Anaerobic Treatment with BIOPAQ®

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1. Introduction Paques

2. Applications

3. BIOPAQ® Anaerobic technologies

4. References
Who is Paques?

- Privately owned company
- Founded in 1960
- Number of employees: ~350
- Business Units in Netherlands, China, Brazil, India, NA
- Worldwide presence through network of 20 partners
- Innovative biological applications for wastewater and gas
Paques’ Services

- Process design
- Engineering
- Manufacturing
- Contracting
- Construction

- Research & Development
- Laboratory services
- Pilot testing
- Consultancy
- After Sales Service
Lab Testing
Pilot testing
Revitalizing Resources

“Application of microorganisms from nature in our high rate reactors”
# Paques’ Technologies

<table>
<thead>
<tr>
<th>Know how area</th>
<th>Application</th>
<th>Products</th>
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</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>ANAEROBIC &amp; AEROBIC WASTE WATER TREATMENT</td>
<td>BIOPAQ®IC</td>
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<tr>
<td></td>
<td></td>
<td>BIOPAQ®UASB+</td>
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<td></td>
<td></td>
<td>BIOPAQ®AFR</td>
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<td>BIOPAQ®UBOX</td>
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<td></td>
<td></td>
<td>CIRCOX®</td>
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<tr>
<td>Sulphur</td>
<td>(BIOGAS) DESULPHURISATION</td>
<td>THIOPAQ®</td>
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<td>BIODESOX®</td>
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<tr>
<td>Nitrogen &amp; Phosphate</td>
<td>NITROGEN REMOVAL PHOSPHORUS RECOVERY</td>
<td>ANAMMOX®</td>
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<tr>
<td></td>
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<td>PHOSPAQ™</td>
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<td>ASTRASAND®</td>
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<tr>
<td>Metals &amp; Chemicals</td>
<td>METALS RECOVERY SULPHIDE PRODUCTION SULPHATE REDUCTION CHEMICALS RECOVERY</td>
<td>THIOTEQ™</td>
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<td>SULFATEQ™</td>
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<td>BIOMETEQ™</td>
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<td>IONPAQ™</td>
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<tr>
<td>Separation</td>
<td>BIOFILTRATION AND SOLIDS REMOVAL MEMBRANE FILTRATION</td>
<td>ASTRASAND®</td>
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<td>ASTRASEPARATOR®</td>
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</table>
more than 1,000 plants in more than 60 countries in the following sectors:

- Pulp and Paper
- Beer and Beverages
- Food
- Distilleries
- Chemical industry
References

But also other sectors:

• Municipalities (Sewage)
• Pharmaceutical industry
• Chemical industry (organic/inorganic)
• Metal and Mining
• Municipalities
Integrated Effluent Treatment Plant

- Conditioning tank
- IC Reactor
- Aeration
- Aeration basins
- Water storage tank
- Secondary clarifier
Combined Anaerobic-Aerobic Treatment
Recovery of Resources

Pure Water for cleaning

Biogas to Steam boiler or CHP

ADVANCED PURIFICATION (Membranes)

PRE-TREATMENT (Screening, Equalisation, Neutralisation)

BIOLOGICAL TREATMENT (Anaerobic/Aerobic)
Overview of anaerobic reactor systems

- Completely Stirred Tank Reactors
- Anaerobic Filters
- Sludge Bed Reactors
- Expanded Sludge Bed Reactors

BVF / Lagoon CSTR / Contact Process

UASB Hybrid

Fluidized bed Conventional EGSB IC
### Typical design parameters anaerobic reactors

<table>
<thead>
<tr>
<th></th>
<th>Volumetric Loading Rate(^1) (kg COD*/m³.d)</th>
<th>Average Reactor Volume(^2) (m³/ton COD)</th>
<th>Hydraulics Retention Time (h)</th>
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<tbody>
<tr>
<td>CSTR lagoon</td>
<td>0.1 – 1</td>
<td>1800</td>
<td>36 – 100</td>
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<tr>
<td>CSTR contact</td>
<td>1 – 5</td>
<td>333</td>
<td>24 – 72</td>
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<tr>
<td>process</td>
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<tr>
<td>UASB</td>
<td>5 – 15</td>
<td>100</td>
<td>4 – 36</td>
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<tr>
<td>EGSB</td>
<td>10 – 23</td>
<td>60</td>
<td>2 – 24</td>
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<tr>
<td>IC</td>
<td>15 – 30</td>
<td>44</td>
<td>2 – 24</td>
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</table>

\(^1\) COD as biodegradable  
\(^2\) for approximate comparison only
Various BIOPAQ® reactors to fit specific customer needs

- BIOPAQ® UASB
- BIOPAQ® UASB+
- BIOPAQ® IC
- BIOPAQ® AFR
Granular Biomass
Biomass controll
Granular Biomass Seeding & Harvesting
Biomass in AFR

up to 25 kg TSS/m³
BIOPAQ® UASB

- Upflow Sludge Bed
- 3-Pase Separator
- Modular system design
- Limited reactor height
BIOPAQ® UASB+

- Upflow Sludge Bed
- 3-Phase Separator
- Suitable for retrofitting
- Building into existing assets
BIOPAQ® IC

• Upflow Sludge Bed

• **2 Stage** 3-Phase Separator (superior biomass retention)

• Self regulated Internal Circulation (extra enhanced mixing biomass)

• Small footprint
BIOPAQ© - AFR

- Digestion of Oils & Fats & Proteins
- Completely mixed reactor type
- Integrated Flotation
- Compact Reactor Design
- Floculent Biomass
Applications BIOPAQ® AFR

Industrial examples:
• Dairy/Ice cream
• Vegetable oils
• Food industry
• Food liquid transport
• Slaughterhouse/Rendering

Influent:
• COD : 7 - 70 g/l
BIOPAQ® AFR
BIOPAQ® UBOX
combined anaerobic-aerobic treatment

- Upflow Sludge Bed
- Combined anaerobic-aerobic treatment
- No odour emission
- Sewage and Industrial
BIOPAQ® UBOX
combined anaerobic-aerobic treatment

20,000 pe
11,000 pe
50,000 pe
Distillery
BIOPAQ® SIZE

to accommodate for 1,000 – 200,000 kg/d
<table>
<thead>
<tr>
<th>AGRO FOOD INDUSTRY</th>
<th>BEVERAGE</th>
<th>DISTILLING INDUSTRY</th>
<th>PULP &amp; PAPER</th>
<th>MISCELLANEOUS</th>
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<tbody>
<tr>
<td>Sugar</td>
<td>Cannery</td>
<td>Soft Drink</td>
<td>Sugar Cane Juice</td>
<td>Recycle Paper</td>
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<td>Potato</td>
<td>Citric Acid</td>
<td>Beer</td>
<td>Sugar cane Molasses</td>
<td>Mechanical Pulping</td>
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<tr>
<td>Starch</td>
<td>Pectin</td>
<td>Malting</td>
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<td>Semi-Chemical NSSC</td>
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<td>Wine</td>
<td>Chemical Pulping</td>
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<td>Grain</td>
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<td>Bakery</td>
<td>Coffee</td>
<td>Fruit</td>
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Applications BIOPAQ®
Experience in the Industry

Fit for Purpose