Generating resources from wastewater through biotechnology

Environment Day

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Place: FIESP, São Paulo/SP
Author: Sérgio Cruz
Who is Paques?

- Founded in 1960
- Number of employees: 400
- Innovative biological solutions to purify wastewater and gas

Paques helps companies to:

- Meet safe water discharge requirements
- Reduce water consumption
- Produce green gas & upgrade biogas
- Recover valuable elements from used water

Brazil

The Netherlands

China
## Applications and Technologies

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Scope and Partners

- Process design
- Basic and detailed engineering
- Manufacturing
- Contracting
- Construction
- Research & Development
- Laboratory services
- Pilot testing
References

Worldwide leader in anaerobic treatment. More than 2,000 plants installed in more than 60 countries in the following industries:

- Pulp and Paper
- Beer and Beverages
- Food
- Distilleries
- Chemical industry
- Metal and Mining
- Oil and Gas
- Municipalities

Since 1984 in Brazil - more than 200 plants installed.

Ecological impact

- 10 million tons of organic pollution treated per year
- Enough biogas produced to supply 3 million households with energy
- Reduction of CO2 emissions by 25 million kg/day
Anaerobic wastewater treatment

COD $\rightarrow$ CH$_4$ + CO$_2$ + BIOMASS

Anaerobic methanogenic biomass
- Production of reusable methane (green energy)
- Low sludge production (& biomass is asset rather than waste)
- Granular biomass
BIOPAQ®IC anaerobic reactor

- High rate (20-30 kg COD/m³/d)
- Small footprint
- Low hydraulic retention time
- Self regulating system
- Intensely mixed biomass at bottom reactor
- Optimal sludge retention at top reactor
- 1,000 installed worldwide
Brasserie Kronenbourg
Beer
France
13 tpd COD
Cervejaria Petropolis
Breer
Brazil
15 tpd COD
Ambev Beer Brazil 17 tpd COD
Hansol Paper
Paper
Korea
42 tpd COD

revitalizing resources
Botian Sugar Yian QiQihaer
Food
China
200 tpd COD
THIOPAQ®: Biogas desulphurisation

Hydrogen sulphide is converted to hydrophilic sulphur
Spent caustic is biologically regenerated to ~90%
Why choose THIOPAQ®

- Deep $\text{H}_2\text{S}$ removal: below 25 ppm
- High uptime and reliable process: 98% uptime, no plugging
- No air or oxygen input in biogas
- Low total cost of ownership: 90% reduction on caustic consumption
- Sulfur production: fertilizer or fungicide

THIOPAQ® applications

- Industrial biogas
- Natural gas
- Refinery gas
- Landfill gas
- Associated gas
- Solids digester biogas
Weltec Biopower
Bioenergy
Germany
35 kpd S
1,800 Nm³/h
FERTIPAQ®: Sulfur back to nature as fertilizer

Currently, 20,000 tons of biosulfur per year are produced by THIOPAQ® installations worldwide.

- Color: white/yellowish
- Smell: none to neutral
- Density: 1.3 kg/liter
- S-content: 600 g/liter
- Easy dilution with water (Hydrophilic)
- Very fine particles 2 – 10 microns
- No blocking of sprays
- Long term nutrition effect in the soil
A brewery that produces 1 million liters/day of beer will also produce 3,000 Nm³/day of biogas.
CLOSING THE CYCLE: CONVERTING WASTEWATER INTO ENERGY AND FERTILIZER

A distillery that produces 1 million liters/day of ethanol can also produce 83,000 Nm³/day of biogas.
Under research: bioplastic from wastewater

- Poly-b-hydroxyalkanoate (PHA)
  - Common and widespread storage material in microorganisms
- Storage up to 90 wt% in granules
- Properties similar to petrochemical plastics
- Biodegradable
- Made from renewable resources

Van Loosdrecht & Kleerebezem
First results: bioplastic from chocolate!
UBOX®: How it all started...

Conventional domestic sewage treatment (WWTP Piracicamirim – Piracicaba/SP)
UBOX®: Making it simple

Settler

Aeration tank

Gas scrubber

UBOX® Reactor

UASB

Gas scrubber
UBOX®: All-in-one

1. DISTRIBUTION SYSTEM
2. 3-PHASE SEPARATOR
3. AERATION SYSTEM
4. SETTLER
5. GAS SCRUBBER

RAW SEWAGE

AIR

AERODIC

ANAOBIC

TREATED SEWAGE

BILOGAS WITHOUT H2S

Flare
UBOX® design
UBOX®: Footprint savings
UBOX®: Advantages

• **Low operational cost:**
  o 40% reduction on energy consumption
  o 60% reduction on sludge generation
  o No chemicals required
  o OPEX < R$ 0.20/m³ treated

• **Low environmental impact**
  o Zero odour emissions
  o Efficiency: BOD removal > 90%
  o Small footprint

• **High durability**
  o All reactor components built in PP, HDPE and stainless steel
## Brazil: Quick market analysis

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| Food, Beer and Beverages      | 123        | Very high | • Competition  
• Slow economy                                           | • Sustainability as marketing tool                                   |
| Distilleries                  | 2          | Low     | • Sector in financial difficulties  
• Energy abundant                                      | • Increase of energy cost  
• 2nd Generation Ethanol  
• Regulations on fertirrigation                           |
| Pulp and Paper                | 3          | Medium  | • Water abundant and cheap                                              | • Close water loop                                                   |
| Metal and Mining              | 0          | Low     | • Not familiar with biotechnology                                      | • Metal recovery  
• Zero gypsum generation                                      |
| Municipalities                | 9          | Very High | • Public tender process  
• No worries about OPEX                                           | • Concessions and PPPs                                               |
Thank you!
Obrigado!
Bedankt!

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