Air Emission & Control Measures in "Pharmaceutical Industry"

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SPEAKER BIO

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Alembic Pharmaceuticals Limited

Touching Lives over 100 years…

Corporate overview

www.alembicpharmaceuticals.com

Alembic Pharmaceuticals Limited

Established in 1907
Location : Vadodara, Gujarat, India, having 9 facilities
Consolidated annual revenue above USD 737 million
Listed on Stock Exchanges (BSE & NSE); approx. market cap of USD 2.48 Billion*

Branded Formulations

- Established across 17 therapeutic segments
- Leaders in Macrolides
- 5000+ sales force & marketing team

Global Generics

- Presence across North America, Europe, APAC, LatAm, MENA
- Market specific Products & Strategy
- Growing at 15% CAGR for last 5 years

Active Ingredients

- Leading supplier of generic APIs globally
- Customers include generic & innovator companies
- Offering 100+ APIs

AGENDA

- VOC Emission and Control
- Fugitive Dust Emission Control
- Stack Emission Control
- Quantification of VOCs
- Emission Monitoring
- Emission Standards for Pharma Industry

VOC Emission and Control

VOC and Its Types Of Emission

- **VOC (Volatile Organic Compounds)** are organic chemicals that have a high vapour pressure at room temperature. In industrial settings, all solvents contribute to VOCs but there could be other sources.
- **Typical sources of VOC emission is categorized in two types:**
  - Point Source (Vent) Emission
  - Fugitive Emission

Sources Of VOC Emission

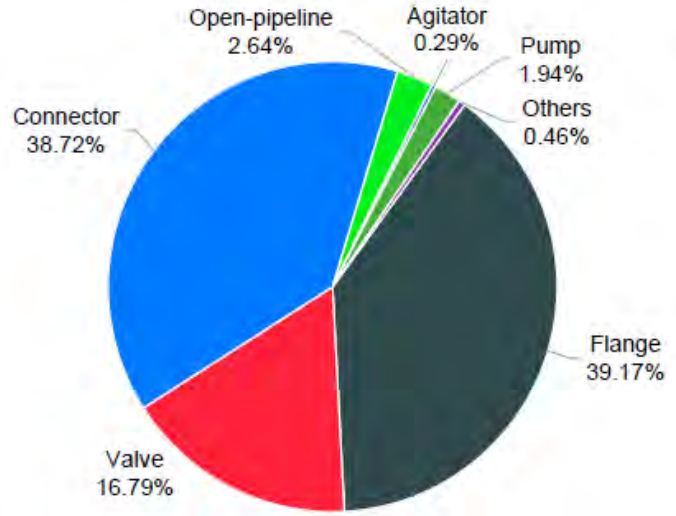
1. VOC Emission from Point sources :

Any open-ended pipe or stack that is vented to the atmosphere either directly, through a vacuum producing system, or a tank associated with the regulated equipment is known as process vent.

- Process vents are associated with:
- Distillation
- Fractionation
- Thin-film evaporation
- Solvent extraction

2. Fugitive VOC Emission

- Fugitive sources are not intended vents but are spread over many abnormal activities.
- Fugitive VOC emissions are found to be caused by leaks from pipelines, centrifugal separation, filtration, vacuum, solvent recovery, and drying equipment; of these, pipelines are found to be particularly significant.



Contribution of different types of equipment to leaks

VOC Emission Control from Point Sources

- **Acid scrubber**
  - An acid scrubber works at low pH levels
  - Used for control of

    NH_3, Amines, Alkali reacting components
- **Alkaline scrubber**
  - Scrubbing media is alkaline, mostly caustic soda
  - Used for control of

    HCl, SO_2, Cl_2, Phenols, Organic acids
- **Venturi scrubber**
  - Additional turbulence is generated in these scrubbers by high gas velocity, for higher efficiency.
  - Used when OEL values are low or fine dust need to be controlled.

