POLYETHYLENE GLYCOL CHARACTERIZATION: EFFECT OF MOLECULAR WEIGHT ON DELIQUESCENCE RELATIVE HUMIDITY

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Introduction and Purpose: The interaction of water with polyethylene glycol (PEG) is critically important since sorbed moisture can influence both the chemical and physical stability of solid dispersions containing PEG as the polymeric carrier. The goal of this study was to construct equilibrium moisture sorption isotherms for different molecular weight (MW) grades of PEG, and evaluate the relationship between PEG MW and moisture sorption profiles, in particular the deliquescence relative humidity (RH_0).

Experimental Methods: Equilibrium moisture sorption isotherms for PEG 1450, 3350, 6000, and 8000 were contructed by storing samples in dessicators of varying RH for 6 months as well as by a symmetrical gravimetric analyzer at 25°C. The effect of moisture sorption on PEG crystallinity after 6 months storage at various RHs was evaluated by performing differential scanning calorimetry (DSC) and powder x-ray diffraction (PXRD). Physical mixtures of PEG 3350 with a second component of varying degrees of hydrophobicity were prepared and the effect on the equilibrium moisture sorption isotherm was evaluated.

Results and Discussion: Equilibrium moisture sorption isotherms constructed from both experimental methods were comparable and indicated a possible relationship between PEG MW and RH_0. At high relative humidities (75, 84, 94%) an increasing amount of water was sorbed as PEG MW decreased. DSC thermograms showed a corresponding decrease in the respective heat of fusion (ΔH_{fus}) values, and PXRD scans showed a decrease in characteristic peak intensity for each PEG MW after 6 months storage at high relative humidities. These results indicate that a change in PEG crystallinity had occurred due to the sorbed water in contrast to control samples stored at 0% RH.

Conclusions: A relationship was observed between PEG MW and RH_0 for low MW PEGs; however, no difference in RH_0 was observed between PEG 6000 and 8000. DSC and PXRD results indicated that significant crystallinity loss occurred for each PEG MW after 6 months storage at high relative humidites.