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Chemical World

Broadening scope

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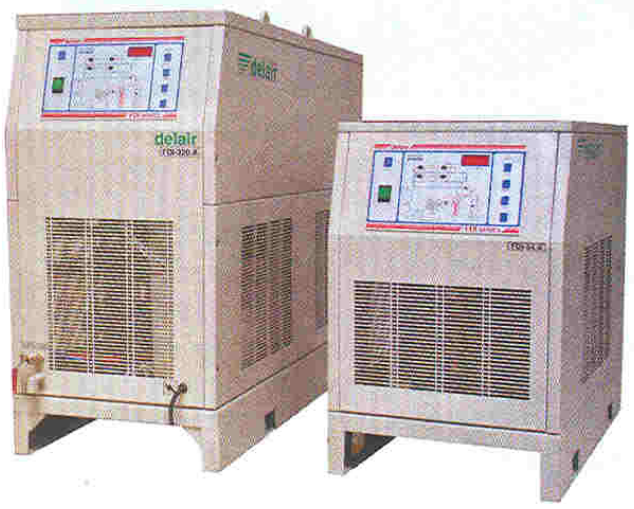
Dehumidification

Broadening scope



Courtesy: Bry-Air

While moisture is undoubtedly a significant menace in every industry, it assumes threatening proportions in the chemical industry where even the presence of minuscule amount of moisture during production, storing and packaging of most chemicals can result in an explosive mixture. However, the advent of new technologies and products has widened the possibility of dehumidification to extensive industrial applications, as many areas of high-humidity levels cannot function without a controlled climate.

Sonali Dutta

Although moisture is invisible, its damaging effect on almost everything around us is evident. Rusting of metals, lumping and decomposition of chemicals, increasing microbial activity leading to the growth of mould, mildew & fungi on organic substances, warping, decay, deterioration, etc are some of the common problems that occur due to high humidity.

In most cases, controlling the relative humidity below 35 per cent helps in keeping the moisture threat under check. The concept of dehumidification dates back to World War II when it was used by the Navy to mothball ships to maintain them in the 'as is' conditions.

Moisture menace

Following are some of the examples where moisture can cause damage:

Titanium dioxide: It is industrially important because of its high opacity, relative chemical inertness and comparative abundance. It has replaced all other white pigments in paper, plastics, rubber, textile and vitreous enamel industries. In bulk packaging and conveying of titanium dioxide, low humidity and temperatures are required.

Gypsum cement: It is used as a raw material for tire moulds, and is highly hygroscopic in nature. In the presence of moisture, it coagulates and does not flow freely. It must, therefore, be stored in a low relative humidity area.

Calcium chloride: It is highly hygroscopic and is used as an additive in the manufacturing of white cement. In the presence of high relative humidity, it converts into liquid state, becoming ineffective for further use in the process. Storage of calcium chloride at less than 30 per cent RH in ambient conditions avoids absorption of moisture and liquefaction.

Phenyl glycerine: In the presence of moisture, it reacts with water and emits MCL fumes, which are corrosive in nature. A relative humidity of 10-5 per cent at 25 + 2°C must be maintained in the storage and packing areas.

Many chemical raw materials, intermediates or finished products are

Key application areas

Areas where humidity control become important in the chemical industry can be categorised as:

- Bulk and special/fine chemicals
- Agrochemicals, pesticides and fertilisers
- Ceramics, detergents, dyestuff and pigments
- Organic and inorganic chemicals

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corrosive & toxic, and their composition may change in the presence of high moisture. Humidity control, with or without a check on temperature becomes imperative, and desiccant dehumidification is the most effective method to control humidity.

Dehumidifiers reduce the moisture in the air, making it dry. These are generally installed in the process areas like pharmaceutical companies and drying equipment, where low humidity is required.

The process of dehumidification is like sponging. Sponge absorbs water and when squeezed gives out water. Desiccant or silica gel absorb moisture from air and when saturated, the other section of the dehumidifier passes air at even high temperatures, which throws out water from the desiccant to make it ready for adsorption again.

Spray drying

Another area where humidity control is a must in the chemical industry is in spray-drying process. Spray/fluid bed dryers require large quantities of hot air for drying. The quality of the final product is affected by the quality of air entering the dryer. It should be dry, free from contamination, foreign particles and odourless.

With the growing emphasis on limiting production losses and downtime, which impacts the final product quality, and thus profits, the importance of using dehumidifiers in conjunction with spray dryer/fluid bed dryer for quality drying has become almost mandatory.

Since the ambience change throughout 24 hour and 365 days a year, the humidity present in the air entering the spray/fluid bed dryer is not constant. This requires close monitoring of the drying temperature and time inside the dryer, as the varying level of humidity present in the air entering dryers results in different final moisture content in product being dried, thereby degrading the quality of the final product. It also hinders the free flow of powders/granules, making many downstream operations (for example, packaging, filtering, handling, etc) difficult and expensive.

The solution is to install desiccant dehumidifier at the inlet (source of air) of the spray/fluid bed dryer for a constant moisture content supply (dry) air inside the dryer. This helps in reducing the physical monitoring of the drying temperature and time, thereby reducing costs and ensuring consistent quality throughout the year.

How does dehumidification work?

Desiccant dehumidifier can be designed to control humidity & temperature, and also for safe, trouble-free handling of chemicals, and eliminating the hazards of moisture damage. It also suits many temperature-sensitive products, which cannot be spray-dried easily at