

BioGas Purification System

BgPur™

By François MORIER



Eco-Tec Inc.

- Specializing in industrial water treatment and chemical recovery systems
- Integrating advanced technology
- More than 1,500 systems installed worldwide over its 35 year history
- ISO 9001:2000 registered

Mission

Develop, design, manufacture, *best value systems* for the industrial water treatment, gas purification and chemical recovery markets

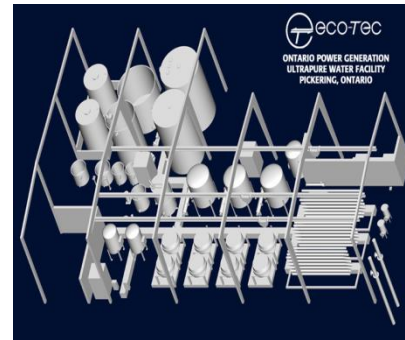


History

- Incorporated in 1970
- Employee owned since 1985
- Canadian corporation
- Eco-Tec (Europe) located in U.K.

What We Do!

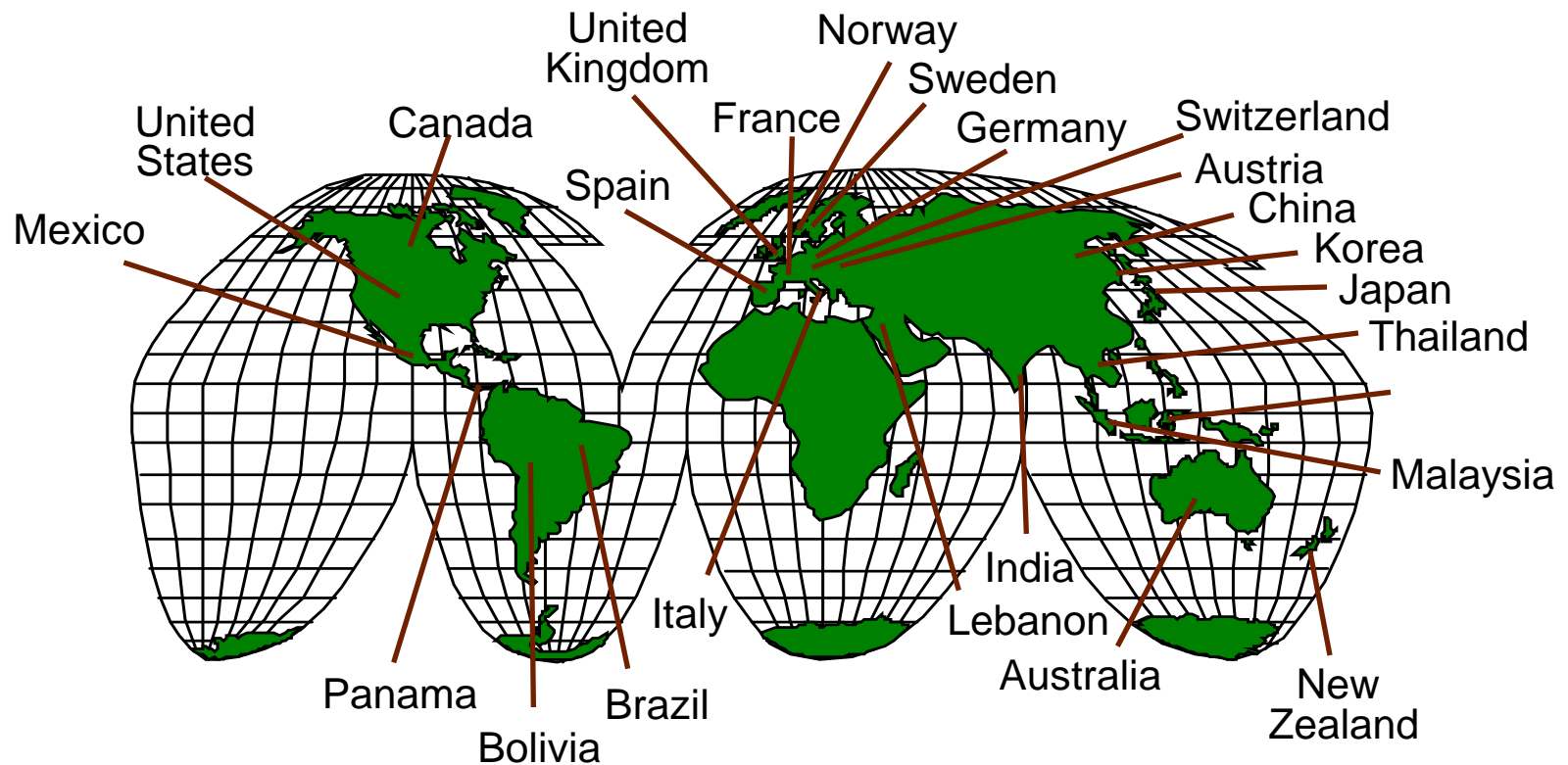
- Engineering
- Manufacturing
- Quality Assurance
- Technical Service
- In-House R & D
- Eco-Serv



