

Which Humidity ?

The term humidity is often used in terms of environmental or product control however the most important factor is which humidity do you actually mean, as there are three different types.

- **Absolute Humidity:** This is a measurement of total amount of water in the air and is expressed in terms of weight of water per unit weight of air , e.g. Kg/Kg. Temperature has no effect on Absolute Humidity.
- **Relative Humidity:** This is a ratio of the amount of water in the air to the maximum amount of water that the same mass of air can hold at a specific temperature. The value is expressed as a percentage but it must be qualified by a temperature. e.g 50%rh at 21C
- **Equilibrium Relative Humidity:** This is a measurement of a Relative Humidity in a layer of air that surrounds a product. This layer about 3 mm thick is controlled by the moisture content of the product. The equilibrium state is when the Relative Humidity of this layer is the same as the Relative Humidity of the air surrounding the product. Temperature of the product as well as temperature of the ambient air has a huge effect on ERH. As with Relative Humidity ERH is expressed in terms of a percentage and again qualified by a temperature.

It is therefore important to understand which humidity you actually need to control as their effects can be widely different. In reality the Relative and Equilibrium Relative Humidity are the two most important parameters that need to be controlled. In achieving this the correct Absolute Humidity is also maintained.

Relative Humidity :

On human beings

Relative Humidity plays a crucial role in our lives.

When the Relative Humidity is low moisture evaporates from the body resulting in cooling; leaving our skin dry and susceptible to cracking and more importantly at greater risk of infection. We also perceive lower than actual temperature and feel even colder than it actually is. Conversely high Relative Humidity makes us feel hotter than it actually is as the rate of evaporation from the skin surface is reduced.

Relative Humidity affects our health in many ways but our bodies tend to cope up with the adversities by working harder and while we may feel uncomfortable, we do survive unless exposed to extremes for a very long time.

Human comfort and well being is directly related to both Relative Humidity and temperature.

Equilibrium Relative Humidity

On products and processes

Products, whether organic or inorganic, are directly affected by both the temperature and Relative Humidity it is exposed to. For example, sugar is free flowing till the Relative Humidity exceeds 70% which is evident during monsoon when it gets sticky as it absorbs moisture from ambient air. Conversely cooked rice will become dry if left open for a long time at room temperature as it loses moisture to the ambient. These processes occur without any effort on our part.

Products lose or gain moisture from the air they are exposed to. It is this phenomena which is the key driver in product processing. The speed and degree of change is directly related to the ambient Relative Humidity and Temperature that the product is exposed to

All materials that are hygroscopic take water from the air or release it to the air depending on the imbalance of vapour pressure between the product surface and the air around it. The exchange process continues until the partial vapour pressure of the boundary layer of air, on the surface of the material, is the same as the partial vapour pressure of the air around the material. When this exchange is complete equilibrium has occurred..

In an unventilated environment filled with a hygroscopic product, the product controls the Relative Humidity in the air around it by absorbing and desorbing water until it reaches the stable equilibrium condition, the ERH of the layer of air surrounding the product is equal to the Relative humidity of the ambient air and both are at the same temperature. During these balancing processes, the product itself undergoes only slight changes to its total water content, since the quantity of water available is a function of the total Absolute Humidity of the air surrounding the product and the moisture content of the product.

In a ventilated environment filled with a hygroscopic product, the Relative Humidity of the air being supplied becomes the controlling factor, the product is able to absorb or de-sorb water vapour accordingly. The stable equilibrium state cannot occur unless the supplied air is in equilibrium with the product . It is therefore critical in this instance that not only are the temperature and Relative humidity levels matched to the ERH of the product the control tolerances, +/- of the set point, are kept to a minimum as certain products have a very small tolerance to changes in ERH. The whole process of Relative Humidity, moisture transfer and ERH controls the quality of the product and your profits.

For more information on ERH and how it can improve your product processing please contact us.