Case Study - Biogas Plant for the Treatment of Fecal Sludge and Straw In NanJing

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Company Profile

Chengdu DeTong is a Chinese engineering company consisting of senior experts from China and BEB BioEnergy Berlin in Germany. DeTong specializes in biogas technologies, biomass energy, and environmental protection. We provide profitable solutions for our clients worldwide. DeTong has also passed the authentication of ISO9001.

DeTong has close contact with some international organizations including UNIDO, ADB, BBK, CIM, and also been maintaining long-term cooperation with CIB and BIOMA. DeTong has introduced several advanced German biogas process and technologies from BEB Germany.
Outline

- Project Background
- Process Flow Chart
- Construction Content
- Highlights
Project Background

Nanjing University of Technology (NUT) covers an area of 200 hectares, approx. 30,000 students and teaching and administrative staff living there. CO₂ generated from the natural degradation of waste will reach 14.3 kiloton/Y.

Classification of waste from NUT

<table>
<thead>
<tr>
<th>Type</th>
<th>Output (kiloton/Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washing water</td>
<td>900</td>
</tr>
<tr>
<td>Fecal sewage</td>
<td>270</td>
</tr>
<tr>
<td>Kitchen swill and residue</td>
<td>1.5</td>
</tr>
<tr>
<td>Sewage from Cooking</td>
<td>98</td>
</tr>
<tr>
<td>Other sewage</td>
<td>592</td>
</tr>
<tr>
<td>Garden waste</td>
<td>0.6</td>
</tr>
<tr>
<td>Solid waste</td>
<td>16</td>
</tr>
<tr>
<td>Total sewage</td>
<td>1860</td>
</tr>
<tr>
<td>Total solid waste</td>
<td>34.8</td>
</tr>
</tbody>
</table>
### Main Parameter for Biogas project

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily straw treatment (TS=87%)</td>
<td>0.8T</td>
</tr>
<tr>
<td>Corn straw TS biogas production rate</td>
<td>0.4m³/kgTS.d</td>
</tr>
<tr>
<td>Daily biogas output (corn straw)</td>
<td>278m³</td>
</tr>
<tr>
<td>Daily fecal sludge treatment (TS=2%)</td>
<td>8m³</td>
</tr>
<tr>
<td>TS of the fecal sludge</td>
<td>0.16m³</td>
</tr>
<tr>
<td>Fecal sludge TS biogas production rate</td>
<td>0.3m³/kgTS.d</td>
</tr>
<tr>
<td>Daily biogas output (fecal sludge)</td>
<td>48m³</td>
</tr>
<tr>
<td>Biogas output per day</td>
<td>326m³</td>
</tr>
<tr>
<td>Daily feed in material</td>
<td>8.8m³</td>
</tr>
<tr>
<td>TS of feed in material</td>
<td>9.7%</td>
</tr>
<tr>
<td>Effective volume of the digester</td>
<td>300m³</td>
</tr>
<tr>
<td>Hydraulic retention time</td>
<td>34d</td>
</tr>
<tr>
<td>Temperature for fermentation</td>
<td>39°C</td>
</tr>
<tr>
<td>TS of fermentation</td>
<td>8%</td>
</tr>
<tr>
<td>Separation rate of biogas residue (solid)</td>
<td>35%</td>
</tr>
<tr>
<td>Daily separation volume of biogas residue (TS=30%-35%)</td>
<td>0.55T</td>
</tr>
<tr>
<td>Daily biogas slurry discharge</td>
<td>8.2m³</td>
</tr>
<tr>
<td>TS content in Biogas slurry</td>
<td>3.7%</td>
</tr>
</tbody>
</table>
Construction Content

Raw material collection
Fecal sludge collection

The truck suck the fecal sludge from the buffer tank directly; on the buffer tank, there would be equipped with filter sieve, which will get rid of foreign object; finally, after filtering, the fecal sludge will flow into the adjusting tank.
Construction Content

MPZ 200 Grinding Miller

1. The reliable and Cost-effective MPZ 200 Grinding Miller overcome the disadvantage of traditional miller, such as high cost, big structure;

2. The MPZ 200 Grinding Miller relys on heavy hammer to crash the feed in material into tiny particle for better fermentation (for higher biogas generation) and fluent
Construction Content

Feed in system
Seepex BN35-6LS

1. High Transmission capacity: Max TS content 12%, which supply the option to feed in Straw, as well as the guarantee for the continuous feed in as planned.

2. Overflow biogas slurry from CSTR digester backflow for mixing with straw again (bring the certain bacteria back to feed in material)
Construction Content

Landia Gas-Liquid Mixing

1. Increase methane concentration due to enhanced cell break down and gas recirculation
2. No Rotating equipment inside tank
3. Unique 3-dimensional mixing pattern reduce formation of surface scum
4. No need of opening tank cover or entering into tank for maintenance
5. Reduce capital cost, no access walkway required as for top or side entry mixer
Construction Content

CSTR Digester and Double Membrane Gas Holder
(Continuous Stirred-Tank Reactor)

1. CSTR Digester was made of MS (mild steel), with the skilled welding, which provide the proof for high quality.
2. Isolation layer of digester create the ideal situation for fermentation
3. anti-UV of external membrane could provide the effective protection against the low pressure, snow etc.
Construction Content

Automatic control system

1. Not only display the Real-time status, but also turn on/off boiler as per the temperature change; start/stop the mixing system as per the feed in material period;

2. unattended operation, data logging, data analysis, audible and visual alarm etc.
Construction Content

Auxiliary facilities

Dewater
Desulphurization tower

Boiler

Lightning Arrester

Torch
Through the PSA (pressure swing adsorption) technology, the methane contents has been increased (more than 97%); which live up to the standard of vehicle fuel.
Highlights

Post-processing system for biogas residue/slurry

CSTR Digester

Biogas residue separator

Biogas slurry

Pre-treatment

Multi-functional organic fertilizer

Concentration system

Concentrated liquor

Liquid fertilizer/biopesticide

Water

Organic Fertilizer

Quick start nitrogen retaining fermentation technology

CO₂, NH₃, H₂O, O₂

FSM3
Highlights

Post-processing system for biogas residue/slurry

CSTR Digester → Separator → Biogas slurry → Pre-treatment → UF Membrane Treatment → NF Concentration system → Water → Concentrated liquor → Leaf fertilizer
谢谢 Thank you

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