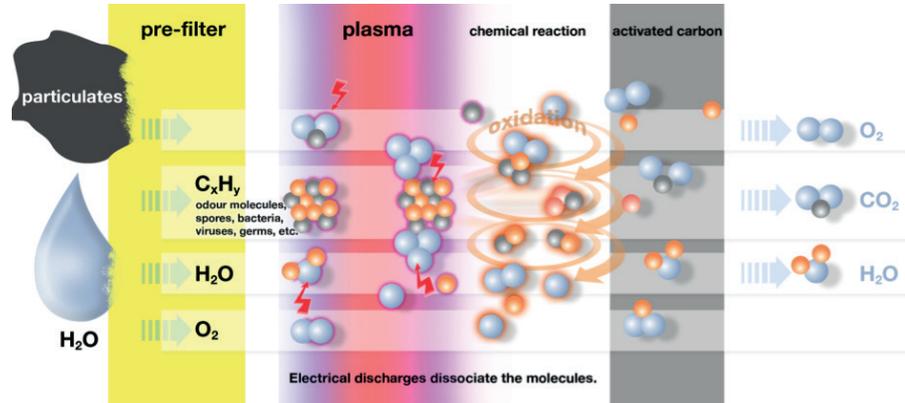


A plasma-chemical process using open plasma (DBD - dielectric barrier discharge) at normal pressures for gas purification, air treatment, molecular, chemical and biological contaminants, odour removal with additional activated carbon storage reactor.

SCHEMATIC DIAGRAM OF A PLASMANORM INSTALLATION



APPLICATIONS

This technology was developed for the removal of odours in the food industry - and purifies the air at the same time. General description: the plasmaNorm® gas purification technology (non-thermal, plasma-chemical process with open, atmospheric, i.e. normal pressure conditions) is used for environment-friendly treatment of incoming, recirculating and exhaust air. It removes minute gaseous organic carbon compounds (volatile organic compounds, e.g. solvents) such as odour molecules, viruses, germs, bacteria, spores, etc. Solids and aerosols are pre-separated in a suitable pre-filter.

plasmaNorm® technology comprises several active stages:

1. PRE-SEPARATION

In the pre-separation stage, the raw gas is treated to remove solids, aerosols and minute particles. Suitable filter media such as bag filters or in the case of moist or greasy exhaust air e.g. hydro-Sorp® separator (see separate datasheet), are selected and installed to best suit the airborne substances requiring removal.

2. REACTION PROCESSES AND OXIDATION

After pre-filtering the air, a plasma-assisted reaction and oxidation process takes place. As the air streams across a high voltage discharge source (open, atmospheric plasma) the majority of atoms are ionised such that electrons are liberated and move freely in the gas where they participate in physical impact reactions resulting in dissociation of molecules. The pre-filtered raw gas is also enriched with atomic oxygen (O[•]) and hydroxyls (OH-radicals). The diffusion of the gaseous substances with high energy ions, oxygen and OH radicals triggers a chemical oxidation process in which the carbon compounds are either stimulated to enter reactions or undergo direct chemical reactions with the oxygen atoms or other radicals.

3. SORPAN® ACTIVATED CARBON STORAGE REACTOR

Any compounds not yet oxidised are adsorbed in the downstream activated carbon where they are retained and finally oxidised. In the plasmaNorm® process, the activated carbon acts as a catalytic storage reactor in which, among other effects, ozone reverts to atmospheric oxygen. The oxygen radicals and other plasma species present then burn off the molecular or atomically occupied activated carbon pores, continuously regenerating the activated carbon during operation. **continues on page 2...**

TECHNICAL DETAILS:

Areas of application:

- Odour removal
- Disinfection
- Reduction of viruses, germs and bacteria
- Degreasing
- Removal of chloroanisoles
- Reduction of gaseous, organic carbon compounds (VOCs - volatile organic compounds)

Process:

- Exhaust and incoming air purification
- Recirculating air purification (possibly with additional components)

Dimensions:

Depend on system, air volume and degree of pollution

Air volumes range:

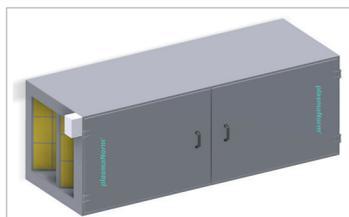
From 350 m³/h to 60,000 m³/h depending upon system

Efficiency:

Up to 99.7 % if required



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Further Information: www.plasmaNorm.de



One of the process's outstanding features is the low cost and extremely long life of the activated carbon, which – as described – is subject to a process of continuous self-regeneration. Filters do not need changing: replacing the activated carbon is the exception. The high-tech plasma process was developed in collaboration with prominent universities and institutes.

EFFICIENCY – EFFECTIVENESS - SUSTAINABILITY AND RESOURCE SAVING

A case study of plasmaNorm in action: a major German slaughterhouse and meat processing facility previously required 2,000 kg activated carbon every six weeks to remove the odours from a convenience product production line. The introduction of plasmaNorm® technology in 2006 with 400 kg activated carbon, replaced for the first time in 2013, saved the operation more than 600 t activated carbon during that period, which at a price of 10 €/kg represents a total cost saving of more than € 6 million. That's how we define efficiency, effectiveness and sustainability in air purification.

TECHNICAL REQUIREMENTS

The use of standard plasmaNorm® technology requires a maximum exhaust air inlet temperature of 40 °C for the technology to function as designed. In the event of higher temperatures, the exhaust air has to be pre-cooled. Under normal circumstances kitchen exhaust air has a temperature of 28 °C and a relative humidity of 45%.

TECHNICAL DETAILS:

System components:

- hydroSorp® pre-filter
- plasmaNorm® electrodes
- EC fan
- sorPan® natural or artificial activated carbon

Optional additional components:

- cycloStream® extraction hoods
- flameSafe pre-filter
- ionCollect electrostatic precipitator
- Heat exchanger

EXAMPLES OF APPLICATION AREAS

plasmaNorm® is used where conventional processes fail, do not achieve the expected/required results, are too expensive to buy or have excessively high running costs.

As a result of continuous further development, application areas are many and include:

Domestic households:

e.g. removal of cigarette odour, animal odours, chloroanisoles, fungus/mould, viruses, toilet odours

Small businesses:

e. g. removal of odours in hairdressers, nail studios, toilets, incontinence rooms in nursing homes for the elderly

Restaurants:

Filtering of aerosols, removal of odours arising from kitchen, cooking and frying processes, toilets, smokers' rooms, heat recuperation (additional components)

Industry:

Removal of odours from industrial food production, animal slaughter processes, chemical compounds, heat recuperation (additional components)

and many more.



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