GAS PHASE FILTRATION SYSTEMS

for
Airborne Molecular Gaseous and Particulate Contamination Removal
resulting in
Corrosion and Odour Control

• Granular and Honeycomb based • Media • Services
The Need for Clean Air...

There is a growing awareness of the threat posed by the deteriorating air quality in the environment today. The deterioration of atmospheric air has mainly two components:

i. Atmospheric Dust and Smoke
ii. Airborne Molecular Contamination (AMC)

Often, the sources of contaminants are found nearby, e.g., a dump yard, a big open drain, heavy traffic, or a polluting industry. Other than ‘outside’ sources, contaminants are also generated within the indoor space, i.e., VOCs, printer, and photocopier’s dust, foul odour of sewage and food odour, etc.

Airborne molecular contamination is a chemical contamination by the vapours of gases like compounds of sulphur (SO₂), nitrogen (NOₓ), chlorine (Cl₂), ammonia (NH₃), mercaptans, formaldehyde, hydrocarbons, and much more. High relative humidity in combination with these corrosive gases forms corrosion elements on electronic circuits, adversely affecting its operation, reliability, and longevity of sensitive electronic process control equipment in industrial control rooms, as well as data centres.

The molecular contamination has become a serious threat to data centres, and server rooms due to the ongoing efforts of miniaturization of electronics and is leading to increased downtime. The cost of downtime because of this corrosion attack is enormous in any mission critical facility and relates directly to the loss of information and revenue. Further, it leads to less efficient processes, additional maintenance, costly repairs, and unplanned downtime. Nowadays, OEMs have also stopped offering annual maintenance contracts for expensive processes, additional maintenance, costly repairs, and unplanned downtime.

Problems due to Contaminated Air

**IT OR TELECOM**

- **Typical Problems:** Frequent Breakdown in Small or Big Data Center/Server Rooms/Miscellaneous Sites
- **Cause:** Corrosion of Electronic/ Electrical Circuits
- **Gases Responsible:** H₂S, SO₂, NOₓ, H₂O₂, Cl₂, NH₃, NOₓ, VOCs

**PETROCHEMICAL & REFINERY**

- **Typical Problems:** Frequent Process Breakdown in SRU, MSQ, DHD, VCR & OMS Control Rooms
- **Cause:** Corrosion of Electronic/ Electrical Circuits
- **Gases Responsible:** Sulphur bearing gases, NOₓ, Cl₂

**FERTILIZER/ CHEMICAL PLANT**

- **Typical Problems:** Frequent Breakdown in Boiler Rooms/DCS/ Switchgear Rooms
- **Cause:** Corrosion of Electronic/ Electrical Circuits
- **Gases Responsible:** NH₃, Cl₂, Acid fumes

**PULP PROCESSING**

- **Typical Problems:** Frequent Breakdown in Pulp Mills/Recovery Boiler/DCS Room/Other Control Rooms
- **Cause:** Corrosion of Electronic/ Electrical Circuits
- **Gases Responsible:** Cl₂, H₂S, NH₃, VOCs

**MUSEUMS & LIBRARIES**

- **Typical Problems:** Degradation of Parchments & Manuscripts
- **Cause:** Harmful contaminated gases in atmosphere
- **Gases Responsible:** SO₂, NOₓ, & VOCs, Harmful acidic gases

**SEWAGE TREATMENT PLANT**

- **Typical Problems:** Foul Odour, Frequent Breakdown of Circuits in Control Rooms/ Switchgear Rooms
- **Cause:** Harmful gases
- **Gases Responsible:** VOCs, H₂S, Cl₂, NH₃, and others

**MORTUARY AUTOPSY ROOMS**

- **Typical Problems:** Foul Odour causing Nausea, Vomiting, Personnel Ill Health
- **Cause:** Solution used to keep the dead bodies
- **Gases Responsible:** Formaldehyde, VOCs

