Moisture sorption isotherms for two desiccants

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SUBJECT MOISTURE SORPTION ISOTHERMS FOR TWO DESICCANTS

One of the problems associated with studies on the performance of sealed, double-glazed window units is the interpretation of internal dew point measurement in relation to moisture gain to the sealed space. One factor of interest in this regard is the equilibrium moisture content vs dew point relationship for the desiccant involved. In order to check the accuracy of published information, and to provide additional data on the characteristics of one commonly used desiccant and one potentially usable material, a series of measurements were made using the special humidity facilities at Saskatoon.

Davison silica gel, Grade 408, mesh size 12-28, was obtained from the McArthur Chemical Company, Limited, and Type 13X, 1/16-inch pellet, molecular sieve material was also procured for these tests.

Samples of both were dried to equilibrium in a vacuum oven at 260 - 265°F. This treatment reduced the moisture content of the silica gel received from the manufacturer by 0.5 to 0.6% (dry weight basis).

Samples were weighed, exposed to air of known dew point at 70°F until they were substantially at equilibrium, then reweighed to find the increase in moisture content. The "atmosphere producer" and a controlled atmosphere chamber were used in these tests to provide the required air conditions.

Several moisture content - dew point values for silica gel, taken from the Chemical Engineers Handbook, third edition, page 912,

are included in the attached Table. These values differ considerably from our experimental values at low dew point temperatures. The discrepancy cannot be entirely attributed to a difference in initial dryness because the absolute difference between the two sets of data is substantially less at higher dew point temperatures. The Prairie Regional Station values were all obtained by a process of adsorption. Although adsorption values lie below desorption values, it seems unlikely that hysteresis would account for such large differences.

TABLE I

Dew Point Temp.	Dry Bulb Temp.	%Weight increase - dry basis					
		Silica gel			Molec. sieves		
		1	2	3	1	2	3
-20.1	69.6	3.2	3.2		13.5	14.3	
-12.1	69.6	3.5	3.7		16.4	17.4	
-10.1	69.7	4.1	4.1		16.7	17.6	
-0.2	69.4	5.7	5.6		17.6	18.6	
+6.5	70.1	7.2	7.2	7.2	19.1	19.1	19.2
+9.6	70.1	7.3	7.4	7.4	19.2	19.2	19.3
+28.3	70.2	15.1	15.1	15.1	21.1	21.1	21.1
+44.7	70.1	24.2	23.8	23.8	22.4	22.4	

Moisture content - dew point values for silica gel, taken from the Chemical Engineers Handbook:

Dew Point	Dry Bulb Temp.	% Moisture content dry basis
-60	70	6.
-30	70	7.
-10	70	8.2
7	70	10
25	70	14
41	70	23.5
59	70	37.3