Moisture sorption analysis of aspirin

Isochema Laboratory, Hiden Isochema Ltd, 422 Europa Blvd, Warrington, WA5 7TS, UK

Introduction

One of the crucial challenges in the development of new pharmaceutical products is the stability of active compounds within an excipient, and their ability to be stored without degradation. Any polymorphism or the formation of amorphous structures resulting from moisture sorption may adversely affect dissolution kinetics and contravene licensing conditions. Such effects in novel medicines may prevent certification.

Experimental method using the IGAsorp instrument

The investigation was performed using an IGAsorp Gravimetric Vapour Sorption (GVS) instrument. This system performs isothermal measurements at atmospheric pressure at relative humidity (RH) levels in the range 0-98 % RH, measuring weight changes due to absorbed vapour with high resolution (from 0.05 μg). The humidity is set by bubbling dry nitrogen (99.999 % purity) through distilled water to provide a 100 % humidity gas stream, which is then combined with another stream of dry nitrogen as necessary to supply the required RH. This is passed over the sample at a rate of 100 ml/min. Isotherms can be determined with a temperature stability of ± 0.05 °C. Kinetic data for each isotherm point is recorded at intervals down to 0.1 seconds. This is analysed in real-time by the IGAsorp software to predict the asymptotic equilibrium point, allowing the instrument to record the predicted value and move to the next RH set-point once user-defined criteria have been satisfied. These equilibrium points are then used to plot an isotherm over the selected RH range.

Sorption onto aspirin

An aspirin tablet was tested using the IGAsorp at a temperature of 37 °C, in the range 0-95 % RH. The tablet was removed from its packaging and placed inside a gas-permeable steel mesh container to ensure vapour contact on all surfaces. The humid gas stream was passed over the sample at a rate of 100 ml/min. Prior to the isotherm measurement, the sample was dried in the dry gas stream overnight at 115 °C.

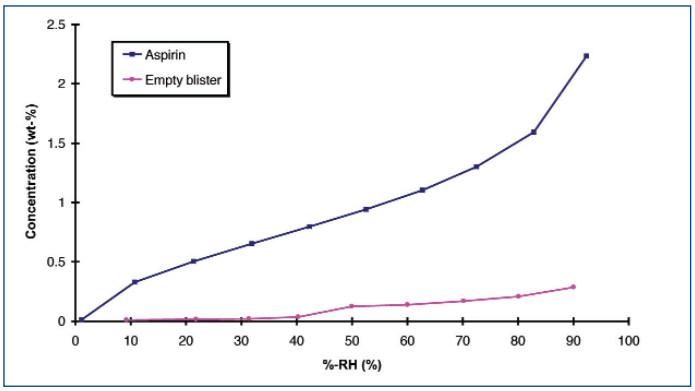


Figure 1: Moisture sorption isotherms for an aspirin and its blister pack

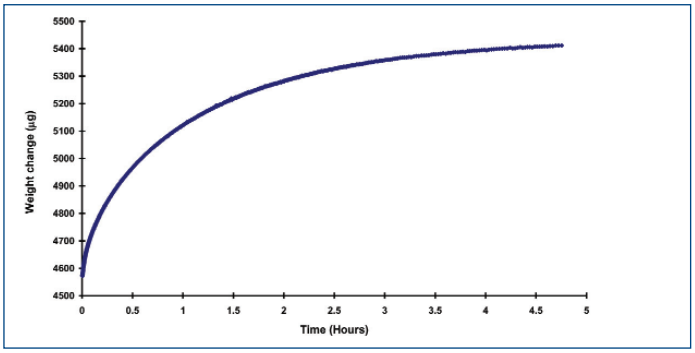
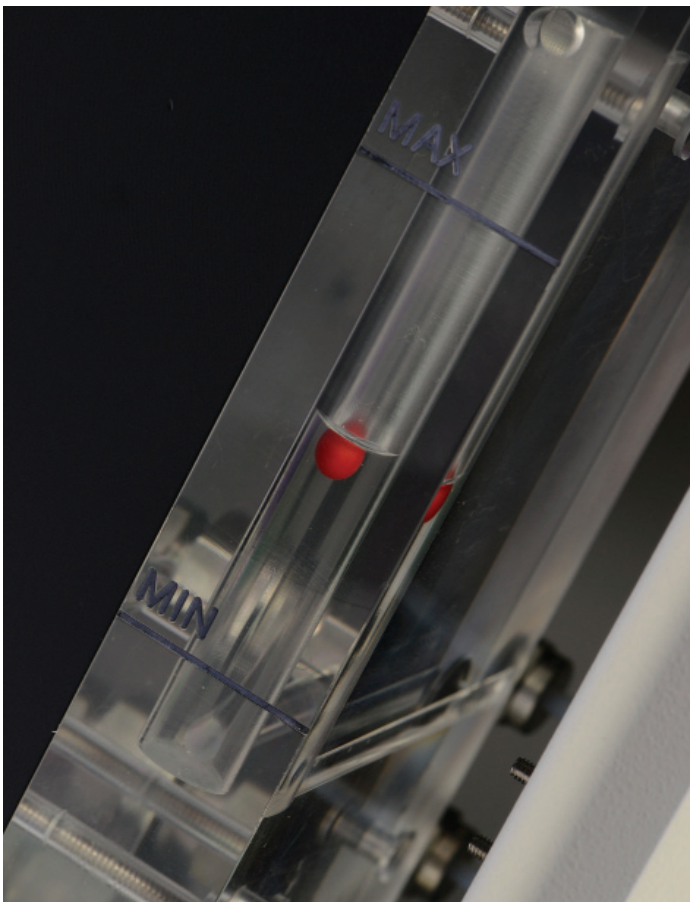


