INNO+

WE ENERGISE FARMING

# InnoClean

## Innovative air scrubbing systems for optimal emission reduction

# Sustainable business with consideration for your environment

As a livestock farmer, you know how important it is to be future-oriented. At Inno+, we believe that innovation is the key to a cleaner, stronger livestock industry. With our advanced air scrubbing systems for ammonia, odour and particulate matter, we help you reduce emissions effectively.

**This enables you to comply with regulations and legislation, limit nuisance for the environment and build a sustainable, responsible business. Whether you are expanding, renovating or optimising your farm: we offer solutions that fit your farm, your way of working and your vision for the future.**

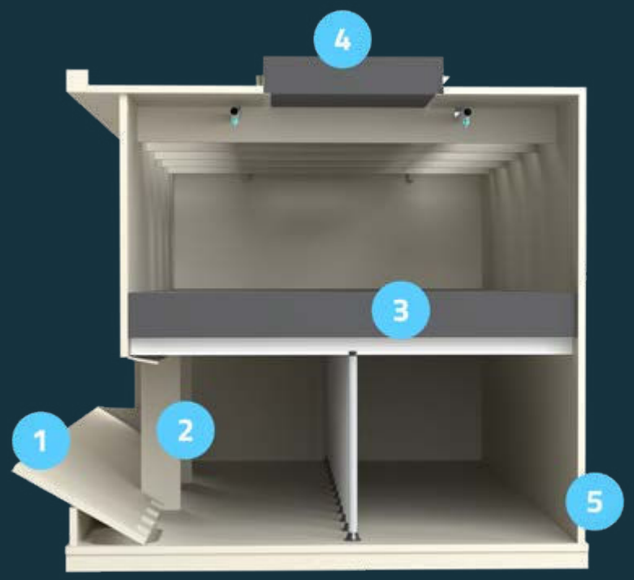

# How InnoClean works

InnoClean air scrubbers work on the basis of a process in which farm air is effectively brought into contact with water. The water is sprayed over a filter package, filtering harmful substances such as ammonia, dust and odour from the air. This process can be either chemical or biological, depending on the emission reduction requirements.

## How does an air scrubber work step-by-step?

**Step 1: Polluted air is extracted from the house**
Ammonia, odours and particulates are generated in a barn by the animals, manure and urine. This dirty air is extracted through a ventilation system.

**Step 2: Air enters the air scrubber**
The extracted air is directed to the air scrubber. The air scrubber is usually a separate room or module attached to the barn.




**Step 3: Air gets scrubbed with water**
Inside the air scrubber, the air flows past a special filter package. Process water is sprayed over these filters, bringing the air into intensive contact with water.

**Removal of harmful substances**

- Ammonia dissolves in water by using (sulphuric) acid or with the help of bacteria.
- Fine dust precipitates on the filter material and enters the water.
- Odorous substances are partly dissolved in the water or adsorbed on the filter material.

**Step 4: Clean air is blown outside**
After the air has been in contact with the water, odour, ammonia and particulate matter are largely removed. The ‘washed’ (cleaned) air is then blown outside.

**Step 5: Drain and refresh process water**
The process water is continuously circulated using a pump. When the process water is saturated with contaminants, part of it is drained off and refreshed. The so-called drain water is stored in a storage tank and can be used as fertiliser.

# Air scrubber configurations

## Master

**Plug-and-Play air scrubber module**

The Master unit is a complete plug-and-play air scrubbing system equipped with all necessary technical features and fully self-contained. Its compact design makes installation easy and quick. This module is flexible in use: it can be installed either at height or at ground level and is suitable for use in both new construction and renovation projects.

**Features**

- Includes all technical components (such as control box, pumps, sensors and dosing technology).
- Cleans the air of one shed (ventilation duct).
- Capacity up to 150,000m3 air per hour.

**Application**

Ideal for smaller to medium-sized livestock houses that do not require upscaling.

**Benefits**

- Plug-and-play system for ease of installation.
- Fully operational with no expansion required.

## Master + Extension/Slave

**2 air scrubbers with 1 control unit**

The Master + Extension/Slave configuration is an extension of the standard Master configuration. In this configuration, the Master unit is combined with one or more Extension or Slave modules to handle a larger air volume.

