

TEMPERATURE CONTROLLED HUMIDITY STUDY OF TREHALOSE USING X-RAY POWDER DIFFRACTION

H. van Weeren¹, C. Resch², C.A. Reiss¹

¹PANalytical B.V., Lelyweg 1, 7602 EA Almelo, The Netherlands.

²Anton Paar GmbH, Anton-Paar-Str 20, A8054, Graz, Austria

E-mail: harald.van.weeren@panalytical.com

Trehalose is a naturally occurring non-reducing disaccharide consisting of two glucose molecules. It plays an important role in plant cells to prevent proteins and other molecules from damaging upon drying. Because of this property it has many applications as a cryopreservation additive as well as a sweetener. It is also used as cryoprotectant for drugs that might undergo degradation during freeze-drying processes. Therefore understanding of the stability conditions and properties of the different phases is essential for the optimization of production processes and storage conditions for drugs.

Under ambient conditions trehalose exists as a dihydrate, but also trehalose anhydrate forms have been reported. Most studies performed on trehalose were monitoring the thermal behavior of trehalose with time. Variations in the phase transition behavior depending on humidity, crystallite size and heating rates are also reported. In this study we have investigated the humidity-temperature diagram with X-ray diffraction. Thanks to the latest developments in temperature-humidity generation, it was possible for the first time to measure X-ray diffraction data at relative humidity's up to 95 % and temperatures up to 80 degrees Celsius. The whole area between 25-80 degrees Celsius and 0-95 % relative humidity has been measured, not only by varying the humidity at constant temperature (as commonly done), but also by varying the temperature at constant humidity and by following the dew point curve. The phase diagram shows unexpected phase changes from crystalline to amorphous to and back to crystalline phases. In this contribution we will present these changes and propose explanations for the effects that we observe.

The data are collected using a standard PANalytical laboratory system with a Copper X-ray tube and an Anton Paar CHC plus⁺ temperature controlled humidity chamber.