BIO-DESOLF®
BIOLOGICAL DESULPHURIZATION TOWER
**GENERAL DESCRIPTION OF THE BIO-DESOLF®**

**Biogas Quality**

The biogas produced by anaerobic fermentation is a mix of various gases, some of them are incombustible or oxidant.

The principal obstacle to the biogas widespread use is the high quality required by the cogeneration plants and car engines.

**Hydrogen Sulphide**

The low quality of the biogas is due to the presence of high levels of hydrogen sulphide. Hydrogen sulphide is corrosive to the energy production system, it is detrimental to the environment and therefore it must be removed from the biogas.

**Biological Desulphurization**

ECOCHIMICA developed BIO-DESOLF®, a vertical biofilter tower that removes the biogas hydrogen sulphide with an efficiency higher than the 95%.

Not only is the ECOCHIMICA BIO-DESOLF® a highly efficient system, it has also low running costs. It does not require chemical reagents, it has low energy consumptions and it has no exhaust discharge.

**Bacteria**

The BIO-DESOLF® tower uses the oxidation capacity of biological microorganisms to metabolize the hydrogen sulphide.

With just a small addition of air the microorganisms convert the hydrogen sulphide in elementary sulphur and elementary acids. The products of this biological oxidation are environmentally neutral. These bacteria need only oxygen, nutrients and a growth substrate.

The oxygen is added as pressurized air. The air amount is checked by automatic controls according to the request and in correlation with the amount of total gases.

A common fertiliser spread all over the world is used to feed the bacteria.

The growth substrate, in order to help the bacteria grow, is composed of a layer of filling bodies with high specific surface.
APPLICATION FIELDS

The ECOCHIMICA BIO-DESOLF towers are easily integrated into every field where sulphuric hydrogen removal is needed. Especially for:

- CIVIL AND INDUSTRIAL SLUDGES TREATMENT PLANTS
- ORGANIC FRACTION OF SOLID WASTES
- CHEMICAL INDUSTRIES
- PAPER INDUSTRIES
- FOOD INDUSTRIES
- LANDFILLS
- AGRICOLTURE
WORKING PRINCIPLES OF THE ECOCHIMICA BIO-DESOLF®

Hydrogen sulphide can be removed with the oxidation process by microorganism of the AcidotihbacillusThiooxidans specie.

These bacteria make energy for their growth by oxidation, converting the hydrogen sulphide in sulphuric acid and elementary sulphur by the following reactions:

\[
\begin{align*}
2\text{H}_2\text{S} + \text{O}_2 & \rightarrow 2\text{S} + 2\text{H}_2\text{O} \\
2\text{S} + 3\text{O}_2 + 2\text{H}_2\text{O} & \rightarrow 2\text{H}_2\text{SO}_4 \\
\text{H}_2\text{S} + 2\text{O}_2 & \rightarrow \text{H}_2\text{SO}_4
\end{align*}
\]

The BIO-DESOLF® system is a tower through which the water circulates in the layer of filling bodies in it inserted, with a high specific surface, in order to help the bacterial growth with the formation of a biofilm. The inlet boga flow passes through the layer of filling bodies and it is degraded by the bacteria following the reaction described above.

The aim of the BIO-DESOLF® tower is to achieve the maximum removal efficiency of hydrogen sulphide, to improve the sulphuric acid production and to reduce the elementary sulphur production also to avoid clogging problems. Microorganisms need optimal conditions in order to improve the growth. These conditions include low pH values (1,5 – 2) and a temperature around 35°C.

BIO-DESOLF® has an automation system to ensure correct management of operation parameters as temperature, pH and oxygen quantity. An addition of nutrients for the cellular growth is necessary, but the proportion of this need of nutrients and of cellular growth is very low.

insufflare in base alla richiesta ed in correlazione con la portata di biogas e a concentrazione di H2S.
The BIO-DESOLF® plant is composed by a tower where the degradation reactions happen and by a control station containing all the technical equipment for the plant management. Thanks to a pump in the control station, the water circulates inside the tower and passes through a layer of filling bodies with high specific surface: this allows the microorganisms to form a biofilm where they can attach and proliferate.

The biogas flows into the tower, through the layer of filling bodies. The microorganisms,..., according to the reactions previously described, start the hydrogen sulphide degradation.

A blower installed in the Control Station provides the necessary oxygen to the biological oxidation process. The amount is provided by the automatic system control logic in function to the biogas flow to be treated.
DETAILS OF THE CONTROL STATION

Whashing system of filling bodies

Intern of BIO-DESOLF® Control Station with nutrient tank, bacteria tank and PLC

Nutries Pumps

Air inlate system for oxygen

Detail of PLC

Intern of BIO-DESOLF® Control Station with recirculation pump
DETAILS OF THE TOWER BIO-DESOLF®

- Detail of spray nozzles and washing jet-pipe
- Connections between control station and BIO-DESOLF® tower
- Detail of conditioning system
- BIO-DESOLF® tower Inspection Manhole
ADVANTAGES OF BIOLOGICAL SYSTEM

- FULLY AUTOMATED SYSTEM
- NO CHEMICAL ADDITIVES
- LOW ELECTRICAL ENERGY CONSUMPTION.
- LOWER MANAGEMENT COSTS THAN THE OTHER H2S REMOVAL METHODS
- STABLE AND SIMPLE METHOD
- MORE CONSISTANT FUNCTIONING OF THE BIOGAS PRODUCTION SYSTEM
- NO CLOGGING
- NO COSTS FOR THE SUBSTITUTION OF FILLING BODIES COMPARED TO THE OTHER FILTRATION METHODS
- VERY LOW NUTRIENT CONSUMPTION
- HIGHER SAFETY AND SECURITY LEVEL FOR WORKERS BECAUSE OF THE ABSENCE OF CHEMICALS
- LOW QUANTITY OF EXHAUST DISCHARGE TO DISPOSE OF
- RETURN OF CAPITAL COSTS IN A SHORT TIME PERIOD
### COMPARISON TABLE for a Biogas Flow of 100 Nm3/h

<table>
<thead>
<tr>
<th></th>
<th>CHEMICAL DESULPHURATOR</th>
<th>BIOLOGICAL DESULPHURATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Water Consumption</td>
<td>At maximum working conditions 30 m³/h</td>
<td>At maximum working conditions 0,5 m³/h</td>
</tr>
<tr>
<td>Reagent Consumption</td>
<td>Close to 67 kg/h di NaOH al 30%</td>
<td>Close to 0,125 kg/h di fertilizzante</td>
</tr>
<tr>
<td>Water Discharge</td>
<td>Close to 30 m³/h</td>
<td>Close to 0,5 m³/h</td>
</tr>
<tr>
<td>Management</td>
<td>High management costs</td>
<td>Low management costs</td>
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ASSEMBLY PHASES OF THE BIO-DESOLF® ECOCHIMICA
LA STORIA DI ECOCHIMICA

Ecochimica è nata negli anni ‘70 e vanta un’esperienza di 40 anni nel settore ambientale. Ecochimica ha realizzato numerosi impianti in tutto il mondo per le più importanti aziende in svariati settori; progetta e realizza impianti su misura per soddisfare al meglio le specifiche richieste del cliente e fornisce assistenza e manutenzione programmata sia per i propri impianti sia per impianti di terze parti.

IMPIANTI ECOCHIMICA NEL MONDO