Biogas Technology

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DEWATS Technology

BORDA—ZUT Project Office
Ensuring access to vital resources | fostering an intact environment
Biogas Technology Application in Zhejiang Province

沼气技术在浙江省的应用

• Brief information of Zhejiang Province
  浙江省简介

• Biogas technology
  沼气技术
Brief information of Zhejiang Province

- 46 million population (4千6百万人口)
- 100,000 square kilometers (10万平方公里)
- Semitropical climate (亚热带气候)
- Fast but unbalanced economic development (经济发展迅速但发展不平衡)
Biogas technology

- Household biogas digesters (户用沼气池)
- Medium sized biogas plant (中型沼气工程)
- Large biogas plant with modern technology (大型沼气工程)
Household biogas digesters

Till the end of 2003,

- There are 85,652 household biogas digesters
  户用沼气池共有85652户
- The total biogas yield is around 17.7 million m³ per year, e.g. 313 m³ per family in average.
  每年沼气总产量为1.77亿立方米，平均户产沼气量313立方米
Household biogas digesters

- **Technology:**
  fully mixed water pressure digester with semi-automatic discharging function

- **Structure:**
  Underground concrete drum shape
Promote agriculture

Promote forest

Improve ecological Environment

Promote hygiene and sanitation conditions

Animal husbandry

Biogas technologies

People’s living
Application and Development Tendency

This technology is appropriate for individual farmer families with small scale husbandry, e.g. to raise 3~5 pigs.

The farmers with small scale husbandry are mainly in the mountainous and semi-mountainous areas in middle, western and southern parts of Zhejiang Province, in which the local economy is less developed.
In the northern plains and eastern coastal area in Zhejiang Province, the intensive animal livestock farms in medium and large scale tend to be main type of the husbandry. In these areas, the household biogas digesters become less dominated in the biogas technology development.

在浙北平原和东部沿海地区，大中型集约化养殖场是养殖业的主要形式，户用沼气技术应用逐渐减少。
The household biogas digester plays an important role for income generation in the less developed rural area, due to the following function:

户用沼气池给农民带来了实惠，主要有以下原因:

- Saving the expenditure in fuel, or, saving the labor for fuel wood collection
  节省了燃料费用和打柴的劳动力
- Saving the expenses on chemical fertilizer
  节省了化肥费用
- Increasing the agricultural yield
  增加了农业产量
- Improve the quality of products
  提高了农产品质量
Large and Medium Sized Biogas Plants

• General description

• Technologies applied in the large and medium sized biogas plants
• There are 114 biogas plants, each volume is larger than 100 m³
  容积超过100立方米的沼气工程有114座
• The total volume is 37808 m³
  总容积是37808立方米
Technologies applied

- Fully mixed anaerobic digestion
  全混合厌氧发酵

- UASB+UASB 二级上流式厌氧污泥床

- UASB+SBR
  上流式厌氧污泥床+连续性间歇式反应器
Applicable condition for medium sized biogas plant

- In the animal livestock farms with less than 5000 pigs, the appropriate technology is the fully mixed anaerobic digestion and the relevant structure could be underground concrete cylinder type or underground concrete tunnel type.

中型沼气工程的应用条件

少于5000头猪的养殖场，应采用全混合厌氧消化技术和相应的地下水泥圆筒式或地下混凝土隧道式消化池。
Applicable condition for Medium sized biogas plant

中型沼气工程的应用条件

• The reactors volume is less than 500 m\(^3\)
  反应器容积小于500立方米
• The integrated utilization of the biogas resources could be realized for supplying fuel gas for households and/or production, providing fertilizer and so on.
  提供户用燃料和肥料等沼气综合利用得以实现
• Since all residues discharged from the plant are used, there is no request to satisfy the environmental standard for the waste water discharging.
  由于所有的残余物得到应用，对环境没有负面影响
Applicable condition for Medium sized biogas plant
中型沼气工程的应用条件