Technology

- Recoflo[®] Ion Exchange
- High Efficiency Gas Processing
- Spectrum Micro Media Filtration
- Standard Process Equipment
 - Evaporation
 - Degasification
 - Chemical Treatment
- Process Systems Integration

Markets



Biogas

- Biogas is produced by the break down of organic material in an oxygen free environment
- Sources of biogas include: waste water treatment plants, anaerobic digesters (agricultural waste or other organic waste), and landfills

BioGas Sources

- Agriculture
- Landfill gas
- Municipal wastewater treatment plants
- Industrial wastewater treatment plants
- Others

BioGas Defined

Typical Composition

Methane (CH_4): 65%

Carbon Dioxide (CO_2): 35%

Hydrogen Sulfide (H_2S): 0-30,000 ppmv

Plus: water vapor and particulates

BioGas Defined

Hydrogen Sulfide (H_2S):

1. Toxic (>10ppm)
2. Odorous (>50 ppb)
3. Corrosive
4. Explosive

Biogas Uses

- Electricity generation
 - Gas engine or turbine
- Cogeneration
- Natural Gas Substitute
 - Residential Heating
 - Vehicle fuel

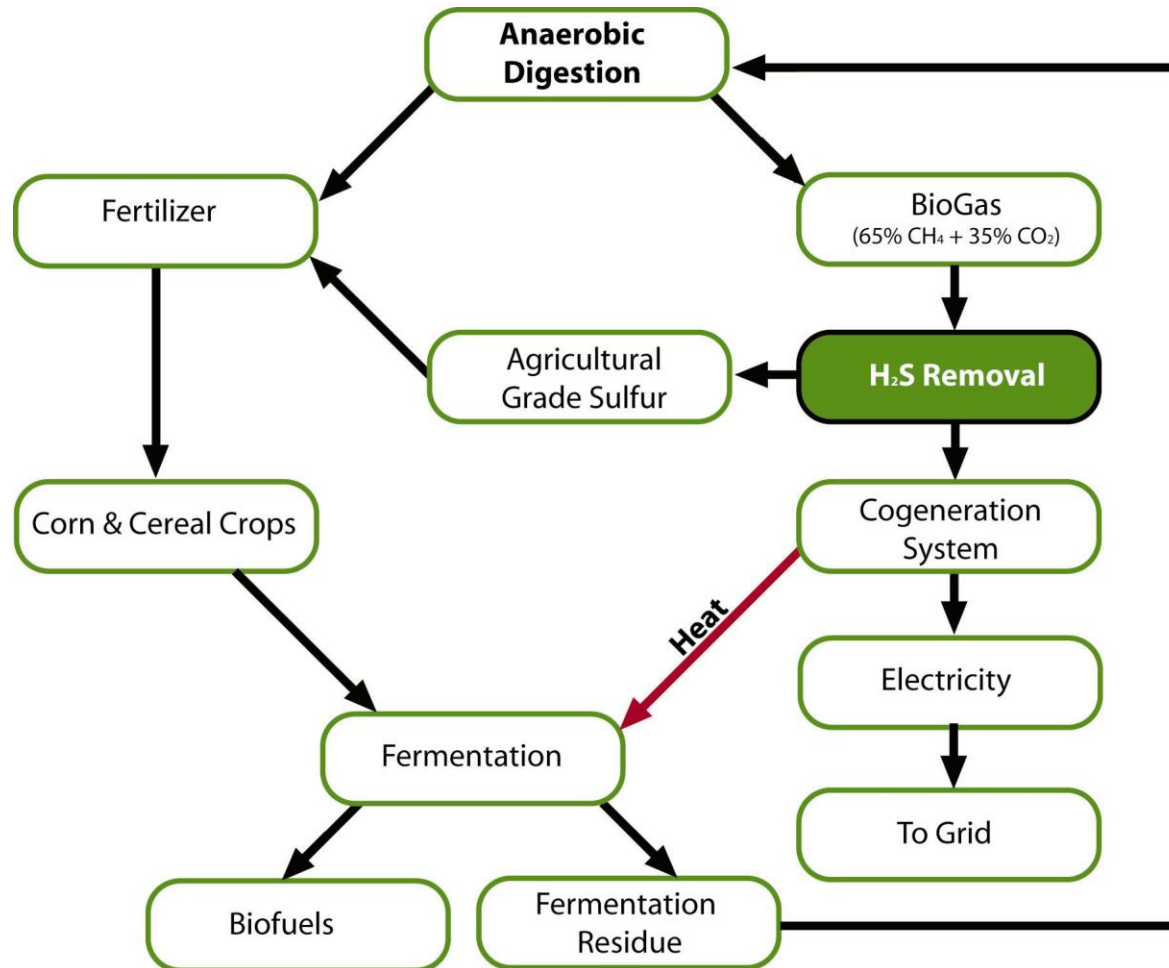
Hydrogen Sulfide

- Contaminant in biogas
- Causes equipment corrosion and SO₂ emissions
- Prior to use in engines or turbines H₂S content must be reduced
- Biogas must meet “pipeline quality” for use as a natural gas substitute

H₂S Removal

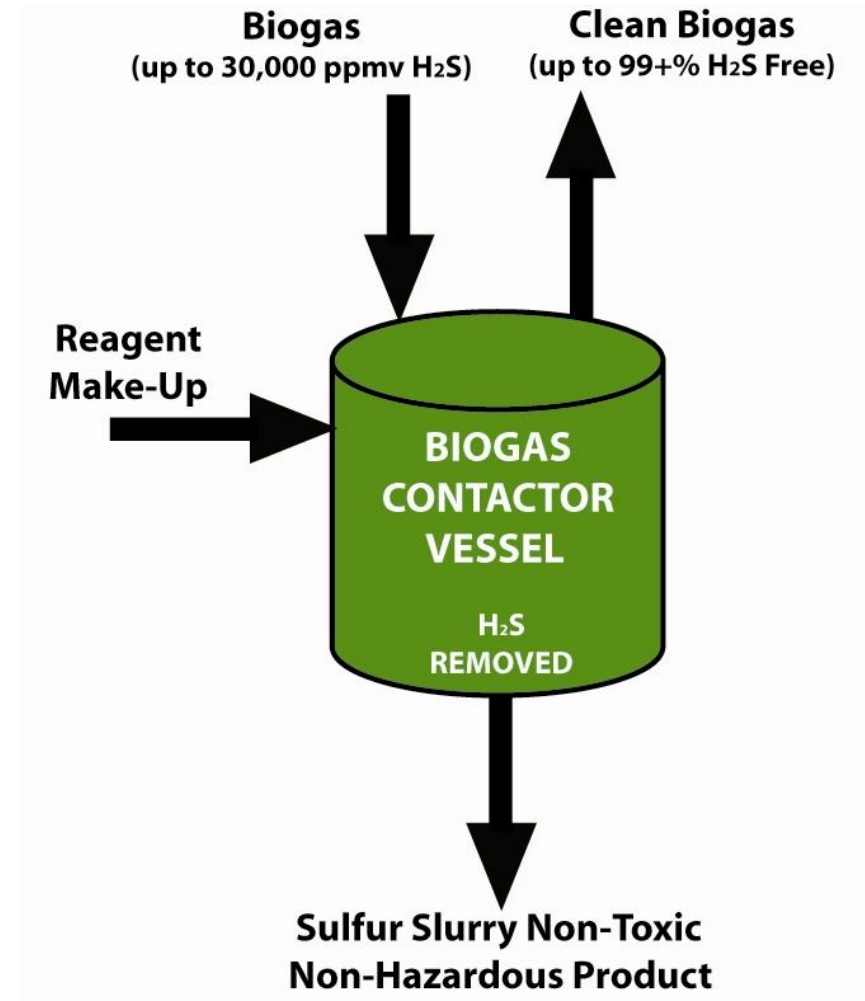
- Reduces toxic emissions
- Reduces odor
- Reduces maintenance
- Able to use gas for energy or heat production

BioGas Flow



BgPur

Eco-Tec's patented gas-liquid contacting process removes H_2S from biogas and converts it into an elemental sulfur by-product.



