ACTOPENTIN®
Biofiltration

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ACTOPENTIN® biofiltration
Efficient cleaning of polluted air streams

Biofiltration is ideally suited for removal of organic solvents and unwanted odors from polluted air streams. Conventional biomasses are compositions of wooden chips, bark, compost and other fibrous, all natural components. These filter masses have significant disadvantages, compared to the newly developed ACTOPENTIN® biofilter mass, which is also composed from only natural ingredients.

Air cleaning with ACTOPENTIN® biofiltration means:

More than 5 times higher cleaning efficiency

Substantially lower space requirements

Cost savings in both investment and operation

No need for sophisticated system control and instrumentation

No expensive water processing and irrigation subsystems

Modular construction, integrated in standard containers

Low maintenance and high design life span of more than 5 years

Covered by patents worldwide

Highly recognized system with versatile use:

The process and related biomass composition have been developed in close cooperation with experts from a leading University in Microbiology; this expertise has resulted in a very competitive and enhanced system unique to the global market.

The research and long term field testing have resulted in formal acknowledgment of this technology by the European Union, who has awarded a large technology transfer project for market introduction of ACTOPENTIN® biofilters in industrial, municipal and agricultural applications. This contract is also financially subsidized to allow for quick vertical market integration and wide coverage of the European marketplace.

ACTOPENTIN® technology

The high degree of air and water pollution has led governments to strictly regulate all such emissions. Air filtration is therefore used in many applications, mostly based on mechanical (screen) filtering or by means of activated carbon or coke filtration. The main problem of this approach is in the fact, that the base components must be disposed off in special waste dumps, as they become contaminated themselves over their life time span. This solution is not acceptable for environmental, technological and economic reasons.

Conventional biomasses are used widespread, their main application is in odor removal or cleaning air streams from very low concentrations of organic solvents. The open construction of such filters and their low efficiency lead to large filter sizes, while the physical properties of the biological ingredients are the reasons for short life cycles and high maintenance requirements.

The goal was to develop a highly efficient filter, with extended applications and still only all natural ingredients - the ACTOPENTIN® biofilter mass. Based on processed grape seeds with mineral additives, this biomass features an ideal living environment for the microorganisms, who reduce pollutants and remove unwanted odors. Depending on air flow volume, concentration and type of pollutants and system design parameters, efficiency is close to 100%; the bio-degradation transforms pollution into H_2O and CO_2 - there are no hazardous components left when the biomass has to be disposed off after its life time.

Two step process:
The polluted air stream is flowing through the biomass, depending on system design and functional parameters. In a first step, pollutants are physically retained in the moisture within the biomass; this moisture is an important part to create the ideal life environment for the microorganisms. After this absorption, the bio-degradation process transforms pollutants and allows the organisms to grow in population; hereby only those microorganisms show high growth, who are best suited to transform the particular pollutants.

ACTOPENTIN® biofilter mass:
Basically, this is the core of the system and may be viewed as a biological and physical buffer. Its internal structure must be stable and should allow the air stream to flow through with minimum resistance; otherwise it should maintain internal structure with no gaps, which may allow crude air to go through without being cleaned.

Moisture, the right temperature range, correct pH values and existence of pollutants are prerequisites for the microorganisms to survive. Only the ACTOPENTIN® biomass features optimum internal properties to maintain this environment. It balances the internal moisture as well as the pH value, acid conditions are reliably avoided; if there are no pollutants in the air stream, nutrition for the microorganisms is supplied from the grape seeds contents of oleins.

Moisture is brought to the biomass by a simple irrigation system, while temperature is maintained by either the polluted air stream itself or additional heating or cooling equipment.

All ingredients are natural, such as grape seeds, porous stone and mineral additives. After the life cycle is expended, the biomass may be composted and used as a light fertilizer.

ACTOPENTIN® systems

To fully utilize the many advantages of the ACTOPENTIN® system, not only the biomass itself, but all system components must fulfill the highest technological standards. High reliability and operational safety can not be achieved with open bed filters, therefore ACTOPENTIN® systems are only available in closed system designs.

The polluted air stream is derived from existing air vents and ducts, which should be optimized for the particular application, as the air volume is a main parameter for system size and cost. Reducing the air volume always results in smaller and less costly filter.

Inflow temperature is measured and controlled (heating, cooling) to stay within specified limits. Moisture is applied to the biomass by means of internal irrigation equipment, the air flow itself transports moisture into the filter mass. Moisture control is performed by measurement at the filter outlet coupled with a process controller. An additional dust filter may be required to avoid plugging of the biofilter mass by small particulate.

The system components are built into standard size containers, made from plastic materials or stainless steel, depending on the application. Each containers is isolated. The biomass is equipped with differential pressure measurement to monitor filter condition. Although there are only minimal maintenance requirements, containers are equipped with manholes to inspect internal parts.

Major advantages of ACTOPENTIN® biofliters are:

Long service life and low maintenance

Minimum life time is in excess of five years, while periodic maintenance is not required; preventive maintenance inspections may be done at annual intervals only.

Low differential pressure

Compared to conventional systems, ACTOPENTIN® features only about 50% of normal pressure drop, thus contributing to lower operating cost.

Compact construction

Standardized modules allow simple unit design and construction; the closed design contributes toward the high efficiency and reliability of the systems.

Extended operating range

While operating temperature may vary between 50 - 160 °F, the air stream can be modulated from 10 - 100% of maximum flow rate desired without effect on the system functionality and cleaning efficiency. This is a turn down ratio of 10 to 1.

Short adaptation time

Microbiological process startup is performed in very minimal time frame; discontinued operation of the filter does not create a startup problem. Variations in air speed through the biofilter and/or pollutant concentration are balanced by the biofilter mass.

