

Liquid Desiccant Systems for Food Processing Meeting the Need for

Precise Humidity Control

AT A GLANCE

- Liquid desiccant systems a powerful tool for dehumidification in food industry
- Heat reduction an additional benefit in newer systems
- New developments include smaller size, better materials, tighter control
- Important to have qualified specialist design systems

Liquid desiccant dehumidification systems are not a new concept. Technology for comfort and process air conditioning using liquid desiccants goes back to the 1930's, and has been widely used in many industries since the 1950's. What is new is advanced designs that are making these systems practical for a wider range of markets.

Newer designs include smaller and simpler packages, increased use of corrosion resistant elements, and hybrid desiccant/electric systems for total comfort control. Liquid desiccant systems are especially well adapted for use in the food processing industry.

LITHIUM CHLORIDE REMOVES AIR MOISTURE

Desiccant dehumidification relies on the ability of certain solids or liquids to absorb moisture from air. Building air or ventilation air is passed over these materials and moisture is removed. The desiccant is regenerated by exposure to heat from a gas-fired burner, and the moisture is then expelled in an exhaust stream. The desiccant is now ready for re-use. The cycle can continue indefinitely. A variety of materials have desiccant properties, and lithium chloride is the commonest.

Dry desiccant systems use a granular or crystalline desiccant solid embedded

on medium such as a rotating "energy wheel" or "enthalpy wheel." One side of the wheel is exposed to moist supply air, which is thereby reduced in humidity, and the opposite side of the wheel is exposed to a counterstream of heated and/or dry exhaust air. The result is a continuous desiccant regeneration and dehumidification process.

LIQUID DESICCANT OFTEN BEST FOR INDUSTRIAL USE

For challenging process dehumidification needs, liquid desiccant systems are often favored. These distribute a solution of concentrated desiccant lithium chloride solution over a medium with high surface area such as a porous honeycomb design. The moist supply air passes over this medium and gives up its moisture to the trickling solution, thereby diluting the desiccant solution en route to a collection tank. The dilute solution flows or is pumped to a second heat exchanger, where it is reconcentrated by heating and exposure to dry exhaust air. Again, the process can be repeated indefinitely.

The advantages claimed for liquid desiccant systems are complete separation of the moisture absorption and regeneration processes, higher potential moisture removal efficiency, and energy savings. Liquid systems have historically

ON THE COVER

Precise humidity control is a requirement in many food processing applications. Often the best choice is a gas-fired industrial liquid desiccant dehumidification system. The number of options and the level of control continues to improve.

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Kathabar System Schematic

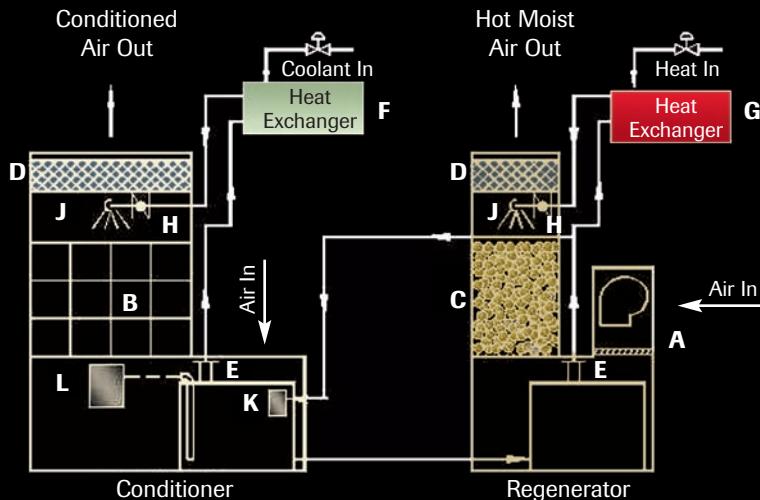


Diagram shows the functional components of the Kathabar liquid desiccant system.

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|---------------------------|-----------------------------|--------------------------------------|
| A Diffuser | E Kathene Pump | J Kathene Flooding Nozzle |
| B Packing Blocks | F Kathene Cooler | K Internal Kathene Flow Meter |
| C Packing Spheres | G Kathene Heater | L Modulating Level Controller |
| D Mist Eliminators | H Flow Control Valve | |

been popular for applications where high volumes of precisely conditioned air are needed for food processing, frozen food handling, pharmaceutical manufacturing, or for large-scale digital circuit manufacturing operations.

THERMAL COMPONENT TO SYSTEMS

In the liquid desiccant dehumidification process, an important thermal transfer also takes place. Desiccant moisture absorption from air results in the air being cooled, and the desiccant solution being heated. In a large scale process, this heat transfer is significant and must be managed. The heat can be released directly using an outdoor heat exchanger or can be routed through a DX or chilled water refrigeration system.

