

**MBRAUN Technical Note:
MAXIMUM WATER VAPOR CAPACITY OF ABSORBENT (MOLECULAR SIEVE)**

In the MBRAUN gas purification systems the water vapor is removed by adsorption. Adsorption is a process in which molecules of gas, of dissolved substances in liquids, or of liquids adhere in an extremely thin layer to surfaces of solid bodies with which they are in contact [1]. The inert gas containing water vapor is passed through the adsorbent (molecular sieve) in the reactor column. The water molecules and other molecules, which are small enough to pass through the pores of the molecular sieve, are adsorbed. Larger molecules pass through. See Figure 1.

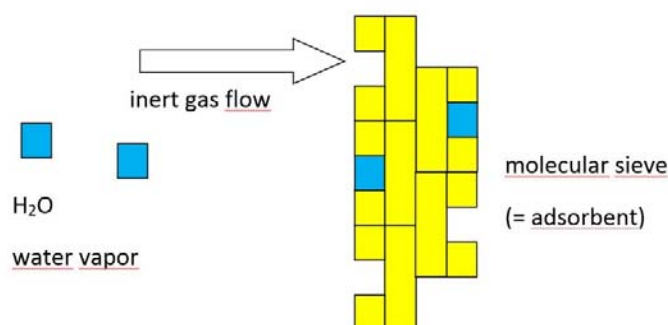


Figure 1: Adsorption of water vapor in molecular sieve

The maximum adsorption capacity for water vapor is reached when the adsorbent is saturated. The used molecular sieve can adsorb water up to 26 %* of its own weight (*Measured at 23 mbar vapor pressure and 25°C, see original manufacturer's data sheet).

Saturation means a thermodynamic equilibrium between the free molecule in the adsorbate and the adsorbed molecule - no additional molecule can be adsorbed. The number of adsorbed molecules is related to the partial pressure of the water vapor corresponding concentration. The dependency of the adsorbent temperature and the loading of the molecular sieve is shown in so-called isosteres. The water adsorption isosteres illustrate the water vapor concentration at the adsorbent at a certain loading.

Difference between maximum and useable vapor capacity:

Industry always quotes the **maximum water vapor capacity**, which means saturation. However, it is an undeniable fact that **for a residual water concentration (moisture purity) < 1 ppm** inside the glove box the loading capacity is less than the maximum absorption capacity of the molecular sieve.

That means the useable water vapor capacity (for purity < 1 ppm) depends upon the desired operation conditions!

If the capacity limit of the molecular sieve is reached the concentration of water vapor in the glove box atmosphere increases. Then the molecular sieve has to be regenerated (=desorbed).

Bibliography

[1] David R. Lide, Ph.D., Thomas J. Bruno W. M. Haynes, Ph.D.: CRC Handbook of Chemistry and Physics: edition 77th (1996-1997). New York: CRC Press, 1996.