BIOFILTER COMPARISON

	Conventional biofilter	ACTOPENTIN® biofilter
Composition	heather, fibrous peat, compost, bark products, coconut fibers, wood chips	proprietary and patented mixture of grape seeds, minerals and other additives
Internal structure	not homogenous, internal changes during service life	constant and stable, no changes during service life
Operational safety	depending on many factors	established and fully reproducible
Adaptation time	8 - 25 weeks	2 - 8 weeks
Temperature range	20 - 40 deg C 70 - 100 deg F	10 - 70 deg C 50 - 160 deg F
Filter resistance	800 - 2,000 Pa	100 - 600 Pa (0.4 - 2.5 in/H_2O)
Moisture	low moisture must be kept fairly constant	high moisture large range variations permissible
pH value	hyperacidity may occur due to internal generation of sulfuric or organic acids	acids and bases are buffered and balanced within the biomass
Dry out effects	lasting severe damage to biomass	no effects after re-moistening
Condition	added water forms sludge	no sludge formation even after extreme over-moistening
Maintenance	dig up of biomass at least once per year but always after dry out or over-moistening	structure maintained internally, no dig up or other rework required over service life span
Service life	1 - 3 years material use: rot of biomass	5 years min. low material use of organic components
Summary	- biomass system with low stability - ventilation characteristics change - life time cycle not sufficient - high maintenance and control	- stable and reproducible system - optimized and stable ventilation - high life time cycle - low maintenance and control

ACTOPENTIN® applications

Major applications for biofilters may be found in:

Food processing:	Coffee and cocoa roasting, meat and fish processing, breweries, slaughterhouses, ...
Agriculture:	Livestock breeding, fodder production, ...
Manufacturing industry:	Whenever heavy air pollution and/or odors are generated such as in pulp and paper industry, furniture manufacture, plastics production and processing, petrochemical processing, paint, lacquer and varnish industries, ...
Sewage treatment plants:	of any size and applications (industrial and municipal)

Unwanted odor bearing VOC's are removed with the following efficiencies:

Hydrogen sulfide	(93 - 95%)	Mercaptans	(> 98%)
Ammonia	(90 - 97%)	Carboxylic acids	(95 - 99%)
Ethers	(> 95%)	Amines	(> 97%)

Organic solvents within the following groups may be treated with similar high efficiencies:

Alcohols	Aldehydes
Ketones	Carboxylic acids
Aromatic hydrocarbons	Thioethers
Ethers	Mercaptans
Esters	Amines

Above cleaning rates are typical for average concentrations of pollutants, derived from applications or lab tests within the system specifications. These values may vary from site to site and should give an estimate for the high efficiency of the ACTOPENTIN® biofilters.

ACTOPENTIN®
typical applications and pollutants

1.1. Lacquer production
- solvents, like acetone, methyl isobutyl ketone (MIBK) and other aliphatic ketones, glycol ethers, toluene, xylene, petroleum ethers;
- solvents for degreasing surfaces such chlorinated hydrocarbons

1.2 Breweries
- halogenated hydrocarbons for cleaning and degreasing operations;
- disinfectant compounds, composition can be taken from the safety data sheets;
- odors

1.3 Dairies and cheese production
- ammonia and other ammonium compounds;
- aromatic and aliphatic amine;
- odors.

1.4 Chemical cleanings and large laundries
- cleaning petrol, petroleum ether;
- degreasing agents like chloroform, dichloromethane, 1,1,1-trichloethane, trichloroethylene, tetrachloroethylene.

1.5 Furniture industry
- formaldehyde and other aldehydes as binding material;
- isocyanates as binding material;
- solvent in lacquers and glues, for example methyl isobutyl ketone, acetone, tetrahydrofuran, dioxane
- acrolein and acrylic resin (for example methyl methacrylate)
- styrene, ethyl acetate.

1.6. Large tanneries
- halogenated hydrocarbons for degreasing;
- cresol and naphthalene.

1.7. Heavy industry
- halogenated hydrocarbons
- solvents like acetone, methyl isobutyl ketone (MIBK);
- phenol, cresol;
- mineral oil hydrocarbon as oil fog.

1.8. Sewage plants: in the industry and local plants
- ammonia and other ammonium compounds;
- methane CH_4, hydrogen sulfide H_2S;
- aliphatic and aromatic hydrocarbons;
- halogenated hydrocarbons
- mercaptans

Typical applications - cont'd.

1.9 Livestock breeding
- ammonia and other ammonium compounds;
- amines, mercaptans, aldehydes, disulfides.

1.10 Odors from
-coffee and cocoa roasting establishments
acetaldehyde, amine, greases, s, ammonia, furan, hydrogen sulfide.
-meat and fish processing industries;
-slaughterhouses;
-fodder production.
-rendering plants
aldehyde, alcohol, ester, unsaturated hydrocarbons, ketones and mercaptans.

1.11 Solvent producing and filling as well as processing, for example:
-acetone, toluene, xylene, butanol, ethylene, methyl ethyl ketone, etc.

1.12 Paper mills

1.13 Plastics producing and processing industry

1.14 French fried potatoes and chips factories

1.15 Oil mills
-hexane
-odors.

1.16 Hard paper dryers
-acetone, formaldehyde, cresol, methanol and phenol.

1.17 Latex- coat machine at carpet factories
-formaldehyde, mercaptans, ammonia, amines, styrene, hydrogen sulfide.

1.18 Foundries
- amines, dichlormethane, formaldehyde, ammonia, phenol, acetone, methanol, crack products.

1.19 Mixed manure works
- fermentation and bad smells, organic acids.

1.20 Pharmaceutical industry
- sewage plant: odors, ammonia, sulfur hydrogen;
- fermentation: odors, ammonia.