Because the heat is removed from the circulating solution, the liquid desiccant system can be an important contribution to reducing the total heat levels in the

building. In food processing applications, environmental temperature control as well as humidity control is important. Whenever desiccant systems are used in the food industry, they need to be able to operate at high levels of reliability through a wide range of supply air conditions, and need to be capable of control as a part of the larger manufacturing process.

KATHABAR A WELL-KNOWN PRODUCT

Kathabar, a division of Ross Air Systems, is an important manufacturer of liquid desiccant systems for the food industry, as well as many other applications. The firm pioneered many of the concepts of liquid desiccant dehumidification for industrial applications. According to Kathabar's Bill Griffiths, liquid desiccant dehumidification is ideal for the food industry because of that industry's need for consistent and low room humidity levels for certain processed foods.

Candy, snack food, and many other food product industries are frequent users of this type of equipment. The pharmaceutical manufacturing and packaging industry is a related area where desiccant dehumidification is common. Gel pharmaceutical capsules are especially sensitive to variations in humidity levels and require these systems. In some cases, building air first goes through a desiccant system to adjust humidity levels, then through a conventional air handler for filtration, mixing and temperature adjustment.

DRYKOR FEATURES ON-BOARD REFRIGERATION

Another manufacturer of commercial/industrial desiccant dehumidification systems is DryKor. Established in 1997, DryKor has developed a system to reduce the temperature as well as the humidity level of treated air. The DryKor unit uses

For More Information

Kathabar/Ross Air Systems
<http://www.kathabar.com>

DryKor
<http://www.drykor.com>

AIL Research, Inc.
<http://www.ailr.com>

an on-board mechanical refrigeration process to reduce the temperature of the working desiccant fluid, and with it the temperature of the dry air discharged to the building air handling system.

When used in conjunction with conventional air conditioning units, targeted temperature and humidity levels are attained more quickly, and require a significantly lower amount of electricity without over-cooling or chilling the air. DryKor systems can be used to substitute desiccant dehumidification to reduce air conditioning requirements in warm and humid climates. These systems are also used in cool and humid climates where mechanical refrigeration is typically used only for dehumidification. Over 1,000 DryKor systems have been installed worldwide.



Installed Kathabar desiccant dehumidification unit

NEW APPROACH BY AIL RESEARCH

Product development continues in the field of liquid desiccant systems. AIL Research is a development firm with an interest in this area since the early 1990s. They have developed new designs for commercial liquid desiccant systems suitable for use in treating building makeup air, and currently have

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a 6,000 cfm product in the beta testing stage, with commercial introduction expected within two years.

According to AIL Research president Dr. Andrew Lowenstein, the advantages of the new design are an extremely compact configuration, a low internal pressure drop, and the ability to dry air to very low absolute humidity. He feels that the new design has a potential efficiency improvement of 15% over most existing systems. One key to the design is an advanced plastic liquid-to-gas heat exchanger that gives the unit significantly increased cooling as well as desiccant action in the same process.

Ron Vallort, P.E., of Ron Vallort and Associates, is a recognized expert in refrigerated buildings and processes, with over 35 years of experience designing and constructing all types of new and renovated facilities in the food industry. His firm specializes in facility design and construction management, as well as operational and building analysis for clients in the food industry including: processing, freezing, storage and distribution.

MEAT PRODUCTS REQUIRE TIGHT HUMIDITY CONTROL

Vallort indicates that one prominent example of a food industry application of desiccant dehumidification is in the processing of moisture-sensitive meat sausage products. “Processing and packaging of these specialty sausages requires precise control of environmen-

tal humidity levels.” He mentions that for his clients the standard methodology is to use a wet desiccant system to treat ventilation air going to large conventional air handlers.

He notes that some clients have been using Kathabar liquid desiccant systems for as long as 35 years. “In the food industry,” Vallort mentions, “consistency in the processing environment is essential. A lot of machinery relies on a constant, low-humidity environment. A liquid desiccant system is usually the best way to get there.”

LOOK FOR HELP FROM A DEHUMIDIFICATION EXPERT

Vallort says that the single most important advice he can offer for industrial owners requiring dehumidification for a manufacturing environment, is to select the right engineer. “It’s important to use someone who has a real grasp of the fundamentals of desiccant equipment. If your regular consulting engineer doesn’t have this experience, ask that firm to bring in a specialist.”

If you are already in the food industry, you probably already understand the importance of humidity control in your manufacturing environment. You may not appreciate the role that liquid desiccant systems can play in getting you there. It’s a good time to start learning more. **<GT>**