating costs</b>
Depreciation (8 yrs. for equipment, 20 yrs. for buildings)	<b>44%</b>
interest (5,5% p.a.)	<b>11%</b>
maintenance (3,5% of invest equipment/building p.a.)	<b>15%</b>
insurances (0,5% of invest equipment/building p.a.)	<b>2%</b>
personnel	<b>8%</b>
power supply	<b>10%</b>
other utilities/auxiliary means (EUR 7.50/Mg input)	<b>10%</b>
<b>Total</b>	<b>100%</b>

- mass specific operating costs can be estimated to be in the range of 65-95 EURO/ton (average 80 EURO/ton input)
- not included in this estimate are the following positions:
  - possible proceeds coming from the sale of surplus generated power
  - water treatment costs
  - disposal costs for digestion residues.

## 7. Generation and utilization of biogas

- Conclusions:
  - biogas generation of food waste is possible, but it needs normally a 2-stage-digestion process
  - is more suitable with energy-rich material
  - co-generation is necessary for food waste
  - financial support (CDM, renewable energy support) is advantageous to reduce costs

**Muchas gracias por su atención!**

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