Comparison between Biotricklingfilter and Bioscrubber

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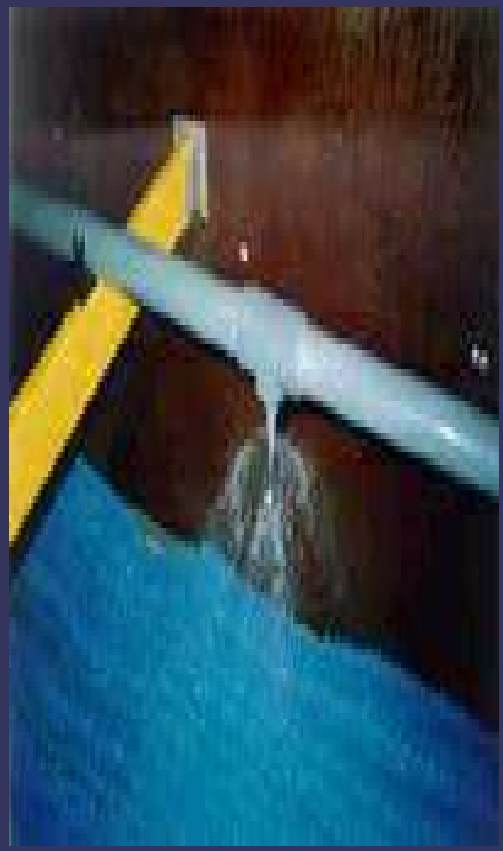
Biotricklingfilter

- Technolgy
  - Porous, inert polyurethane foam as packing material with high surface area
  - Pollutants are transported by mass transfer from gas phase to biological layer
  - Metabolism controlled by nutrients
  - Intermitted low sprinkling rate < 0,3 m^3/m^2



Biotricklingfilter

- Flexible construction - column or container
- Less space requirements
- Controlled biological layer by special nutrient source to avoid clogging
- Countercurrent or cocurrent flow direction possible
- No changing of packing
- Modulare construction- expandable

Biotricklingfilter

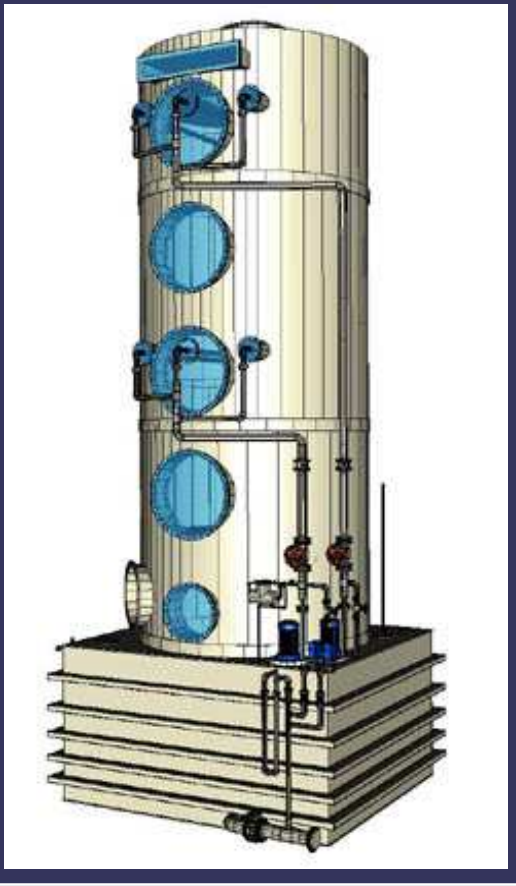
- Special technological Details
  - Cocurrent or countercurrent flow direction
  - Sprinkling rates < 0,3 m^3/m^2
  - Container pressure drop < 500 Pa /bed height
  - Intermitted sprinkling periods – max. 10 minutes in 3 hours
  - Residende time for odour removal for tobacco odours 10 to 15 seconds
  - No activated sludge handling

Biotricklingfilter

- Advantages
  - Flexible construction
  - Modulare expandable
  - Very low operation and maintenance costs
  - Less waste water discharge
  - Low pressure drop
  - High efficiency
  - High elimination rates for nonsoluble substances
- Disadvantages
  - Expensive packing material
  - High quality materials necessary – stainless or coated steel
  - Special high concentrated nutrients used for anticlogging

Bioscrubber

- Technology
  - Pollutants have to be washed out from the exhaust gas by absorption
  - Regeneration of the water by biological elemination with microroganisms
  - Microrganisms settled on packings or in suspension as activated sludge



Bioscrubber

- Principles
  - Pollutants must be soluble in water
  - Pollutants must be degradeable by microrgansims
  - No toxic substances
  - The temperature should be as low as possible, due to a better solubility
  - No dust
  - Oxygen in the regeneration phase/basin necessary (min. 1mg/l)
  - Phosphorous and nitrogen necessary for metabolism

Bioscrubber

- Special technological Details
  - Countercurrent flow
  - Sprinkling rate >25 m^3/m^2
  - Residence time 2 – 3 seconds
  - Inert packing
  - Mesophile conditions (30 degr.; pH 5,5 – 9;N:P:K;)
  - Biomass concentration between 2 and 15 g/l
  - Waste water 0,1–0,5 %/h of total sprinkling rate
  - Oxygen compressors for aerobic sludge process

Bioscrubber

- Advantages
  - Space requirement
  - Investment costs
  - Good performance for high soluble and degradable pollutants
  - No pre-humidification necessary
  - High buffer capacity
- Disadvantages
  - Very high operation and maintenance costs (> 25 - 30 €/m³ exhaust gas)
  - Difficult handling of the biological layer
  - High techical expense
  - Very long adaption period
  - Worst efficiency for less soluble pollutants
  - Low efficieny by changing concentration and pollutants
  - High pressure drop

Biotricklingfilter/Bioscrubber

- Examination of operation and maintenance costs of both technologies by Reemtsma – Berlin during the evaluation phase – reference Mr. Radola - Plant manager
  - Basic Data:

flow rate	3000 m^3/min
available space	200 m^2
odours/	max 1000 m^3
temperature	55- 65Celsius
dust	< 5 mg/m^3
substances in pollutants	> 50

Biotricklingfilter/Bioscrubber

- Results of Reemtsma- Zander BiotricklingFilter (calculation)
  - Operation costs
    - < 92000 €/year
  - Maintenance costs
    - < 12000 €/year
  - Results of realised plant
    - 2001 < 82000 €/year
    - 2000 < 78000 €/year
    - 1999 < 85000 €/year
    - 1998 < 83000 €/year
- Results of Reemtsma – Bioscrubber (calculation)
  - Operation costs
    - > 245000 €/year
  - Maintenance costs
    - > 21000 €/year