**ANIMAL RESEARCH LABS**

- **Typical Problems:** Over Ripening, Wastage, Shorter Shelf life
- **Cause:** Excess ethylene in atmosphere
- **Gases Responsible:** Ethylene

**FRUITS & VEGETABLE STORAGE**

- **Typical Problems:**
- **Cause:**

The Solution

Remove the airborne molecular contaminants through the process of chemisorption using Bry-Air Gas Phase Filtration Systems.

www.bryair.com
At Bry-Air, we understand the need for clear air. Bry-Air is the only company in India providing the complete spectrum of Gas Phase Filtration products and services from pre-installation assessment of environment to the post-installation evaluation of remaining media life and AMC of equipment. We specialise in Gas Phase Filtration solutions, and our solutions are backed by decades of research and development, state-of-the-art manufacturing facilities and world-class R&D and testing lab technology and systems. We have filed 11 international patent applications for desiccant based honeycomb chemical filter technology.

We are the trusted partners of leading companies in wide variety of industries. Bry-Air Gas Phase Filtration Systems (GPF) are used in business sectors like pulp and paper, petrochemical and refinery, media and broadcasting, telecommunication, hospitals and healthcare, banking and financial Institutions, IT and ITES, and much more. Our efforts are driven by the needs of our customers, and we design solutions to meet their expectations with the aim of making operations more sustainable, reliable, energy efficient and productive. The scope of applications is unlimited and ranges from corrosion prevention in data centres, process control rooms in various industrial sectors, to removing foul odours and harmful gases in human occupied spaces.

As a global solution provider of air and gas purification systems for corrosion and odour control, Bry-Air understands that purified air is a mandate for every industry/commercial organization. The infiltration of airborne molecular contaminants inside the control room is causing corrosion in electronic/electric circuits.

Bry-Air, today, is the name recognised as one stop shop for Gas Phase Filtration products and services.
Gas Phase Filtration Systems
BPU series

Granular Media Based Deep/Thin Bed Systems
Granular media based deep/thin bed systems are suitable for applications where a higher concentration of corrosive gases are prevalent in the environment. Such environments are near to oil refineries, pulp processing areas, chemical plants, substations/switchyards and many others. These systems are specially made for heavy usage and provide high media volume holding capacity and air-to-media ratios. They are widely used in petrochemical plants and refineries, chemical and fertilizer plants, pulp and paper mills, and much more. Since this equipment uses modular construction, they can handle high air flow capacities under both indoor and outdoor conditions.

Advantages
- High efficiency and reliability
- Self-contained re-circulatory and fresh air units, offered, both in horizontal and vertical configurations
- Removes both corrosive and odour causing gases and VOCs from air

Unique Features
- Multi-bed design provides flexibility to use variety of media for removal of multiple contaminants
- Confirms and helps meet ISA 71.04-2013 standard of air quality
- UL certified media
- Affirms to all industry standards such as EIL, PDIL, Telecom, TCE, NTPC
- Standard variants available in 850-3400 CMH (500-2000 CFM) and can go to any size of CMH required
- Robust structural, steel frame construction, CNC fabricated and tightly welded structures
- Design flexibility for easy customisation
- Insulated units with double skin construction

Corrosion Rate per yr vs. Equipment Failure
- > 2.0 micron: Inoperative in 0.25-0.5 year
- > 0.6 micron: Intermittent failures in 0.5-1 year
- > 0.4 micron: Inoperative in 2-4 years
- > 0.1 micron: Intermittent failures in 1-2 years
- < 0.1 micron: No failures found
- For electronic equipment, the same can be as high as 0.5 micron per year
- For electrical equipment, corrosion rate has to be below 0.1 micron per year
- For steel or equipment, the same can be as high as 0.5 micron per year

Deep Bed System (Internal view)
Data Center Air Purifier (DAP)

Based on the most advanced Honeycomb Filtration Technology

The Data Center Air Purifier is a self-contained, stand-alone, movable unit that recirculates the air in an enclosed space. The contaminant laden air enters through the bottom grill and passes through multiple beds of patented honeycomb chemical media filters. The harmful corrosive gases are captured and permanently neutralised in the filter by an adsorption and chemisorption process. The purified air then comes out from the top. The Data Center Air Purifier has low energy consumption and noise, and installation is just plug and play. DAP finds its unique usage in big/small server rooms/data centres and small process control rooms where the indoor environment is affected due to various pollutant sites in proximity.

