Preventing Breakdown of Datacentres in Chemical Industry

The focus in this article will be how gaseous contamination causes breakdown in Datacentres and the cure (removal).

The Indian chemical industry boasts of being Asia's third-largest industry, and holds the sixth rank globally in terms of volume. Growing at an average rate of 12.5 per cent, the specialty chemical segment is projected to register considerable growth while the commodity and bulk chemicals segment is expected to witness a comparatively slower growth.

Comprising basic, specialty and knowledge chemicals, the industry caters to a wide range of end-user industries producing various commodities such as pharmaceuticals, fertilisers, textiles, plastic, polymers, agrochemicals, and paints and dyes, among others.

The industry has earned global repute as a manufacturer of fine chemicals on the back of strong R&D activities from a producer of basic chemicals. Thus, the Indian manufacturers have not only to be aware of global trends, viz, Shale gas developments in North America, major non-oil and gas diversification drives in the Middle East, expanding chemical capacity in China, etc, to plan their strategy for times to come but also must shore up their infrastructure to ensure there are no outages and breakdowns specially in the server rooms and datacentres as most of the processes in the chemical industry are IT driven.

Contamination Control in Datacentres

Almost every big chemical company processes thousands of tons of material in a day which means tons of material moving in and out of the plant in a day.

Much of that movement is monitored using IT. When trucks carrying raw materials enter the plant, weighbridges weigh them and generate a logistic invoice. Similarly, trucks on the way out loaded with finished goods also need an invoice. With hundreds of trucks entering and exiting the plants every day, it's a lot of IT-dependant invoice creation.

Sometimes during peak hours, systems generate almost an invoice a minute. So if the system goes down, it results in production being shutdown, piling up of invoices which leads to a whole host of other problems.

Outages and breakdowns take a painful toll on bottom lines and reputations.

Challenges of Datacentres

IT operations are a crucial aspect of most organizational operations and more so in process driven industries as the chemical industry. One of the main concerns which process industries face is business continuity; companies rely on their information systems to run their operations. It is necessary to provide a reliable infrastructure for IT operations, in order to minimize any chance of disruption.

Many datacentres may have harmful environment arising from infiltration of outdoor particulate or gaseous contaminants. They are more prone if, the offices are situated near to landfill sites, sewerage/drains, high density traffic, process industries, etc. Infiltration of these gaseous contaminants can lead to electronic corrosion, which can result in increased downtime, low productivity, electronic equipment disturbance and failure.

Protecting the electronic equipment data processing centres from any potential environmental threat is a vital step for a datacentre manager. Even extremely low levels of corrosive gases in datacentres can create costly complications, downtime, a non-compliance of electronic warranty specifications, failure of electronic components and sporadic circuit

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Figure 1 - Datacentre

failure, leading to incorrect and lost data in datacentres.

After the introduction of "lead free" law, such as EU directive "on the restriction of the use of certain hazardous substance" ROHS, manufacturers have replaced lead with other substances which are more susceptible to electronic corrosion. As a result, replacing damaged electronic components due to micro corrosion can substantially increase a datacentre's maintenance costs. Due to increasing number of failures where lead-free materials are used electronic manufacturers have started asking for ISA GI Class environment for warranty compliance as described by the International Society of Automation (ISA) Standard 71.04 - 1985

For efficient working of datacentres, datacentre managers have to overcome various operational challenges such as:

- Control of gaseous contamination, which is one of the major cause for electronic corrosion and hardware failures in datacentres (as per ASHRAE white paper by TC 9.9 committee).
- To maintain the severity level of G1 as per ISA 71.04 – 2013 Standard to avoid electronic corrosion.
- To design and equip datacentres with latest energy-efficient solutions in order to reduce power costs.

Types of Contaminants

Contamination can be broadly classified in two parts:

1) Particulate Contamination, and

2) Gas Phase Contamination

While the size of particulate contaminants is up to 0.1 microns, which can be removed by using particulate filters; gas phase contaminants are usually much smaller.

Gaseous Contamination

Sulphur-bearing gases, such as sulphur dioxide (SO_2) and hydrogen sulphide (H_2S) are the most common gases causing corrosion of electronic equipment. SO_2 and H_2S alone are not very corrosive to silver or copper but the combination of these gases with gases such as NO_2 and/or ozone are very corrosive. The corrosion rate of copper is a strong function of relative humidity, while the corrosion rate of silver has lesser dependence on humidity.

Effects of Gaseous Contamination

A) Copper creep corrosion on printed circuit boards

Corrosion of copper platting to copper sulphide on PCBs and creeping of same. It leads to:

- Electrically shorting adjacent circuit-board features.

B) Corrosion of silver termination in miniature surface-mounted components

- Corrosion of silver termination to silver sulphide which leads to loss of silver metallization – eventual open circuiting of components such as resistors.

