Reducing emissions by air scrubbers

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Why combined air scrubbers?

- In specific areas restrictions on the emission of both ammonia, odour and PM10
- Need for a technology with high removal performances for all mentioned compounds to enable large scale pig and poultry operations

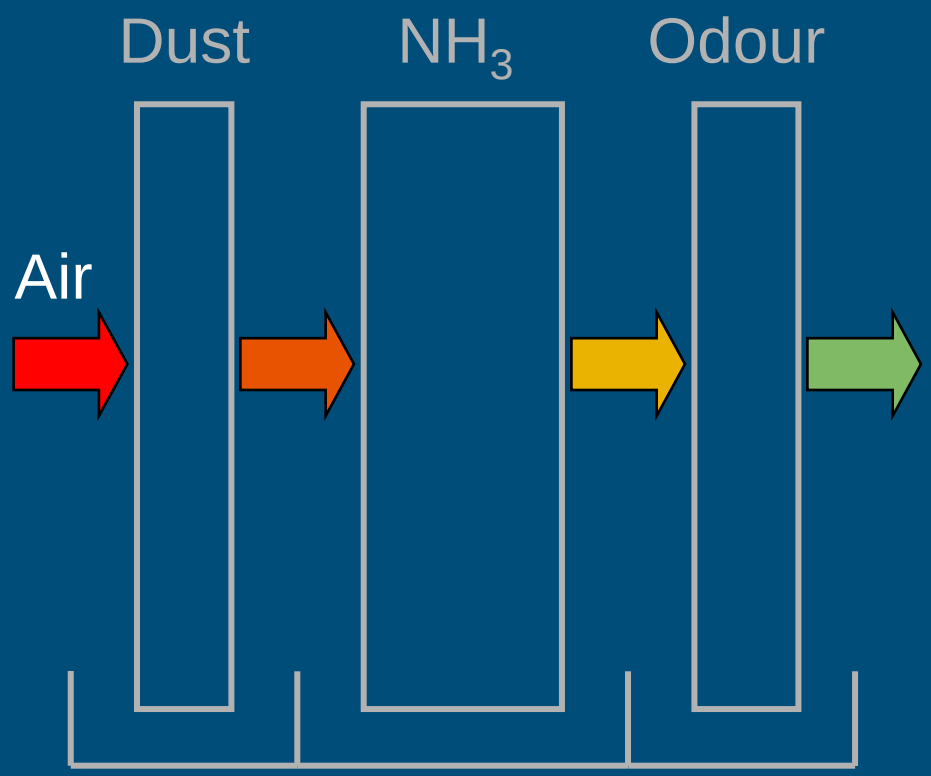
Restrictions of biofilters and chemical scrubbers

- Biobed/biofilters: very effective in odour removal
- Long term performance of biofilters affected by high ammonia loads, dust and insufficient humidification
- Given risks in performance limited application of biofilters in livestock
- Chemical scrubbers: very effective for ammonia removal (>90%) but poor odour removal (<30%)

Principles applied in combined air scrubbers

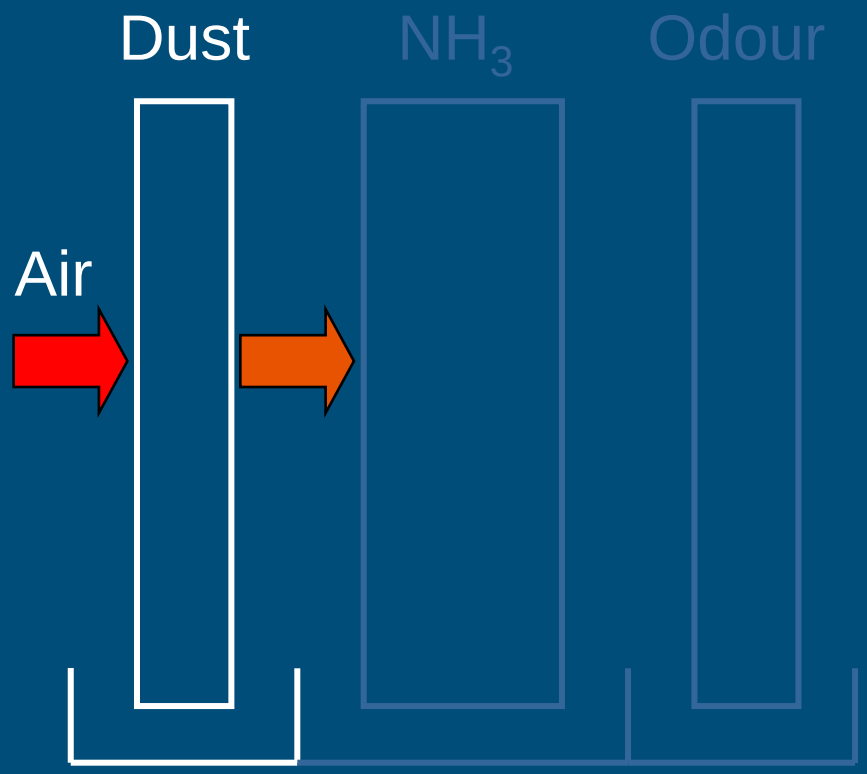
- High removal capacities for different compounds can be achieved by combining biological and chemical removal principles
- Sustainability of biofilters can be ensured by pre-positioning scrubbing units in the waste air that eliminate dust, ammonia