Unique Features

- A self-contained unit
- Combines particulate filters, honeycomb chemical filters to create total clean air solutions
- UL certified honeycomb chemical media filter
- Removes gases such as H₂S, SO₂, NOₓ, Cl₂, NH₃, O₃, HF and all other VOCs
- Helps meet ISA71.04 - 2013 standard in data centres
- Standard variants available in 850-3400 CMH (500-2000 CFM) and engineered above
- Customisation as per the requirement
- Suitable for 125-180 m/sec (400-600 FPM) usages
- Only honeycomb filter with potassium permanganate (KMnO₄) impregnation to cater various gases
- Easy to replace media filter/cassette
- Optimum space utilisation
- Filter cassettes are made up of stainless steel (SS)
- Filters are tested by the ASHRAE 145.2 and ISO 11155-2 standards
- Energy saving due to low-pressure drop

Damages caused by harmful gases in IT Server/Control Rooms

- Increased contact resistance
- Leakage current and short circuits
- Deterioration of circuit lines and connectors
- Mechanical deterioration of printed circuit boards
- Leakage of EMG - shielding

FRP Constructed Body

- Non corrosive
- No leakage current
- Very light weight

Stage I
Pre-Filter (up to 20 micron)

Stage II
After-Filter (5-20 micron)

Stage III
Final-Filter (up to 5 micron)

Stage IV
Honeycomb Chemical Filter

Supply air motor assembly

Impure air inlet with optional manual damper

Data Center Air Purifier (Internal view)
Ethylene Scrubber

Based on the most advanced Honeycomb Filtration Technology

Bry-Air Ethylene Scrubber (BES) is a product which removes excess ethylene in fruits and vegetable storage. It removes ethylene by the process of adsorption and chemisorption in its honeycomb matrix based macroporous chemical filters impregnated with potassium permanganate. Bry-Air Ethylene Scrubber (BES) extends the shelf life of fruits and vegetables, minimizes loss due to over-ripening, rotting, ensures off-season availability and eliminates harmful preservation practices that use Nitrogen and Sulphur gas. Fruits and vegetables thus retain their naturalness and can be ripened as per demand without bearing traces of toxic gases.

Unique Features
- Easily replaceable filter cassettes, without any expertise
- UL certified media for post harvest storage of food and vegetables
- Low footprint
- Energy saving because of low-pressure drop
- Removes ethylene most effectively

Odour Control Unit

Based on the most advanced Honeycomb Filtration Technology

Bry-Air Odour Control unit provides a fresh, clean and odour free environment for human beings. Regular air purifiers can trap common contaminants like dust, pollen and other particulate pollutants. However, Bry-Air Odour Control Unit not only removes particulate pollutants but also effectively and efficiently scrub gaseous pollutants which cause odour and indoor air quality problems. It is successfully eliminating odorous ethylene from animal research labs, mortuaries, sewage pumping stations and other places having a foul smell due to gases released by chemicals used in various processes.

Unique Features
- A self-contained unit
- Standard variants available in 850-3400 CMH (500-2000 CFM)
- Easy to replace media filter/cassette
- Filter cassettes are made up of stainless steel (SS)
- Energy saving due to low-pressure drop
- Filters tested against the ASHRAE 145.2 and ISO 11155-2 std.
- Suitable for 125-180 m/sec (400-600 FPM) usages
- Only honeycomb filter with potassium permanganate (KMnO₄) impregnation
- Can be customised as per requirement

