HIDROGEN SULFIDE REMOVAL BY BIOLOGICAL SYSTEMS

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HIDROGEN SULFIDE Sources

- Natural
  - Geothermal
  - Anaerobic degradación of residues
- Antropogénic
  - Industries
    - Petroleum Refineries
    - Kraft celulose production
  - Plantas de Tratamiento de aguas residuales y residuos sólidos → **BIOGAS PRODUCTION**

Principles of Particle Removal
Mechanisms Used in Air Pollution Control

HIDROGEN SULFIDE

- Vapor Presssure at 25.5 ºC : 2026 kPa
- Solubility in water at 20 ºC : 0,4 % p/p
- Boiling point : -60.7 ºC (a 101.3 kPa)
- Especific Gravity : 1,19 (aire=1)
- Olfactive detectión : 0,13 ppm
  - 1ppm = 1,394 mg/m^3 a 25 ºC

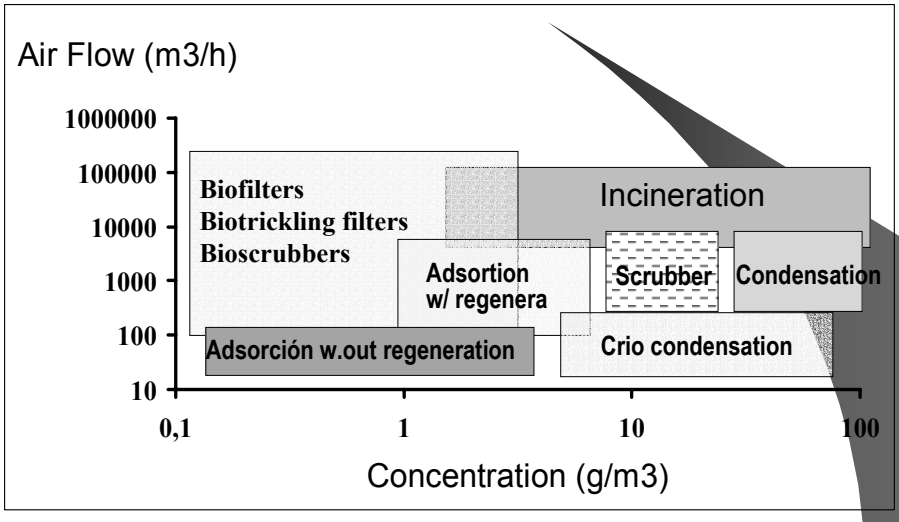
Physicochemical processes for treating sour gases

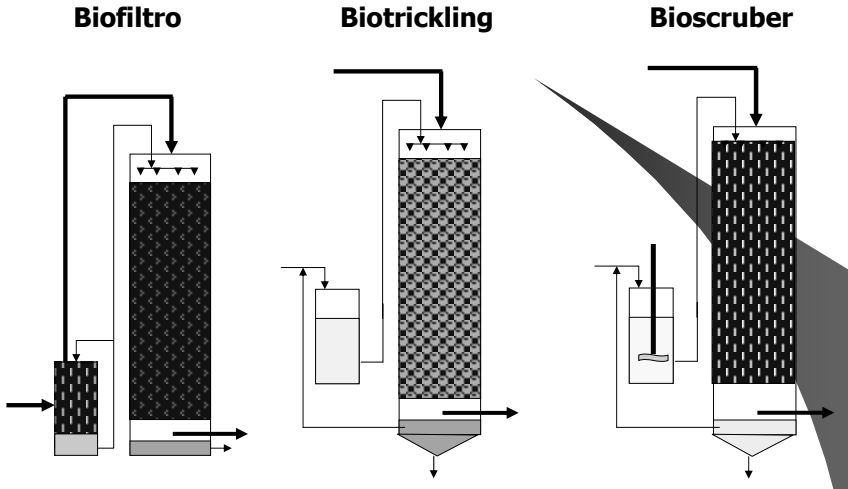
- Liquid phase chemical reactions
- Liquid phase physical absorption
- Dry bed
- Direct conversion