Process Overview

1. Air Injection
2. Gas/Liquid Contact
3. Absorption/Regeneration
4. Flotation
5. Sulfur Removal

Air Injection

- Oxygen is required for the reaction with H_2S to produce sulfur
- *Overall Reaction:* $H_2S + \frac{1}{2} O_2 \rightarrow H_2O + S$
- An excess of 2 x stoichiometric oxygen must be present in the gas
- If there is not enough oxygen in the incoming gas, air must be injected

Air Injection

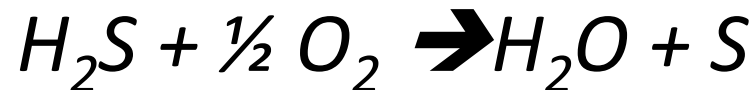
- Air is injected via air blower directly into a static mixer on the gas line
- Static mixer ensures the gas mixes instantaneously and effectively prior to entering the contactor

Gas/Liquid Contact

- Gas is forced by the rotating impeller to flow through the shroud openings producing fine bubbles
- Shear forces allow for good gas liquid contact and mass transfer

Absorption/Regeneration

- Contactor solution absorbs H_2S in the gas
- Oxygen reacts with H_2S to produce sulfur
 - regenerating solution



Flotation

- The shroud is made of up multiple small perforations
- Fine bubbles are produced which lift sulfur particles
- Foam layer at the surface

Sulfur Removal

- The sulfur layer flows over the weir by gravity, where the slurry is collected
- A pump feeds the slurry to the filter press where it is dewatered
- To prevent sulfur building up in the contactor, the slurry flowrate must be fairly continuous

Rapid Cyclic Press (RCP)

- Minimal off stream time (< 15 min)
- Fully automated
 - Valves
 - Open/close
 - Shake
 - Spray
- No operator attention

Features & Benefits

Feature	Benefit
Patented Gas-Liquid Contactor	<ul style="list-style-type: none">• >99% H₂S removal• Forgiving of gas flow & H₂S concentration fluctuations
Quick Reaction Time	<ul style="list-style-type: none">• Small footprint• Skid-mounted
Flexible Design	<ul style="list-style-type: none">• Scalable to be cost effective to customer's specific needs
Robust Design	<ul style="list-style-type: none">• Suitable for industrial applications and resists sulfur plugging and foaming problems• Low maintenance costs
Simple Operation (pH control only)	<ul style="list-style-type: none">• Low operating cost (electrical and chemical)• Environmentally friendly (agricultural chemicals used and agricultural by-product produced)

Features & Benefits

Patented Gas-Liquid Contactor

- The system consistently removes 99+% of the H₂S from biogas
- Forgiving of gas flow and H₂S fluctuations

Features & Benefits

Quick Reaction Time

- Small footprint
- Skid mounted

Features & Benefits

Flexible Design

- Scalable to be cost effective for the customer's specific needs

Features & Benefits

Robust Design

- Suitable for industrial applications
- Low maintenance costs

Features & Benefits

Simple Operation

- Low operating costs
- Environmentally friendly

Benefits

Economical Operation

- The system requires minimal energy resulting in lower costs

Benefits

Environmentally Friendly

- Agricultural chemicals used
- Agricultural by-product produced
- Minimal energy consumption
- Maximum energy recovery

Hampton Roads Municipal District



Sewage Treatment Plant
Virginia Beach, VA, USA
400 CFM, 2500 ppm H₂S

GRD Minproc Sydney, Australia



GRD Minproc Sydney, Australia

- Commissioned 2005
- Municipal Garbage Processing Plant
- H₂S levels ranging between 4000 – 5000 ppmv
- **After purification, H₂S levels \leq 2 ppmv**
- Purified gas used to produce up to 2.4 MW electrical power