Damage caused by Ethylene

<table>
<thead>
<tr>
<th>Fruits</th>
<th>Ethylene effect on fruits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>Scald</td>
</tr>
<tr>
<td>Grapes</td>
<td>Mold</td>
</tr>
<tr>
<td>Bananas</td>
<td>Decay</td>
</tr>
<tr>
<td>Apricots</td>
<td>Decay</td>
</tr>
<tr>
<td>Peaches</td>
<td>Browning</td>
</tr>
<tr>
<td>Passion Fruit</td>
<td>Shriving and weight loss</td>
</tr>
<tr>
<td>Cherimoyas</td>
<td>Rapid softening</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vegetables</th>
<th>Ethylene effect on vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potatoes</td>
<td>Sprouting</td>
</tr>
<tr>
<td>Onions</td>
<td>Odour, sprouting</td>
</tr>
<tr>
<td>Carrots</td>
<td>Bitterness</td>
</tr>
<tr>
<td>Green Vegetables</td>
<td>Yellowing, loss of green color</td>
</tr>
<tr>
<td>Lettuce</td>
<td>Darksens and turns slimy</td>
</tr>
<tr>
<td>Cabbage</td>
<td>Leaf abscission</td>
</tr>
</tbody>
</table>

Advantages of Odour Control Units
- Hygienic and clean atmosphere
- Increased workforce efficiency
- Easy-to-work locations
- Healthy staff and low absenteeism

Widely used in places near to
- Mortuaries
- Sewage treatment plants
- Open drains
- Foul odour releasing industries such as chemical and rubber

www.bryair.com
Raising the Bar

Bry-Air set a new benchmark in Gas Phase Filtration technology market in 2013 by introducing a game changer - **Formed Honeycomb Chemical Filter** with the advantage of 100% efficiency at the AHR Expo, USA. This breakthrough took us ahead from Granular to Extruded Carbon to Formed Honeycomb Media in Gas Phase Filtration technology. Until now, 11 international patent applications have been filed for this desiccant based honeycomb chemical filter technology.

**Formed v/s Extruded Honeycomb**

Extruded Honeycomb Chemical Filters are mainly limited to active carbon and are fragile. They are limited in size, and also in the amount of impregnates that can be added to the carbon honeycomb, and further limited to the impregnates that can be put onto the honeycomb e.g. carbon honeycombs cannot be impregnated with permanganates. On the other hand, Bry-Air macroporous desiccant formed honeycomb matrix has a high bulk density, very high structural strength and adsorption capacity, and it can be impregnated with permanganates, hydroxides, phosphoric acid, thiosulphate and bicarbonate, and many more and those impregnates are often 3 to 5 times of what can be put on an extruded carbon honeycomb.

**Bry-Air Desiccant Formed Honeycomb Chemical Filter Fits All Applications**

Bry-Air honeycomb technology can be used both in commercial and industrial applications and is ideal for human and hardware health. It removes contaminants and eliminates odour and downtime by eliminating toxic/corrosive gases through the process of adsorption and chemisorption.

Honeycomb Chemical Filter

**DRISORB™ series**

Bry-Air Honeycomb Chemical filter, DRISORB™ series, is an 'in-situ' synthesised/deposited (insoluble metal silicate and activated carbon) macroporous desiccant honeycomb matrix, impregnated with choice of oxidising agents and alkaline solutions. It has high efficiency and reliability. The filter is specially designed for higher airflow, therefore, requires lower surface area and has lower pressure drop.

**Unique Features**

- Bulk density >320.3 Kg/Cu.mtr. (>20 Lbs./Cu.Ft.)
- Honeycomb monolith media available in 1" to 12" depth in standard and custom filter sizes
- Tested in accordance to ASHRAE 145.2 P and ISO 11155-2
- Higher air flow range from 125 - 180 m/s (400-600 FPM)
- 100% efficiency
- Tested by most respectable RTI lab of the USA
- Longer life (higher MTBR)
- Available in combination of various impregnates
- Very low-pressure drop
- Backed by Bry-Air’s cutting-edge state-of-art R&D and testing facilities
- UL certified media