How to measure Corrosion - Reactive Monitoring

A low-cost, simple approach to monitoring the air quality in a datacentre is to expose copper and silver foil coupons in the datacentre for 30 days followed by coulometric reduction analysis in a laboratory to determine the thickness of the corrosion products on the metal coupons. Corrosion levels are defined as G1, G2, G3 & G4 with G4 being severe and G1 being mild.

How to create acceptable gaseous levels in Datacentres – Solution is Dry Scrubbers (Gas Phase Filtration)

In dry scrubbers the contaminated air is passed thru adsorbent in granular form, impregnated with active chemicals to adsorb the unwanted gases and then neutralize/oxidize the same thru chemical reaction.

The chemical in the filter gets consumed over time as it reacts with gases which are cleaned through this reaction. Till date, chemical filtration was being done by granular or pelletized media which causes substantial pressure drop hence requiring greater fan power leading to more power consumption for same work done.

While effective in controlling the desired levels of corrosive gases in Datacentres,

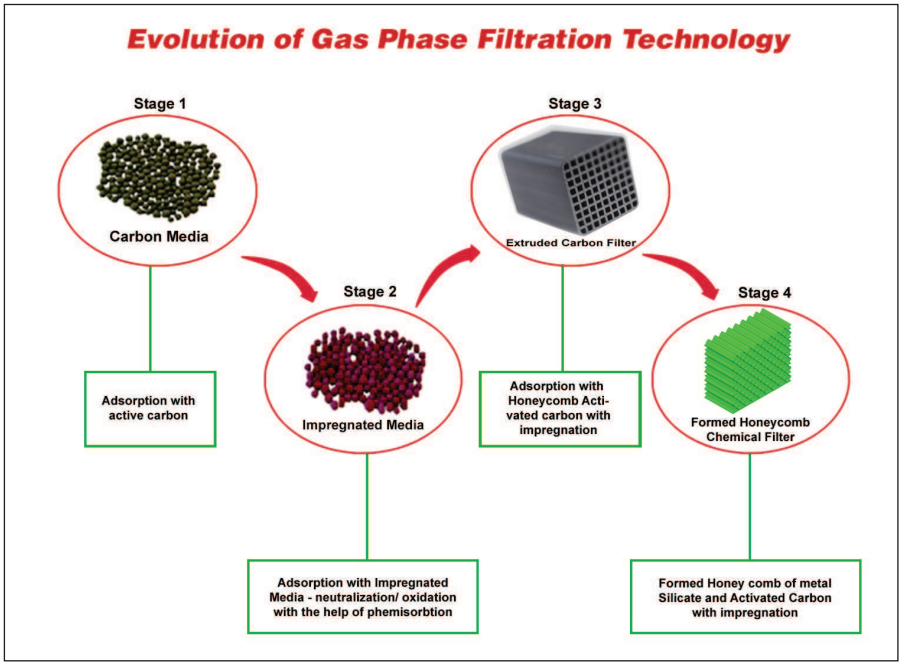

Figure 2 : Evolution of Gas Phase Filtration technologies

limitations of these granular/pelletised media based systems are:

a) Large footprints taking expensive commercial space.

b) Bulky, difficult to install in multistory locations.

c) High power consumption due to greater pressure drop.

d) Difficult to replace consumed media due to general level of cleanliness required in Datacentres.

Recent Developments in Gas Phase Filtration:

Limitation of using granular based dry scrubbers in commercial installations led to development of technologies allowing adsorbtion media in Honeycomb matrix to be impregnated with active chemical in microporous of the substrate. This new technology can remove contaminants gases, odoir elements or volatile organic compounds more efficiently and effectively from air supply stream.

These Honeycomb matrix media/filters provide:

- Largest amount of impregnated chemical (typical 15% for $KMnO_4$) for the chemical reaction,
- Maximum efficiency for a given physical size and geometry of the media matrix.
- Air flows through the Honeycomb matrix are typically at 400 to 600 fpm (2 to 3 mtrs/sec) unlike the granular media bed at 80 to 120 fpm (0.4 to 0.6 mtrs/sec).
- Lower foot print.

In summary, datacentre equipment should be protected from corrosion by keeping the relative humidity below 60% and by limiting the particulate and gaseous contamination concentration to levels at which the copper rate is less than 300 Å per month and silver corrosion rate is less than 200 Å per month.

To help better understanding of the various technologies available for gas phase filtration, Figure 2 gives snapshot of Evolution of Gas Phase Filtration technologies.

Figure 3 : Datacentre Air Purifiers

Specially designed Datacentre Air Purifiers incorporating the revolutionary Honeycomb Chemical Filter are now available which not only reduces the size of the equipment but also increases its efficiency. ◘