Biological Oxidation

- *Clorobium limicola*
  - $H_2S + 2\ CO_2 + 2\ H_2O$ -----> $2\ CH_2O + H_2SO_4$
- *Xanthomonas sp*
- *Thiobacillus denitrificans*
- *Thiobacillus thioparus*
- *Acidithiobacillus thioxidans (Thiobacillus thioxidans)*
- *Acidithiobacillus ferrooxidans (Thiobacillus ferrooxidans)*
  - H_2S ----> S^o ----> $SO_4^=$

Ranges of application of technologies for the treatment of gaseous emissions





Biofiltration for RSC abatement

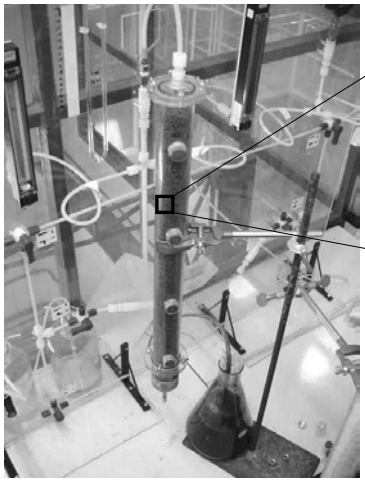
- Biofilters
  - Cheap, simple, clean
  - Large residence time (30-60s) → large area
  - Difficult process control (moisture, pH)

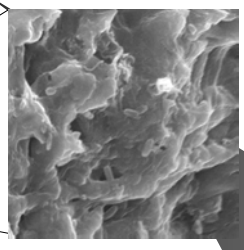
$$RSC + O_2 \rightarrow H_2SO_4$$

- Biotrickling filters
  - More expensive
  - Good process control, very efficient, smaller area
- Bioscrubbers
  - Requires an oxidant solution (Fe+3)

Biofilter
Materiales y Métodos

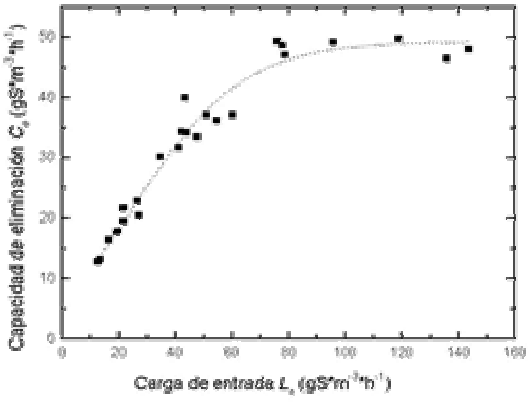
- Soporte
  - Pet from Magallanes
- Microorganism
  - *Thiobacillus thioparus* ATCC 23645
- Determination de H2S
  - Gas Cromatography





Thiobacillus thioparus

Capacidad de eliminación vs Carga de entrada



Problems

→$SO_4^{=}$ ⇒ acidification

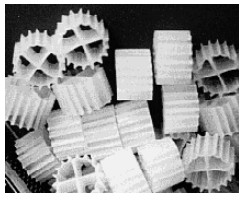
→Difficult control of the pH in the organic support

Biotrickling filter

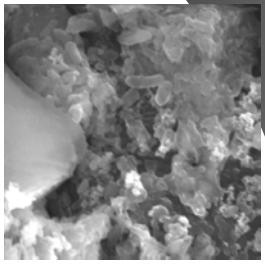
- Thiobacillus thioparus (ATCC 23645)
- Acidithiobacillus thioxidans (ATCC 19377)

Support

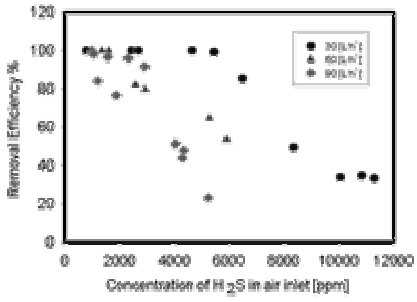
- Kaldness MiljOteknology AS Norway
- 280 Kg/m^3
- 1270 m^2/m^3
- 73% free volume