**Advantages of DRISORB™ Filters**

- Optimum choice for places with space constraints
- Impregnation % higher due to its design
- Easy to replace and maintain
Granular Media - BRYSORB™ Series

Bry-Air is the only company in India having vertically integrated manufacturing facility producing gas phase filtration systems and the chemical media. A comprehensive range of granular media (pellets and beads) is manufactured in India. The media is specially designed to safely deliver gas removal effectiveness on a variety of target gaseous contaminants found in industrial applications. BRYSORB™ series is a combination of activated alumina and carbon impregnated with various impregnate chemicals, majorly potassium permanganate (KMnO₄), phosphoric acid (H₃PO₄), and potassium hydroxide (KOH).

Bry-Air is the only company in India having vertically integrated manufacturing facility producing gas phase filtration systems for effective removal of sulphur oxides, hydrogen sulfides, ethylene and aldehydes.

<table>
<thead>
<tr>
<th>Media name</th>
<th>SO₂</th>
<th>NO₂</th>
<th>H₂S</th>
<th>Cl₂</th>
<th>NH₃</th>
<th>HF</th>
<th>O₃</th>
<th>VOCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRYSORB™ 508</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>BRYSORB™ 508</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>BRYSORB™ 515</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>BRYSORB™ 520</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>BRYSORB™ 525</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

A UL certified, activated alumina impregnated with potassium permanganate (KMnO₄) for effective removal of sulphur oxides, hydrogen sulfides, ethylene and aldehydes.

A perfect blend of activated alumina and activated carbon impregnated with potassium hydroxide (KOH) for effective removal of sulphur oxides, hydrogen sulfides, ethylene and aldehydes.

A high-performance chemical media for effective removal of odorous gases such as nitrogen oxide, oxygen, formaldehyde and various VOCs.

A special grade activated carbon impregnated with phosphoric acid (H₃PO₄) for effective removal of ammonia (NH₃).

Atmospheric Corrosivity Monitor (ACM)

Air Quality Assessments

ACM lets you continuously monitor the environment in real-time to help you meet ISA 71.04-2013 standard of corrosivity of the environment and ensure the attention your costly system needs. Bry-Air’s ACM measures the corrosion reactivity levels of airborne gaseous contaminants, room temperature, RH and optionally the differential pressure, to give the complete corrosion parameters at any Data Center, Server Room and Control Room. It is a device that can be easily deployed in a confined space feeding you the results in real-time and assisting you to take corrective actions thereof. The device measures humidity, temperature, and the corrosive attack on two replaceable copper and silver sensors. The information collected can be stored in its internal memory/SD card or fed into another system. The device uses quartz crystal microbalance methodology to measure the corrosion of metal due to reactions with the environment.

Corrosivity Levels of Environment as per ISA 71.04 - 2013 Standard

<table>
<thead>
<tr>
<th>Class</th>
<th>Severity Level</th>
<th>Cu/Ag Reactivity Rate/Month</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Mild</td>
<td>&lt;300 A/Cu &lt;200 A/Ag</td>
<td>An environment sufficiently well-controlled such that corrosion is not a factor in determining equipment reliability.</td>
</tr>
<tr>
<td>G2</td>
<td>Moderate</td>
<td>&lt;1000 A</td>
<td>An environment in which the effects of corrosion are measurable and corrosion may be a factor in determining equipment reliability.</td>
</tr>
<tr>
<td>G3</td>
<td>Harsh</td>
<td>&lt;2000 A</td>
<td>An environment in which only specially designed and packaged equipment would be expected to survive. Specifications for equipment in this class are a matter of negotiation between user and supplier.</td>
</tr>
<tr>
<td>GX</td>
<td>Severe</td>
<td>&gt;2000 A</td>
<td>An environment in which there is a high probability that corrosive attack will occur. These harsh levels should prompt further evaluation resulting in environmental controls or specially designed and packaged equipment.</td>
</tr>
</tbody>
</table>

