

A Microclimatic Hygrometer

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For many purposes there is at present a much felt want for an apparatus for measuring the humidity of small spaces. The well known property of dilutions of sulphuric acid to exchange water with air having a vapour pressure differing from that of the dilution, can be employed in the construction of a hygrometer of very small dimensions.

In a capillary glass tube filled to the rim with diluted sulphuric acid of a known vapour pressure, the fluid will move back into the tube (—), if the surrounding air possesses a lower vapour pressure than that of the acid, while the fluid will protrude out of the tube (+) if the opposite condition is the case. Only when the vapour pressures of both air and acid are equal will the surface of the fluid remain unchanged (0). These may easily be observed with a magnifying glass.

In practice it is necessary to make dilutions of sulphuric acid differing stepwise as regards their vapour pressure e. g. corresponding to 5 per cent r. h. (relative humidity). A number of capillary tubes ($\frac{1}{2}$ mm in width, 3--5 mm in length) may be filled with a known dilution for each, and fixed with plasticine, the ends of the tube being left free. In due time you have only to observe the movements of the fluid surfaces in the tubes. The table shows the course of a determination:

Experiment No.			
I		II	
Tried for	Reaction	Tried for	Reaction
20	+	45	+
40	+	50	+
60	—	55	0
80	—	60	—

Result: 55 per cent r. h.

The accuracy of the method is 1,5 per cent r. h. below 50 per cent r. h. and then increases up to 100 per cent r. h. being e. g. at 96 per cent r. h. 0,1 per cent r. h. This sensitivity, however, prevails only when so long a time has elapsed, that equilibrium has been reached. For shorter periods, only a somewhat lower standard of accuracy is obtainable. In spaces without air-movements the requisite lapse of time before reliable reaction can be observed, may be from 1 to 20 minutes, according to the difference between the vapour pressure of the sulphuric acid and that of the air. With a difference of 10 per cent r. h. the reaction time is about 5 minutes, with a difference of 5 per cent the reaction time is 10—15 minutes. Air movements will considerably shorten the time necessary.

As possible sources of error, in the above method, mention should be made of: 1) the influence of temperature, (for which corrections may be made), 2) the curvature of the fluid-surface, this being in nearly all cases insignificant, and 3) the alteration of the amount of the water vapour present in the air arising when the hygrometer is placed in a completely closed space without a vapour-pressure regulating factor; this error will however only appear under special conditions.

The method may be applied in many different ways and can be used with advantage for several micro-climatic and ecological purposes. A more detailed account will appear shortly.