- An Extension module is directly linked to the Master and both units operate the same ventilation duct together. They function as one integrated system.
- A Slave module is connected to the Master through piping and is used to control a second house or a separate ventilation duct. The Slave operates under the direction of the Master, but operates on a separate air duct.

**Features**

- The Master contains all technical equipment (pump, control, etc.).
- The Extension/Slave does not have its own pumps or controls - the Master controls the Extension/Slave.
- The Extension/Slave is mainly an additional washing system to handle multiple air flows.

**Application**

Suitable if a livestock house gets bigger or if a second house is linked to the central washer.

**Benefits**

- Cost-efficient: no need to buy a separate technical installation for each additional air scrubber.
- Flexibly expandable according to requested capacity and barn size.

## Central control + Slave modules

**Optimal solution for multiple barns**

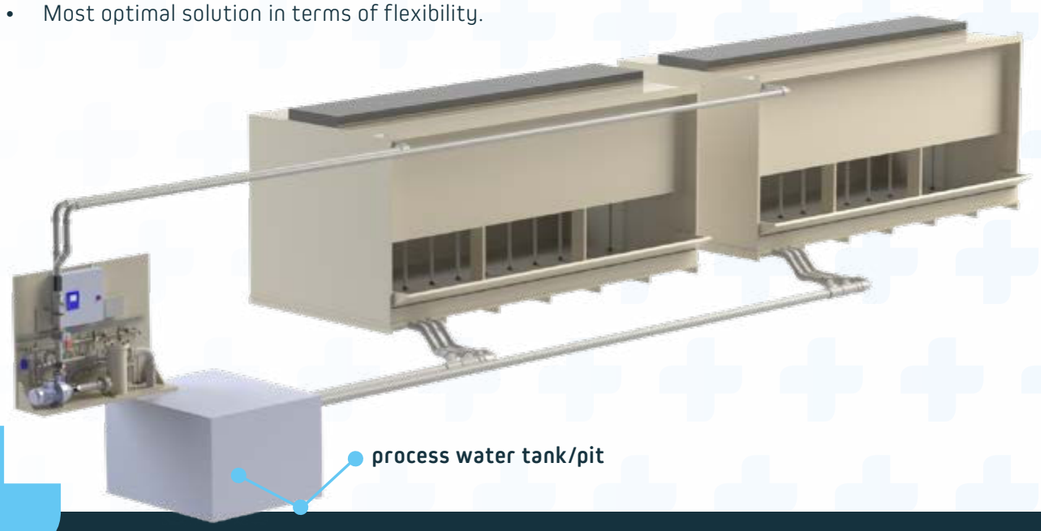
With central control, several air scrubbers (slave modules) are controlled from a single technical room. As a result, all technical facilities are conveniently located centrally together. We provide the central control system as a separate prefab SKID, but it can also be installed as a completely installed technical room outside the barn.

**Features**

- Suitable for more complex farm structures with multiple houses (up to 4 houses per control).
- All technical equipment and consumables are placed in a separate room.
- Ideal when scrubbers need to be placed at height (in the roof structure).
- Most optimal solution in terms of flexibility.

**Application**

Perfect for large livestock sites, farms with multiple houses or when there is a need for centralised technical control.




**Benefits**

- Economically advantageous in terms of investment.
- Highly scalable: expansion is easy.
- Space-saving: technical equipment can be in a central location.
- Maintenance-friendly: all technology is conveniently located together.
- Process water can be collected centrally for e.g. heat recovery.

