Desiccant Dehumidification and Humidity Control Challenges

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Absolute Humidity

- The amount of water vapour in the air varies over the year and is different in different places on the earth.
- The amount of water vapour is measured in g or kg of water vapour per kg of (dry) air (g/kg) and is called Humidity Ratio or Absolute Humidity.
- In this part of the world the maximum Absolute Humidity is about 26 g/kg.
Relative Humidity

- The ratio (in %) between the actual quantity of water vapour in the air and the maximum quantity of water vapour that the air can contain at a certain temperature.

Actual 10 g/kg
Max. 20 g/kg

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\frac{10}{20} = 0.5 = 50\% \text{RH}
\]
General Humidity Theory

- **Dew point temperature**
  - At each temperature there is a maximum amount of water vapour the air can contain (saturation). The higher the temperature is the more water vapour the air can contain.
  - When the air is cold down the %RH will increase and if the air is cold down to saturation the **Dew Point Temperature** is reached.
General Humidity Problems

- Condensation (100%RH)
- Mould (>70%RH)
- Corrosion (>50%RH)
- Hygroscopic material
To prevent corrosion we need to maintain 50% RH or less.
The Need To Control Humidity

To prevent mold growth we need to maintain below 70% RH.
The Need To Control Humidity

To keep quality of products; hygroscopic materials quality affected by moisture content, which can be affected by surrounding %RH level.
What is Desiccant Dehumidification

- Process air
- Wet air
- Dry air
- Reactivation air
- Drive motor
- Air heater
When to use desiccant rather than cooling?

- Cooling down the air removes moisture by condensation
- Limitations are the off coil conditions of conventional cooling system
- We can cool down to 13-14°C, which means we can reach down to 9.4 g/kg (Absolute Humidity)
- To get dryer conditions below 9.4 g/kg conventional cooling can't do the job

- Here comes the need for desiccant dehumidifiers, where it able to dry the air down to 1 g/kg or less.
Dry bulb temperature, °C
Humidity ratio, g/kg

Cooling
Desiccant Dehumidification
Over cooling and condensation

hx-diagram 100,32 kPa
Energy Recovery Purge

- with reduced react heat energy compared to a standard unit. Same capacity as a standard unit
Munters PowerPurge offers energy and cost savings:
- Reduced reactivation energy
- Reduced post cooling requirements
- Reduced chiller capacity needed
- Reduced piping size requirements
Systems out of desiccant technology
The problem is caused by air exchange in the door:

Warm air flows in on top
Cold air flows out at the bottom
Humidity Problems in Cold Stores and Freezers

Force changed mix condition at the door and removal capacity for sublimation
Humidity Problems

Main issues:
• Ice build up
• Condensation
• Fog
• Slippery floors
• High energy consumption
• Low cooling capacity
Humidity Problems in Cold Stores and Freezers
Dehumidification Solutions in Cold Stores

- Cold Store: -25°C
- Loading Bay: +10°C
- Outdoor: +30-40°C
  - 20g/kg
DH-Installation in above 0°C area

Air-lock installation

Air-lock installation

Air-lock installation

Loading bay installation
Installations in below 0°C area
Before and after DH-Installations
Questions?