• Since all residues discharged from the plant are used, there is no request to satisfy the environmental standard for the waste water discharging.
由于所有的残余物得到应用，对环境没有负面影响
Example 1

biogas plant built in
Xinxin livestock farm in Jiaxin

嘉兴欣欣养殖场的沼气工程
Brief introduction

• Built in 2002 建于2002年
• Technology: fully mixed anaerobic digestion 技术：全混合厌氧发酵
• Volume: 300 m³ 容积：300立方米
• Total investment: 420,000 yuan RMB 总投资：42万元
• Annual treatment capacity : 15000 tons 每年处理废水能力：15000吨
• Annual biogas yield: >20000 m³ 每年产沼气大于20000立方米
Resources utilization

- Biogas for fueling the boiler for steam generation
- Sludge and slurry for fertilizing the rice land and vegetable growing
- Transferring the waste into energy and other useful resources.
Example 2

biogas plant built in Sanlian Farm in Haining

海宁市三连农场的沼气工程
• Built in 2002 建于2002年
• Fully mixed anaerobic digestion 技术：全混合厌氧发酵
• Volume: 350 m³ 容积：300立方米
• Annual treatment capacity: 18000 tons 每年处理废水能力：18000吨
• Total investment: 250,000 yuan RMB 总投资：25万元
• Daily biogas production: 66 m³ 每天产沼气大于66立方米
• Biogas used as fuel for farmer households
沼气用于农户的燃料
• Sludge and slurry used for fertilizing and irrigating 27 hectares of mulberry trees.
沼渣和沼液用于27公顷的桑园灌溉和施肥料
• Creating a chain of “husbandry-biogas plant-mulberry trees”
建立了“畜牧业－沼气工程－桑树”的生态链
Applicable condition for large biogas plant

- In the animal livestock farms which have over 5000 pigs, the appropriate technologies are UASB, UASB+SBR and the main structure could be ground cylinder tanks made of concrete or steel.
- The reactors’ volume is > 500 m³
- In some cases there is no environmental request due to full use residues discharged from plant.
- In other cases, there are discharging standard for the treated effluence (second grade of National standard).
Example 1
Large plant built in Fujingda Agriculture Co. in Shaoxing
绍兴市福佳达农业有限公司的大型沼气工程
• Built in 2000 建于2000年
• Technology: fully mixed anaerobic digestion in medium temperature 技术：全混合中厌氧发酵
• Total investment: 1.32 million yuan RMB 总投资：132万元
• Volume: 600m³ 容积：600立方米
• Daily treatment capacity: 150 tons/day 每天处理能力为150吨
• Biogas generated is supplied to 340 farmer families for their daily fuel consumption.
沼气可以满足340户农户的日常燃料消耗

• The sledge and slurry are discharged for irrigating and fertilizing over 50 hectares tea garden and 32 hectares of rice land.
沼渣和沼液用于50公顷茶园和32公顷稻田灌溉和肥料

• Eliminating the pollutant source, promoting the agricultural production, saving the cost for fertilizer etc.
减少了污染源，提高了农产品产量和质量，节省了肥料的费用。
Example 2
Large plant built in Zhengxin Husbandry Co. in Hangzhou
杭州市正信畜牧养殖有限公司的大型沼气工程项目
Brief introduction

• Built in 2003 建于2003年
• Technology: UASB in two stages 技术：两级UASB
• Volume: 600m³ 容积：600立方米
• Total investment : 1.90 million yuan RMB 总投资：190万元
• Daily treatment capacity: 150 tons/day 每天处理能力为150吨
• Daily biogas yield: 180 m³ 每天产沼气180立方米
- The biogas supplied for the canteen in the farm and the farmer households nearby 沼气供给农场餐厅和附近农户作为燃料
- The sledge and slurry are used for irrigating and fertilizing the fruit trees, bamboo and vegetable fields 沼渣和沼液用于果树，竹园和蔬菜的灌溉和肥料
- No pollutant discharged to the environment. 对环境没有污染
Example 3
Large plant built in
Xizi Animal Livestock Farm
西子畜牧养殖场的大型沼气工程
Brief introduction

- Built in 1997  
- Technology: UASB+SBR  
- Volume: 500m³  
- Total investment: 1.30 million yuan RMB  
- Daily treatment capacity: 100 tons/day  
- Daily biogas yield: 500 m³
Resource utilization

- The biogas supplied for the canteen in the farm and for the power generation
- Through UASB and SBR treatment, the effluent is discharged to an aerobic pond. From the outlet of the aerobic pond, the treated effluent satisfies with the second grade of National Standard.
DEWATS

Decentralised wastewater treatment systems
- Over 200 systems operating in India, Indonesia and China
DEWATS

Planning, designing and construction of decentralised wastewater treatment systems.