## Built-in air scrubber

**Flexible sizing for large air scrubbers**

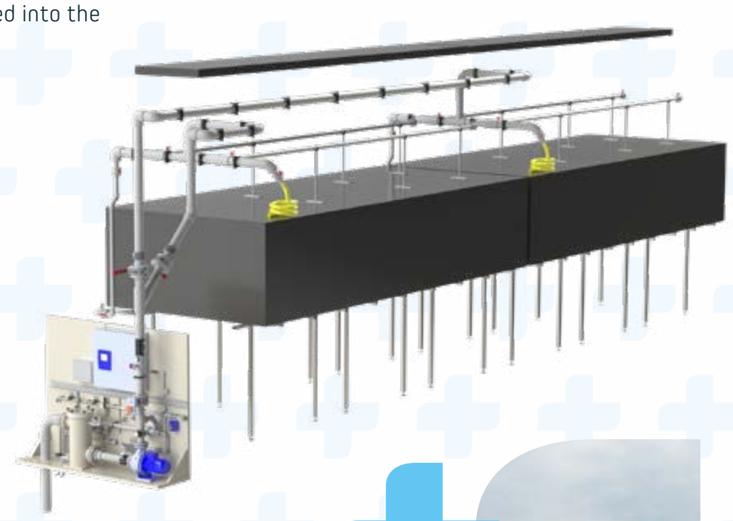
A built-in air scrubber is a constructional air scrubber. We supply the interior of the air washer complete, but without the housing. The housing is provided in or attached to the barn in a constructional way.

**Features**

- The interior of the air scrubber is designed and supplied by Inno+
- All technical components and consumables will be in a separate room.
- Building construction as washroom will be provided by the client.
- Process water collection and air extraction are integrated into the construction work.
- Often fully customised.

**Application**

If the ventilation system requires more capacity than standard air scrubbers can handle, a built-in air scrubber is the best solution.
This type of scrubber is mainly used for large, fixed installations, where capacity and durability outweigh speed of installation.



**Benefits**

- Flexible design: perfectly suited to the barn layout.
- Durable: robust construction, long service life.
- Beautiful integration: technically and aesthetically neatly concealed.

# What suits your situation?

**The choice between organic and chemical depends on the specific situation of the livestock farm, the entrepreneur's wishes and the applicable legislation and licensing regulations. The main differences between the two systems are briefly outlined below.**

## Biological air scrubbers

A biological air scrubber cleans polluted air using bacteria that break down pollutants naturally. By actively bringing the air into contact with water, substances such as ammonia, odour compounds and particulate matter are absorbed into the water.

Bacteria grow in the process water and on the filter package which convert these substances into harmless compounds such as nitrate and carbon dioxide. Proper management of the system is crucial for proper operation. In doing so, factors such as acidity (pH), temperature, water flow and oxygen supply are essential and must be kept within certain limits.

The contaminated process water is periodically drained or purified. The cleaned air leaves the system through a drain.

## Chemical air scrubbers

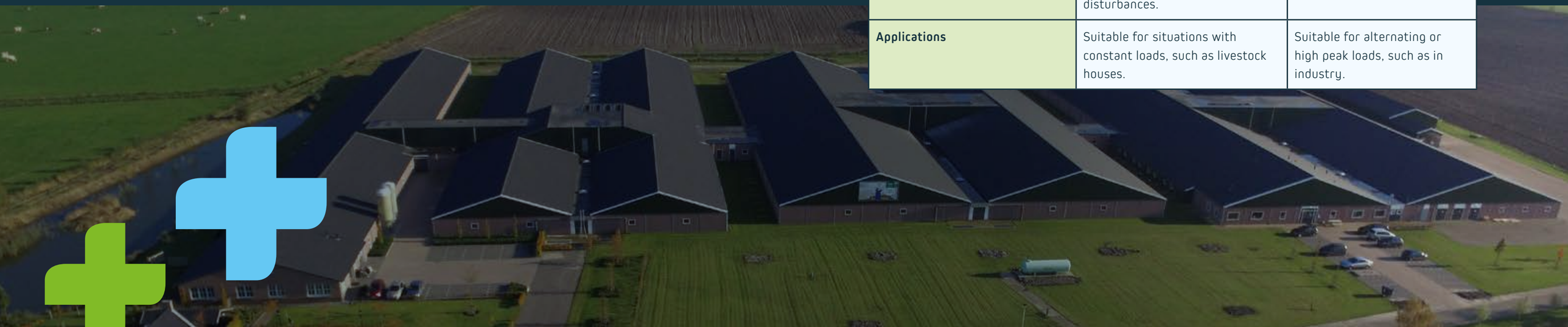
A chemical air scrubber cleans polluted air by bringing it into contact with an acidic washing liquid, usually sulphuric acid-based. Using a spray system, pollutants such as ammonia and odour components from the air are absorbed into the washing water.