Unique Features

- Accuracy better than 1%
- Inbuilt temperature & humidity sensor for fluctuations monitoring
- Loss-free transmission on to existing Building Management Systems (BMS) through digital RS485 port or analogue 4-20 mA output
- Sensor life up to 4000 A
- PC based software for configuration and data.
- Real-time data view and stored in internal memory and SD card
- Copper and silver sensors
- Incremental and cumulative corrosion values
- Differential pressure transmitter input or optional built-in pressure sensor
- Four programmable 4-20 mA analogue outputs, optional alarm relay outputs

www.bryair.com
Corrosion Classification Coupons

Air Quality Assessments

The Corrosion Classification Coupon (CCC) provides a direct, quantitative measure of the overall corrosion potential of an environment.

CCC allows the customer to assess control room/server room air quality as well as evaluate the performance of the Gas Phase Filtration Systems in post installation tests. It does not require any electrical connection or calibration and is very simple to use. CCC is placed at one or multiple locations for a period of 1 to 30 days where the environmental corrosivity rate is to be measured. The coupon is then tested at Bry-Air GPF laboratories. The thickness of the corrosion product on the strips is measured to determine the room environmental corrosion classification as per ISA 71.04-2013 standard. Also, identification of the type of corrosion product is also established, e.g. sulphides, chlorides, oxides, etc. Based on the results the environment is classified as G1, G2, G3 and G4 as per ISA 71.04-2013 classifications. The results of the CCC tests are then used to design an optimal gas phase filtration system.

Laboyratory and Technical Support Services

Bry-Air offers a comprehensive technical and service support to its customers. With offices across the country, we are never far away from you. We have the reach and network to respond quickly to any issues you may have - either remotely or on-site, as necessary.

Chemical Media Residual Life Testing Facility

Approved by Ministry of Science and Technology, our labs successfully provide in-house testing % of Remaining Media Life (RML) for both impregnated granular media and honeycomb chemical filter. Test reports are used to determine various critical factors such as media/filter replacement frequency and periodicity, variation in surrounding atmosphere toxicity and media/filter inventory. Bry-Air is the only company in India which has the state-of-art labs for in-house performance testing as per following ASHRAE standards:

- ASHRAE 145.1 Laboratory Test Method for Assessing the Performance of Gas-Phase Air-Cleaning Systems: Loose Granular Media
- ASHRAE 145.2 Laboratory Test Method for Assessing the performance of Gas-Phase Air-Cleaning Systems: Air Cleaning Devices

Other Laboratory Services

- We conduct tests on the samples taken at specified periodicity, usually 3-4 months, in a year. The results are then analysed to develop various media/filter consumption trends for future years.
- Corrosion testing through Corrosion Classification Coupon (CCC) and Atmospheric Corrosion Monitor (ACM)
- CCC testing and report generation
- Trained BRYCARE service team are available at site in 24 hours across all metros

Examples of Granular Media/Honeycomb Chemical Filter Residual Life Testing in Various Locations

Fig. 1 Typical example of residual life of chemical media placed in urban area

Fig. 2 Typical example of residual life of chemical media placed in industrial zone
At Pahwa group, innovations based on effective and efficient research and development are not only the heart of our business but also a significant growth engine. The group has filed 108 international patent applications for 12 new technologies, out of which 34 has already been granted/allowed. The group has 8 state-of-the-art test facilities.

Bry-Air maintains a great emphasis to quality control and R&D to meet the increasing demand for clean air. We are a focussed R&D team on current markets and continually seek to develop existing materials, innovative product line and identify new media to meet short-term changes as they arise in the marketplace. Bry-Air’s R&D facilities are government recognised, and Bry-Air’s state-of-art laboratory for granular media/honeycomb chemical filter testing is one of its kinds in the world. Bry-Air has two test labs, for gas phase filtration, equipped with world-class technology and systems, capable of testing the performance of both, impregnated honeycomb chemical filter as well as impregnated granular media.

Some of our Prestigious Customers

... and many more