Biotrickling filters



Removal of H2S
Biofilm of *At. thioxidans*, pH 1.8-2.5



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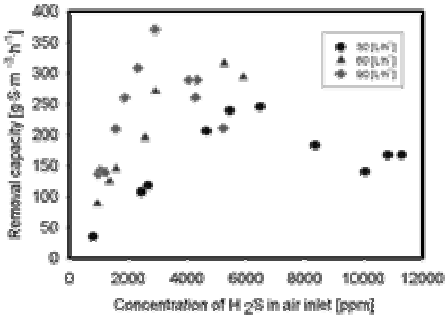
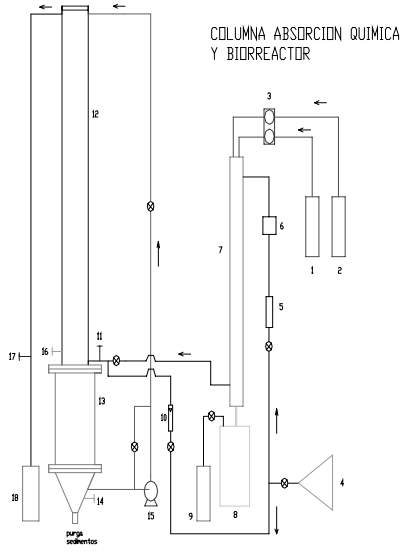
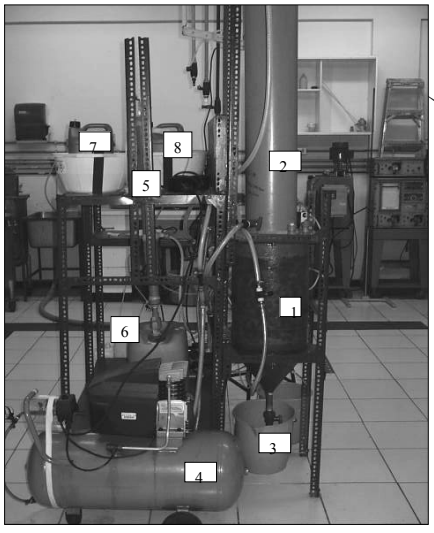


Bioscruber

- Solutions of Fe+3 for oxidase H2S
  - → Fe+2
- Regeneration of the solution of Fe+3
  - *Thiobacillus ferrooxidans*

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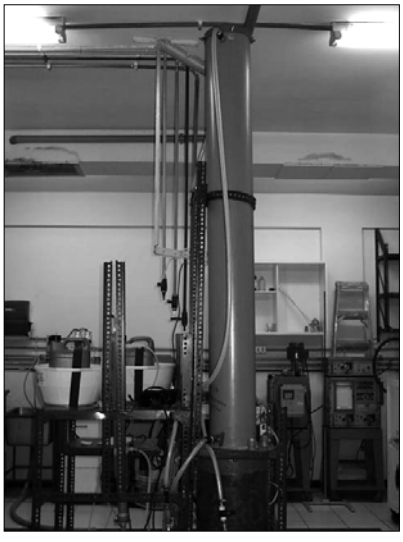
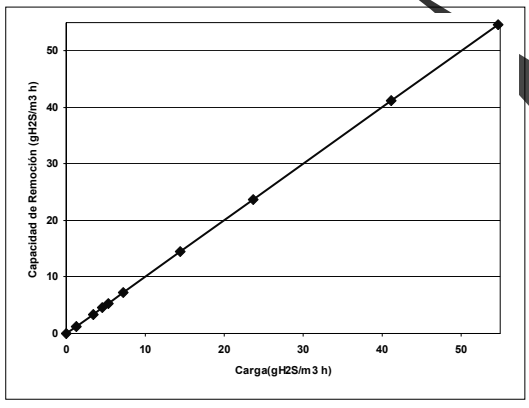


H_2S Removal Capacity in Bioscruber



Conclusions

- It is posinble to remove H2S from gaseous mixtures by using an acidophilic chemolitrotophic microorganism
- In biofilters the operation is complex because of acidification of the medium.
- A maximum is observed in removal capacity of the biotrickling filters indicating that there is an inhibitory effect over certain concentrations of H_2S in the air inlet.

Conclusions

- The material used for supporting the biofilm shows very good properties, being stable to the acid conditions and allowing a fast formation.
- The biosrubber is the most recommended system for removing H2S in a broad range of conditions.

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