General layout of combined systems



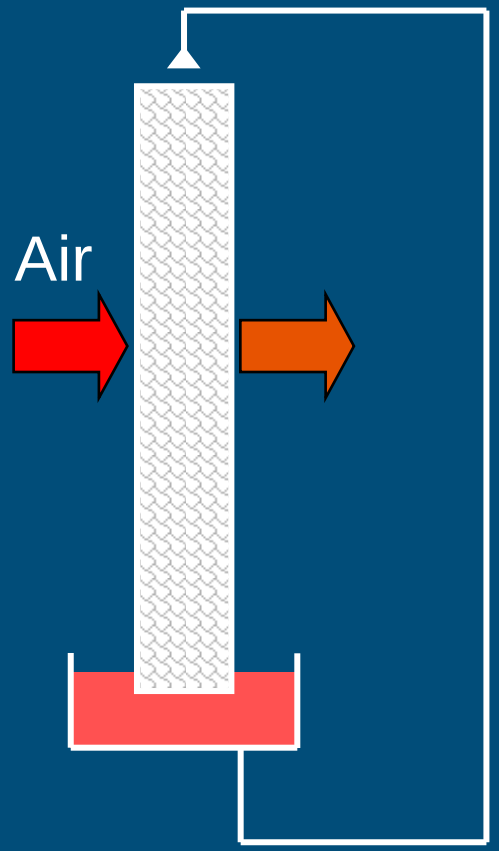
- Air flow is treated in steps
  - Dust removal
  - Ammonia removal
  - Odour removal