Support of micro-, small- and medium-sized enterprises, public institutions
25 Years Biogas

- 1977: 1st Biogas projects in Maharashtra/India
  - 在印度开展沼气项目
- 1978: Biogas Technology Transfer India-Ethiopia
  - 沼气技术从印度转让到埃塞俄比亚
- 1979: 1st International Biogas Conference in Bremen, Germany with Chinese participation
  - 第一届国际沼气技术在德国不莱梅召开，中国派员参加
- 1980-1993: Intensive supra-regional Biogas dissemination
  - 跨地区的沼气技术深入推广
- 1994-1998 DEWATS research project in India and China
  - 在印度和中国开展分散式废水处理系统项目
- 1999-2004 DEWATS and CBS in Indonesia and Vietnam
  - 在印度尼西亚和越南开展分散式废水处理系统与社区公共卫生系统项目
DEWATS
Decentralised Wastewater Treatment in Developing Countries

BORDA

Pedras Plantas de Tratamiento de Aguas Residuales Domesticas (Aplicadas en Pisos Andinos)

Possibilities of Increasing Biogas Production by using Different Mixtures of Animal Wastes

Decentralised Wastewater Treatment Systems (DEWATS)

The Readers Survey

Evaluation of Nitrification Potential of Selected Industrial Organic Effluents in India

Biogas Users Survey 1998/99 in Nepal

Remarks on Control Parameters for Decentralised Wastewater Treatment Plants (DEWATS)

Community Value the Engineer

including Wastewater

Biogas Pressure Regulator
Sedimentation pond

Septic tank

Anaerobic digestion

Anaerobic filter

Anaerobic baffled reactor

Planted gravel filter

Aerobic and facultative decomposition

Aerobic-facultative ponds and aerobic polishing ponds

Post treatment
Technical Characteristics

- for organic wastewater from domestic and industrial sources
- for daily wastewater flows of 1 - 1000 m³
- reliable, long lasting and tolerant towards inflow fluctuation
- *dewats* work without conventional energy when sufficient inclination is available - thus, is power-independent
Application

- Settlements
- Hospitals
- Hotels
- Community sanitation units
- Agriculture and husbandry
Sino-German Technical Academy
Shanghai, China
case studies

Sino-German Technical Academy
Shanghai, China
Initial problem identification

- 6 500 students & staff
- Offices and workshops
- Environmental standard GB/T 18921-2002 (2nd stage)
- Limited capital for investment
- Limited technical capacity
- Space only at the outskirts of the premises
- Little inclination
Sino-German Technical Academy
Shanghai, China

- Underground System: sedimentation, anaerobic digester & filter, horizontal sandfilter, irrigation tank, 766m³ for 138 m³ ww/day

- Total construction cost: ¥ 740 000.-

- *dewats* maintenance training for technical staff of the institution

- 1 year guarantee
Construction of Infrastructure 
underground settler, anaerobic treatment
Sino-German Technical Academy
Shanghai, China

Spherical Digester under construction
New University Campus
Wenzhou, China

Decentralised Wastewater Treatment Systems
New University Campus Wenzhou, China

- Decentralised system
- Underground solutions
- Incremental approach: system grows stepwise with the buildings
- Individual primary, shared secondary treatment
- Discharge according to National Standard GB/T 18921-2002 (2nd stage)
New University Campus Wenzhou, China

- Underground System: sedimentation, anaerobic digester & filter, shared horizontal sandfilter, 950m³ for 186 m³ ww/day
- Total construction cost: ¥ 846 000.-
- dewats maintenance training for technical staff of the institution
- 1 year guarantee
New University Campus
Wenzhou, China

- Underground System: sedimentation, anaerobic digester & filter, shared horizontal sandfilter, 1100m³ for 215 m³ ww/day
- Total construction cost: ¥ 979 000.-
- **dewats** maintenance training for technical staff of the institution
- 1 year guarantee
Contact

Should you require more information...

... please do not hesitate to contact us:
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