Acid / Alkaline Scrubber

Venturi Scrubber

Fugitive VOC Emission Control Measures

- Creating negative draft and connecting the vacuum system to scrubber.
- Use of chilling media (condensers)
- Close handling of the chemicals. Use of equalization lines
- Use of breather valves
- Use of Barrel pumps for liquid charging
- Use of Double mechanical seals
- PM of all material transferring equipment
- Use of LDAR technique

Reactor vent connected with double condenser

Fugitive Dust Emission Control

Fugitive dust emission control

- **AHU (Air Handling Unit)**
  - AHU regulates air quality mostly though air-conditioning (HVAC) system.
  - Number of air changes should be decided based on OEL values of chemicals.
- **HEPA Filter**
  - HEPA (high-efficiency particulate air) filters capture pollen, dirt, dust, moisture, bacteria , virus, and submicron liquid aerosol.
- **PTS System for Charging of Solid materials**
  - Powder Transmission System (PTS) not only stops fugitive dust emission but also effective control against dust explosion.
  - Can dispense both dry and wet powders and granules in a safe and contained manner.
- **Dust Collectors**
  - Normally use bag filters, with or without cyclonic action

PTS

Dust collector

Stack Emission Control

Stack Emission Management in Boilers

- **Wet Scrubber**
  - Normally water is used for capturing dust or acidic gases
  - Has associated problems of corrosion, choking, disposal of high TDS media, solid disposal
- **Bag Filter**
  - Used for control of particulate matter
- **Lime injunction**
  - Used for control of SO2 in flue gases
  - Lime powder can be injected after furnace, followed by bag-filter, or
  - It can be mixed with fuel (coal) at the feed

Wet scrubber – ventury type

Bag Filters

Stack Emission Management in Boilers

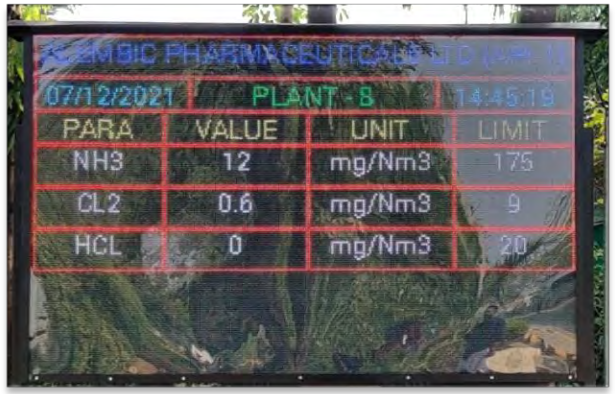
- **Control Through height (dispersion)**
- Adequate height (minimum 30 meters) is mandatorily required for Boiler and DG stack
- If the capacity of boiler is high or SO2 load is high, height is to be calculated with formula H=14Q0.3, where Q is SO2 load in kg/hr. (As per CPCB guidelines)

DG Set stack

Boiler Stack

Online Emission monitoring

- **Continuous Emission Monitoring Systems (CEMS)**
- To monitor the emission gases (Gas Flow, NOX, PM, Pressure, SO2, Temperature) in real time.
- On line Data recorded and transmitted to SPCB / CPCB office server.
- Mandatory for some category of industries