Dust Removal

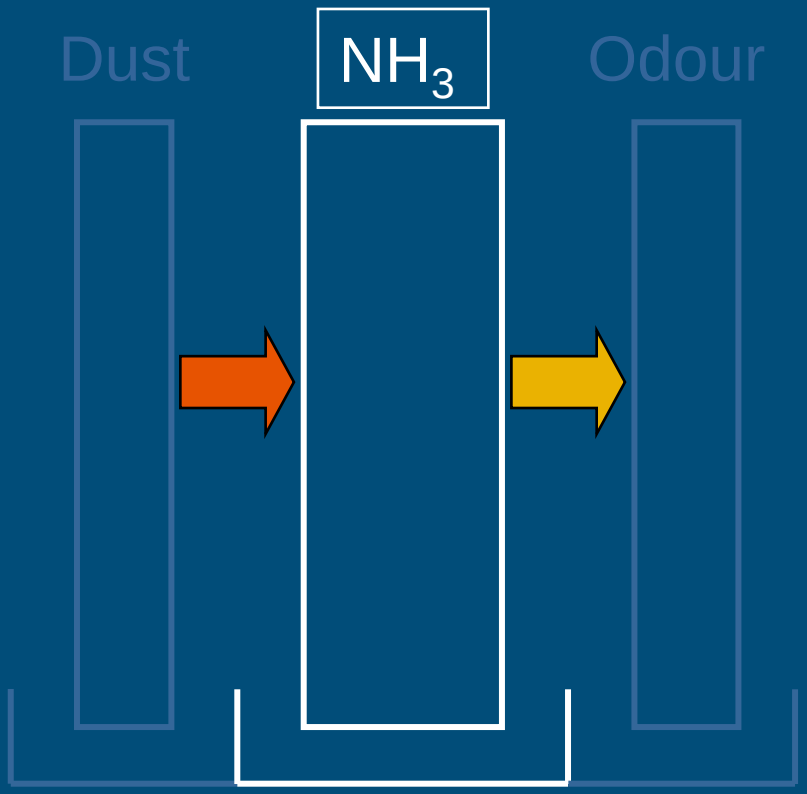


- Characteristics inflowing air
- Removal of particles
- Protection next steps

Dust Removal

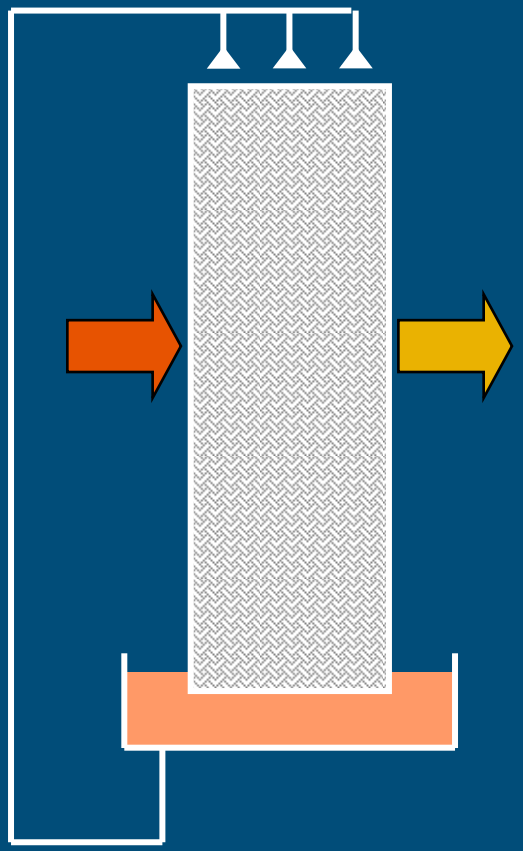


Ammonia Removal

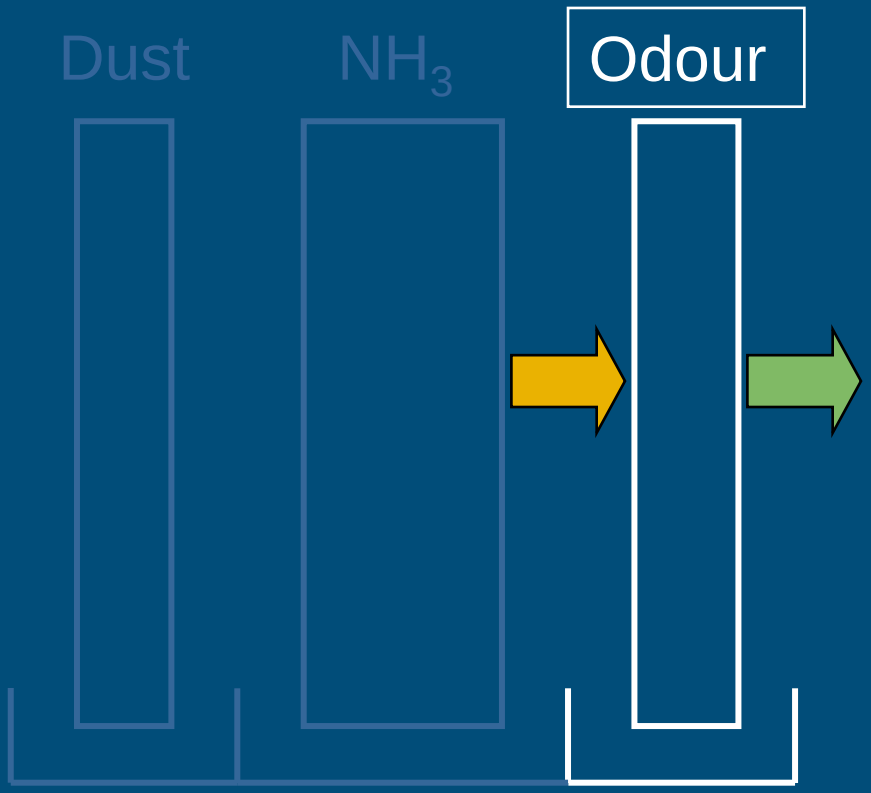


- Acid washing fluid
- Recirculation
- Discharge on ion strength

Ammonia Removal

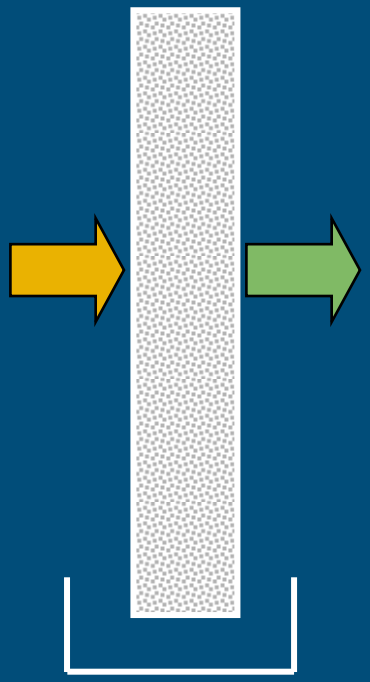


Odour Removal

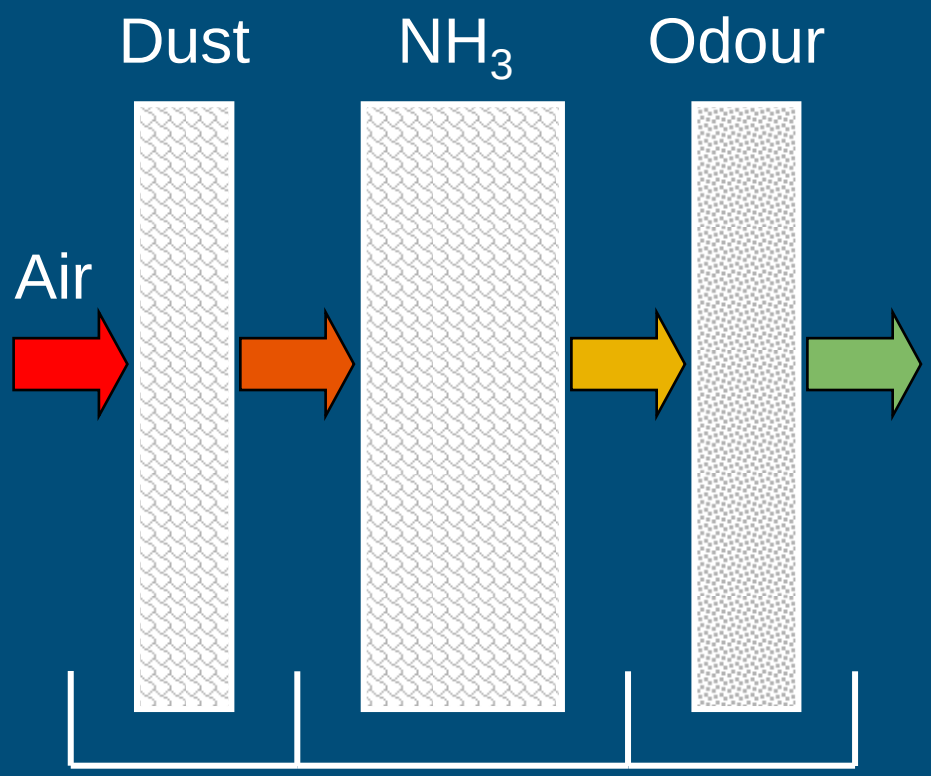


- Bacterial digestion
  - Volatile fatty acids
  - Sulfuric compounds
- Design
  - Biofilter
  - Bioscrubber

Odour Removal



Combined System



- Operating parameters
  - Back pressure
  - Cross influences
- Operating costs
- In practice both two-stage and three-stage scrubbers are developed

Removal PM10 and PM2.5: field test NL

System	Loading % of maximum	Residence time Mean (s)	Removal PM10 % (± s.e.)	Removal PM2.5 % (± s.e.)
Two-stage	29	3,6	83 (±3)	62 (±9)
Two-stage	21	1,2	62 (±3)	47 (±2)
Three-stage	15	7,4	93 (±1)	90 (±2)

Conclusions

- Scrubbers are effective in removing total dust
- First indicative results: high PM10 removal potential of combined air scrubbers
- Removal performances are lower for PM2.5
- Proper dimensioning important
- More in depth research required: package material, residence time, particle size etc.