Figure 2: Kinetic sorption data recorded on the aspirin tablet for the adsorption point from 40% to 50% RH

Results and discussion

Fig. 1 shows the moisture sorption isotherm for the aspirin tablet and the blister pack. It can be seen that the aspirin absorbs 2.24 wt.% water at a RH of 95 %. The kinetics of this uptake appear to be limited by the transmission of water



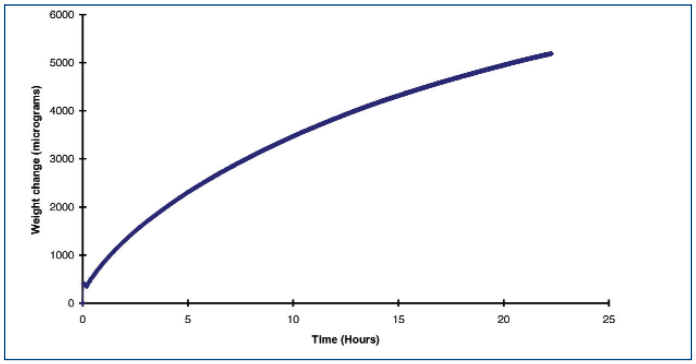


Figure 3: The permeation of moisture through a blister packet containing an aspirin tablet

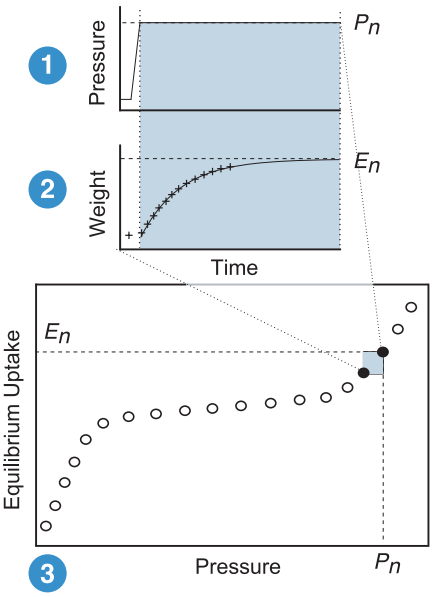
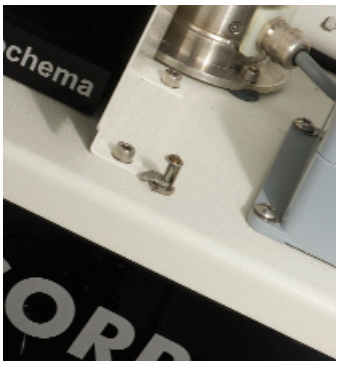


Figure 4: The IGA Method

1. The gas pressure or composition in the balance chamber is ramped to the setpoint, P_n, and then held constant through active control of the inlet gas flow
2. The weight change is analyzed in real time to determine kinetic parameters and simultaneously predict the equilibrium point, E_n
3. Equilibrium points are then collected, corrected for buoyancy, and plotted as an isotherm



through the excipient. Fig. 2 shows the uptake kinetics for the aspirin tablet during the 40 – 50 % RH isotherm step. It can be seen that the aspirin absorbs 840 μg of moisture over a 4.8 hour period, at which point the uptake reached 99 % of the asymptotic value. This indicates that the medicine may be altered if exposed to moisture for a short time (< 30 min), and protective packaging should be selected and tested appropriately to prevent this exposure. The moisture sorption isotherm for the blister pack in Fig. 1 shows that the packaging can resist the permeation of moisture well, certainly better than the aspirin tablet, but not entirely. A notable wt. % gain occurs above 40 %RH. Fig. 3 shows permeation of water occurring at high (90 %RH) humidity over a period of nearly 24 hours. Thus it is concluded that the blister pack in question may not be suitable for medicines of a highly moisture-sensitive nature at above 40 % ambient humidity. This study has demonstrated the use of IGAsorp to accurately determine moisture sorption uptake by pharmaceutical products and packaging. With this information, the longevity and safety of medicines can be assured under various naturally occurring climatic conditions.

422 Europa Boulevard, Warrington WA5 7TS England
t: +44 (0)1925 244 678 e: info@hidenisochema.com
www.hidenisochema.com