The ammonia reacts with the acid to form ammonium sulphate, a harmless substance that remains in the water. For optimal operation, the pH should be 3-4, requiring regular addition of acid to maintain effective operation.

The contaminated wash water is periodically discharged or purified. The cleaned air leaves the system through a drain.

## Comparison of biological and chemical air scrubbing systems

| | Biological air scrubbing system | Chemical air scrubbing system |
|---|---|---|
| **Operation** | Uses bacteria that biodegrade contaminants. | Removes contaminants via a chemical reaction with acid (usually sulphuric acid). |
| **Maintenance** | Regular maintenance required to keep the bacterial culture healthy. | Regular refilling of chemicals; easier to regulate. |
| **Startup time** | Longer start-up time (+/- 6 weeks) needed to build up bacteria population. | Immediately operational after installation. |
| **Operating costs** | Lower with good management (less consumption of materials). | Higher due to structural use of chemicals. |
| **Investment costs** | Usually more expensive to buy. | Slightly cheaper to buy, depending on capacity. |
| **Environmental impact** | Environmentally friendly when managed properly; no harmful residues. | Higher environmental impact due to use of chemicals. |
| **Reduction:**<br><br>**Ammonia odour**<br>**Particulate matter** | 70-85% (depending on load and management).<br>About 45%.<br>Up to 80%. | 90-95% (highly effective in ammonia removal).<br>About 35%.<br>Up to 80%. |
| **Waste water production** | About 235 litres per kg ammonia (conductivity: ± 20 µS/cm). | About 23,5 litres per kg ammonia (conductivity: ± 180 µS/cm). |
| **Sensitivity to conditions** | Sensitive to temperature variations, pH and load. | Less sensitive; delivers more consistent results. |
| **Safety** | No hazardous substances, but risk of blockages or biological disturbances. | Risk of contact with chemicals: safety measures required. |
| **Applications** | Suitable for situations with constant loads, such as livestock houses. | Suitable for alternating or high peak loads, such as in industry. |



## PURO Air scrubbing systems

**Two-stage air scrubbing system - biological or chemical**

The PURO air scrubber is an advanced air cleaning system that works in two stages. The first filter step is available in both a biological and chemical variant. The second filter step consists of a layer of branches or brushwood, which is kept constantly moist. On this moist wood, micro-organisms grow that further break down odour components. This makes the PURO air scrubbing system extremely suitable for achieving a very high odour reduction in addition to the removal of ammonia and dust.

**Benefits**

- Thanks to the special structure of the filter, ammonia and dust particles are efficiently separated. The wall has a self-cleaning effect due to constant flushing.
- High efficiency in the removal of ammonia, dust and odour due to the additional biological filter.
- No more odour of polluted air perceptible in the outlet air (≤ 300 OU/$m^3$)
- Sustainable system: use of natural filter material.
- DLG-certified (test report no. 7226).

**Key considerations**

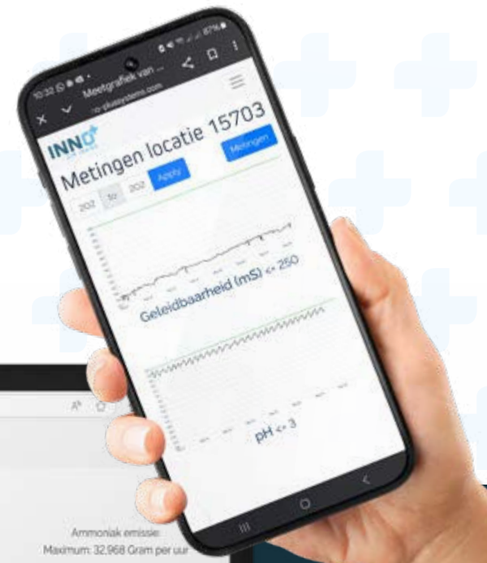
- Periodic replacement of wood chips is required.
- Susceptible to drying out in case of disturbances or low humidity.
- Clogging risk at high dust load.

