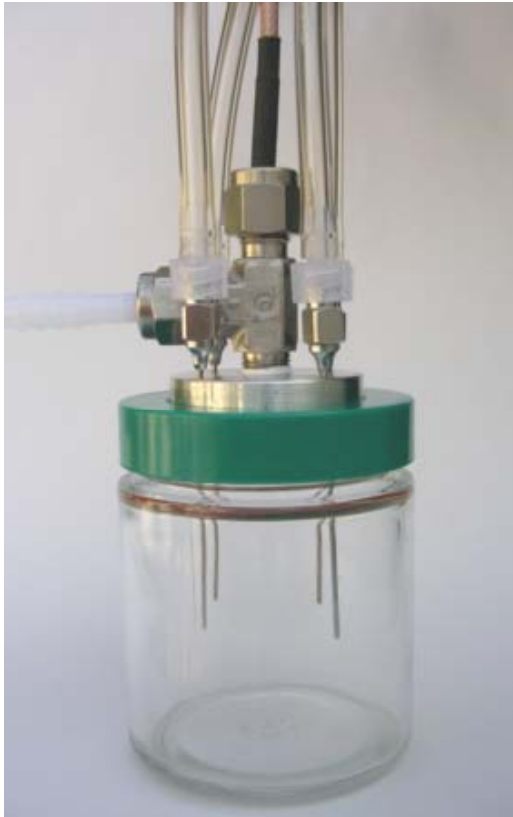

Automated and multi-point relative humidity delivery to variety of samples

Diversity of samples and study of their properties at different water vapor conditions requires often a specialized hardware to facilitate delivery of a humidified stream to the samples. Although the configurable and R&D friendly relative humidity generators, like V-Gen or HumiSys, are designed to address variety of RH needs and control modes, some simple and inexpensive ancillary equipment can further enhance their capabilities and add convenience to carry out research work.

For example, the output of the heated transfer line can be connected to a multi-port distributor instead of a typical single port connection to a user-defined location. As an illustration, the picture below shows a 1-to-9 distributor that can be used in variety of ways.



One of possibilities is to provide multipoint RH source for a relatively large mass of sample and humidify it more effectively. The next picture on the left shows a glass jar with hermetic enclosure housing a miniature RH probe (or any other sensor) and four entry ports. The distributor is mounted vertically in this example. Unused delivery lines are capped, but for larger containers all lines can be used. The stream leaving the jar through the side port can be redirected to other instrumentation, for example, to study gaseous constituents extracted by the water vapors. In addition, since the tubing used or needles and the RH probe can be easily removed and reinserted, the container with its contents can be weighed on a precision balance to yield a water sorption isotherm. The setup can be easily made in such way, that the sample can be treated with variety of vapors, without being exposed to the ambient atmosphere. Also, this setup can be placed inside a chamber with good temperature regulation to carry out experiments at different temperatures.



In cases when contamination of the RH probe by the sample is of concern, another approach of equal flow division can be used. As shown on the picture on the right hand side, one empty vial can be used for housing the RH probe while another one can contain the sample. The same RH conditions can be readily rechecked by swapping the tubing or the needles. Additionally, an optical probe (e.g. Raman) can be used for simultaneous recording of spectra of the sample at a well known RH and temperature values measured by the RH probe. The whole setup can be placed inside a specially made aluminum block to assure equal temperatures or inside a thermostated chamber.

The process of equilibrating the sample at known RH and temperature values and/or introducing organic vapors to the sample can be automated. An autosampler style instrument, like the ones used in headspace analysis, can be constructed. Positioning of vials at an appropriate angle and their rotation would further speed up the equilibration of samples during delivery of RH and/or organic vapors.

Variety of application specific setups can be designed and automated to provide complete solutions to the ever changing research needs. Modular approach to our instrumentation design further facilitates changes of the experimental setups.