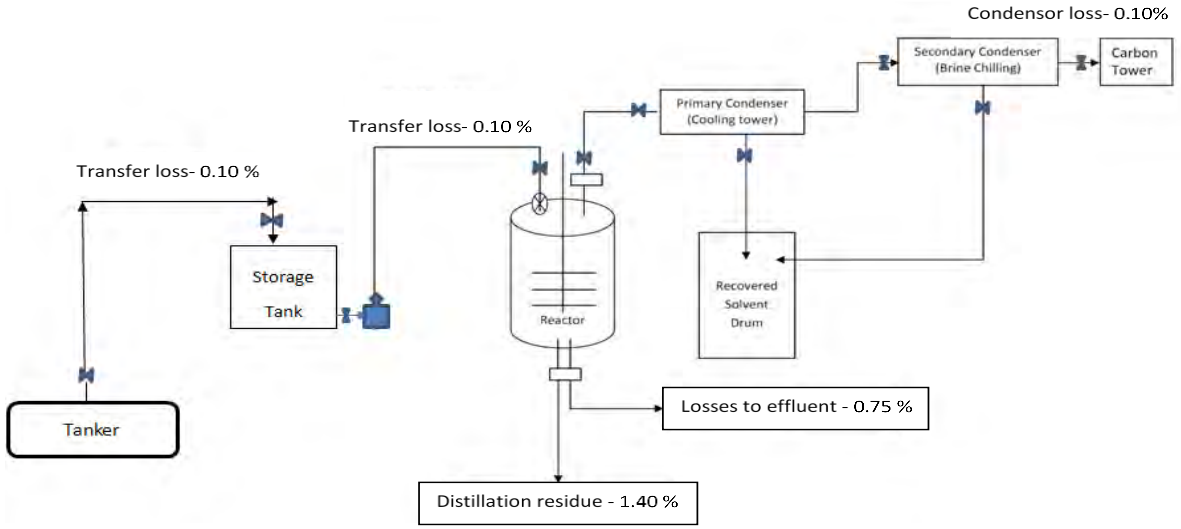


CEMS System

Quantification of VOCs

Quantification of VOCs

- **Quantification of VOCs is not a easy task. We can adopt two methods for quantification:**
  - Mass balance
  - Actual Measurement (Given in next section)
- **Solvent losses in any particular area need to be measured. These losses can be from**:
  1. Material transfer
  2. Losses from glands/ flanges
  3. Vents/ centrifuge openings
  4. Drums/ storage tanks/ intermediate vessels
  5. Driers
- Cumulative losses can be divided with total room volume and air changes to arrive at a theoretical VOC value.



Typical points of solvent losses

Emission Monitoring

Workplace Monitoring For Exposure Control

- OEL (Occupational Exposure Limit) of the chemicals being handled should be established.
- Monitoring of chemical at workplace should be conducted for establishing work place concentrations.
- Workplace concentration should be checked
  - at source
  - At environment, and
  - At recipient

- If OEL values are very low (potent drugs, Onco drugs, peptides, etc.) controls like PAPR or Isolators should be used.
- Legally workplace monitoring to be recorded in Form-37 as per Factories Act.

Handy Air sampler (Source monitoring)

VOC Meter (Work place monitoring)

Isolator

Monitoring with Dosimeter (Recipient monitoring)

Emission Standards For Pharmaceutical Industries

Emission Standards

Air Emission Standards:

- Ministry of Environment has notified new air emission standards for Pharmaceutical Industries on 06.08.2021.
- For Boilers and Incinerators, separate standards are available
- Mandatory installation of Continuous Emission Monitoring System (CEMS) for more than 8 MT capacity boilers
- Use or scrubbers or lime injection for coal fired boilers
- FO can not be used

Process Stack Emission

Parameters	Limiting Value for concentration (mg/Nm^3)
Chlorine	15
Hydrochloric Acid Vapour	35
Ammonia	30
Benzene	5
Toluene	100
Acetonitrile	1000
Dichloromethane	200
Xylene	100
Acetone	2000

The total losses of solvent should not be more than 3% of the solvent consumed.

National Ambient Air Quality Standards

Pollutant	Time Weighted Average	Concentration in Ambient Air		
		Industrial Area	Residential, Rural and other Areas	Sensitive Area
Sulphur Dioxide (SO_2)	Annual Average*	80 µg/m³	60 µg/m³	15 µg/m³
	24 Hours Average**	120 µg/m³	80 µg/m³	30 µg/m³
Oxides of Nitrogen as NO_2	Annual Average*	80 µg/m³	60 µg/m³	15 µg/m³
	24 Hours Average**	120 µg/m³	80 µg/m³	30 µg/m³
Suspended Particulate Matter (SPM)	Annual Average*	360 µg/m³	140 µg/m³	70 µg/m³
	24 Hours Average**	500 µg/m³	200 µg/m³	100 µg/m³
Respirable Particulate Matter (Size less than 10µm) (RPM)	Annual Average*	120 µg/m³	60 µg/m³	50 µg/m³
	24 Hours Average**	150 µg/m³	100 µg/m³	75 µg/m³
Lead (Pb)	Annual Average*	1.0 µg/m³	0.75 µg/m³	0.50 µg/m³
	24 Hour Average**	1.5 µg/m³	1.0 µg/m³	0.75 µg/m³
Carbon Monoxide (CO)	8 Hours Average**	5.0 mg/m³	2.0 mg/m³	1.0 mg/m³
	1 Hour Average	10.0mg/m³	4.0 mg/m³	2.0 mg/m³
Ammonia (NH_3)	Annual Average*	0.1 mg/m³		
	24 Hour Average**	0.4 mg/m³		


THANK
YOU!