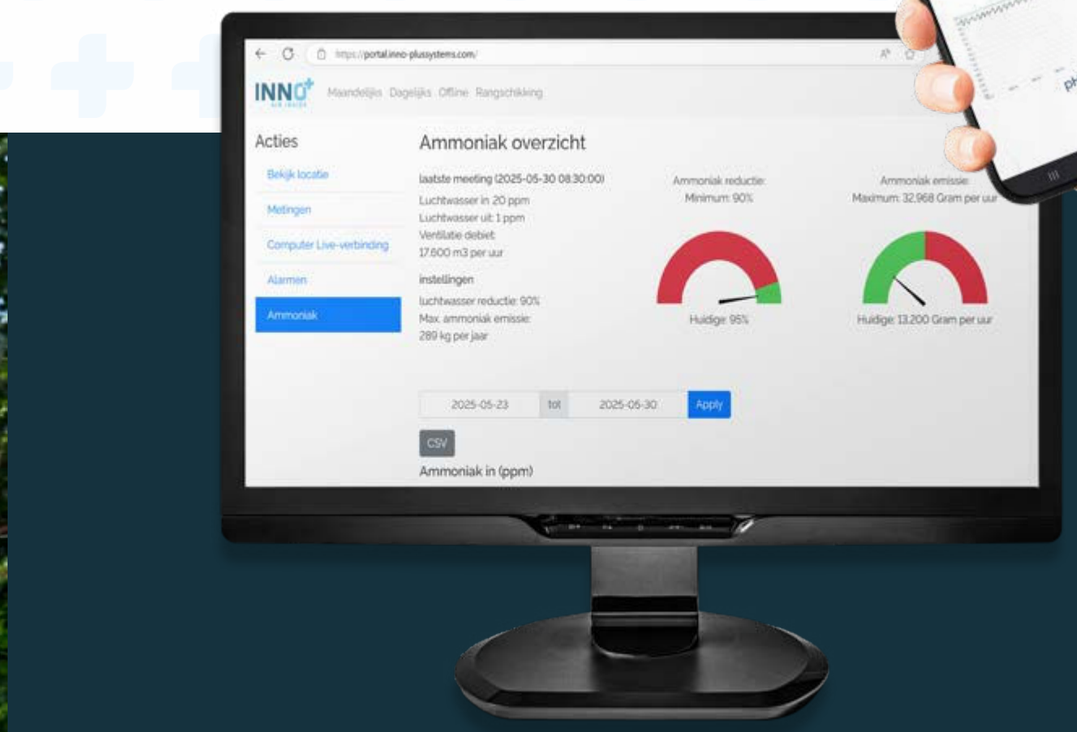
## Validated operation thanks to data logging

**Demonstrating the proper operation of an air scrubber is becoming increasingly important. With Inno+'s solutions, parameters such as temperature, pH value, conductivity, pressure difference, water consumption and ammonia concentrations can be continuously measured and registered. This provides insight into the effectiveness of the system and timely adjustments can be made when necessary.**

By specifically measuring ammonia concentrations before and after the air scrubber, direct insight is gained into the performance of the system. This substantiates the actual emission reduction, essential for compliance with increasingly stringent environmental and health standards.
The measurement data also form a valuable basis for inspections, audits and optimisations.

Inno+ thus offers a transparent and demonstrable way to monitor the operation of air scrubbing systems and supports efficient management and maintenance. This contributes to lower operational costs and stable management.



## The right certification

**In case of business development, a permit process is often unavoidable. When an air scrubber is made mandatory, governments usually require the system to meet specific conditions - including recognised certification.**

The required certifications vary from country to country, as each country has its own regulations and standards on environmental protection and air purification. Not only the design of the air scrubber must meet these requirements, the operation, maintenance and correct recording of measurement data also play a crucial role.

Our systems therefore meet the requirements applicable in the Netherlands, Belgium, Germany, Denmark and the United Kingdom. We therefore support you not only technically, but also in the smooth running of your licensing process.

Inno+ offers an extensive range of air scrubber systems that are provided with the correct certifications, including DLG and OW numbers.

## Make your emission reduction verifiable and future-proof.

**Contact Inno+ for tailor-made advice and a solution that meets all requirements.**

Maasbreeseweg 50
5981 NB Panningen
+31(0)77 – 4657360

info@inno-plussystems.com
inno-plussystems.com