

General Description of the Plant

Biotrickling filter

1. Function principle

The biotrickling filter is a 1-stage packed scrubber passed by the waste air from the bottom to the top. This unit operates under limited aerobic conditions and uses specific bacteria to convert hydrogen sulfide into water-soluble harmless components.

Biotrickling filter columns contain a plastic carrier media which provides a large surface area for settlement and growth of specialized microorganisms. The oxygen enriched air stream passes through the carrier material within the bio-trickling column from the bottom to the top; counter-currently the nutrient-enriched scrubbing liquid will be re-circulated and irrigated on the top of the carrier material. The scrubbing liquid provides the microorganisms with moisture and nutrients, and it also washes the metabolic sulfate out of the media. The supply of nutrients is realized by a time-controlled dosing of a liquid fertilizer solution.

In order to ensure optimum pH conditions and to purge accumulating sulfuric acid, scrubbing liquid has to be periodically removed from the system and has to be replaced by fresh water or (better) treated effluent. The frequency of the liquid replacement is controlled by means of a pH measurement in the pump sump.

The waste water is automatically discharged from the recirculation circuit whereas water is automatically fed into the column sump according to the continuous filling level measurement. The system temperature is monitored by continuous measurement of the column sump.

Well adapted biological desulfurization units are able to achieve a H₂S removal efficiency of up to 95 %. It has to be emphasized that such a biological system can only be designed for an avg. pollutant load. During and after H₂S concentration peaks in the gas stream, the removal efficiency for H₂S concentration will noticeably decrease. The reason is in the nature of biological systems which work best during stable conditions.

1.1. Gas flow

The waste gas streams upwards through the packing material bed and gets in contact with the washing liquid sprayed out from the irrigation system placed above the packing bed. This principle using a counter-current system of gas and liquid circulation leads to the highest distribution of nutrients-enriched scrubbing liquid.

Biotrickling filters are mainly used for waste air or gas streams with only few components of similar physical quality. One typical application is the desulphurization of biogas streams.

1.2. Washing liquid circulation / Packing bed

A recirculation pump transfers the washing liquid from the integrated scrubber sump, providing a constant liquid flow through the duct line, to the spraying nozzles. The spiral full cone nozzles are very widely opened, nearly plugging-free and able to spray the liquid homogenously on the packing bed. The scrubbing liquid then trickles through the packing bed, humidifies the biofilm, distributes nutrients to the bacteria and washes out the generated salts.

1.2.1. Recirculation pump

Very robust and corrosion-free vertical or horizontal chemical recirculation pumps made of thermoplastic are used for these applications. All parts in contact with the liquid are very resistant and well suited for the aggressive and abrasive washing medium as well as for the contaminants and chemicals transferred into the liquid phase.

1.2.2. Packing material

Main function of the packing material is to increase the transfer of the contaminants from the gas phase into the liquid phase. This is mainly possible due to the very high active surface able to hold up a big amount of washing liquid.

The used packing material serves with a specific surface of over 100 m² per m³ of filter bed. Through the special construction of the packing material (open structure, widely spaced and therefore high free volume), plenty of washing water droplets are built on the surface. These droplets are segmented and re-shaped constantly allowing the absorption process of the contaminants in the liquid phase to be renewed continuously.

1.2.3. Droplet separator

Following the packing bed, the air is led through a droplet separator. Its function is the separation of the washing water droplets from the pre-cleaned gas. These droplet separators are nearly plugging-free with high efficiency and low-pressure loss.

1.3. Measurement and control of the plant

The standard measurement and control of our scrubber includes:

- Level control of the scrubber sump with automatic water re-fill
- Protection against dry running of the recirculation pump
- Pressure gauge to indicate the pressure upstream of the spraying nozzles
- pH-value-control when fresh water is added
- Temperature monitoring of the scrubbing liquid to control the heat supply

The following options can also be quoted on request:

- Analytical measurement of the crude and clean gas

1.4. Dosing station

Nutrients are added by special dimensioned dosing pumps. The pumps are magnetic or motor driven diaphragm pumps. All materials in contact with the washing liquid are suitable for the chemicals. Each dosing pump adds nutrients solution discontinuously in a time-controlled manner.

2. Materials of the plant

The scrubber shell, the recirculation duct line and all other equipment in contact with the washing liquid (packing material, grids etc.) are built of corrosion-resistant plastic.

The scrubber shell - our scrubber type - G - is manufactured from corrosion-free glass fiber reinforced plastic (FRP). The shell is produced as a laminate by a filament winding machine. This laminate consists of high-quality polyester resin, woven roving and chop strand mat.

The inner side of the scrubber shell is coated with a special chemical protective layer. The outside is provided with a pigment layer containing UV-absorbers. This method allows a durable protection as well as a long lifetime of the scrubber.

Our scrubber type - P - is built of high-quality thermoplastic materials, such as Polypropylene or HDPE (high molecular polyethylene). There we use plates or winding tubes depending on size and structure.

3. Delivery / Installation

We deliver our scrubbers mostly in one module. Our well-practiced installation staff installs the complete scrubber on site as follows:

- Supervision of the positioning of the plant equipment
- Installation of the recirculation pump
- Filling-in of the packing material and installation of the grids
- Installation of the recirculation pipe
- Connecting of the supply and disposal lines which are provided by the customer
- Installation of the measuring equipment

4. Essentials

- Air stream from the bottom to the top
- High separation results / high efficiency
- Low investments and operation costs
- High flexibility against variable waste gas amount
- Optimal consumption of fresh water and nutrients
- Little space demand / compact size
- Low pressure loss

- Corrosion resistant
- Weather resistant
- Low risk of plugging due to the structure of the packing material
- Easy overview and easy handling of the display

