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Desiccant Dehumidification in Breweries: Mold and Fungus Prevention, Food Safety and Energy Savings

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Brewery Refrigeration System Considerations

- Product quality / integrity / efficiency
- Condensation elimination
- Consistent room temperature
- Mold and bacteria control
- Clean, sanitary environment
- Floor drying time
- Operating and maintenance costs
- Energy use

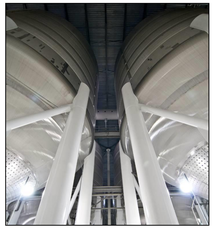
Mold growing on ceiling

Fermentation Cellar

Desired conditions:

- 45°F DB
- 50% RH

Desiccants provide the most efficient humidity and temperature control

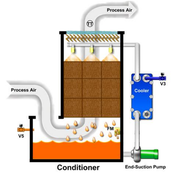


Advantages of Desiccant System

- Consistent space conditions (temperature and dew point)
- Efficient absorption of water vapor from the air
- Control of mold and bacteria
- Asset protection
- Cooler, dryer air for clean sanitary environments
- Continuous product output
- Lower energy use
- Uniform product quality
- Reduced operating costs
- Extended equipment life

Liquid Desiccant Concept

- Refrigerant circulates through external plate & frame heat exchanger
- Desiccant solution drenches structured packing
- Air is induced and comes in contact with sprayed desiccant solution



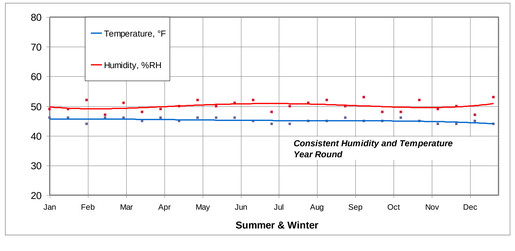
Liquid Desiccant Energy Savings

- Eliminates vapor-to-solid phase change during defrost cycle
- Fan horsepower reduction due to non-frosted coil
- Eliminates moisture being reintroduced into space during defrost
- Eliminates need to oversize refrigeration system for hot gas defrost
- Heat recovery potential for desiccant regeneration process

Brewery Applications

- Yeast rooms
- Hop rooms
- Packaging rooms
- Storage areas
- Fermenting cellars
- Aging cellars
- Finishing cellars
- Racking cellars
- Filtering cellars

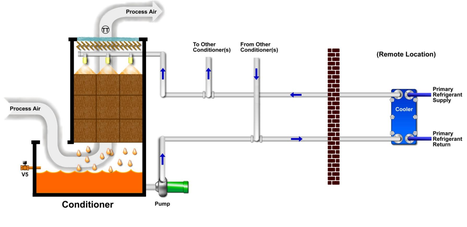
Consistent Cellar Conditions with Desiccant Cooling



Minimal refrigerant charge is desirable to achieve environmental, regulatory, and financial goals.

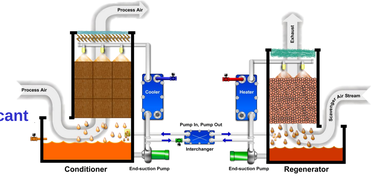
Liquid Desiccant Distributed System

- Reduces refrigerant charge to 1 lb/ton of cooling
- Refrigeration charge located in powerhouse
- Secondary cooling piped to and from process areas
- Eliminates refrigerant health and safety concerns in process areas
- Minimizes regulatory requirements
- Eliminates hardware, controls and complexity required for defrost cycles
- Reduces refrigerant and maintenance costs



Liquid Desiccant System Components

- Conditioner
- Cooling source
- Heat exchanger
- Chemical desiccant
- Regenerator
- Heat source



Effects on Space Sanitation

- Dry surfaces eliminate breeding site for microorganisms
- Desiccant solution permanently inhibits common airborne microorganisms such as *Lysteria, Salmonella, and Yersinia*
- Desiccant solution spray provides excellent air filtration effect

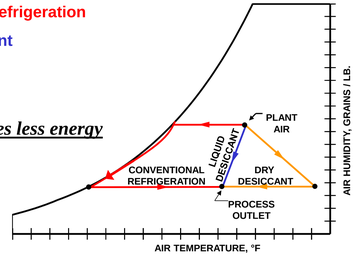
Liquid Dehumidification Systems

- Secondary coolant for minimum charge refrigeration systems operating below freezing
  - Reduces refrigeration tonnage required
- Energy efficient dehumidification
  - Can be even more efficient by using recovered heat
- Moisture removal is controlled by temperature and concentration of desiccant liquid
- Desiccant inhibits airborne microorganisms
- Frost-free; no defrost cycle

Methods of Dehumidification

- Conventional refrigeration
- Liquid desiccant
- Dry desiccant

LD requires less energy



Typical Liquid Desiccant System

Multiple conditioner units can be distributed throughout the brewery to cool and dehumidify numerous process areas

Centralize regenerator near or in powerhouse that serves multiple conditioners.

Summary

Provides:

- Efficient chemical absorption of water vapor from the air
- Continuous airborne microorganism removal
- Cooler, dryer air for clean, sanitary environments

Eliminates:

- Vapor-to-solid phase change
- Inefficient defrost cycle
- Fan horsepower increase due to frosted coil operation
- Low suction temperature requirement
- Moisture being reintroduced into space during defrost

Advantages:

- Lower energy use
- Reduce operating and maintenance costs
- Extended equipment life – less "wear & tear"
- Rugged industrial construction
- Uniform product quality