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Data Article

Water vapor sorption and glass transition temperatures of phase-separated amorphous blends of hydrophobically-modified starch and sucrose

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ABSTRACT

This article contains water vapor sorption data obtained on amorphous blends of octenyl succinic acid-modified (denoted as hydrophobically modified starch; HMS) and sucrose (S) in the anhydrous weight HMS/S ratios between 100/0 and 27/75. The water vapor sorption data was obtained gravimetrically. The amorphous state of the blends was confirmed by X-ray diffraction. The glass transition temperatures of the phase-separated blends are listed; the blends show phase separation into a sucrose-rich phase and a HMS-rich phase, the composition of which varies with the blend ratios. The sucrose-rich phase is characterized by a glass transition temperature $T_{g,lower}$ that is 40 to 90 K lower than the glass transition temperature $T_{g,upper}$ of the HMS-rich phase.

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Specifications table

Subject area	*Physical chemistry*
More specific subject area	*Hydrocolloids, carbohydrate polymers, phase transitions*
Type of data	*Table (Water vapor sorption, glass transition data), figure (X-ray diffraction, Water vapor sorption isotherms*
How data was acquired	*Water vapor sorption data (gravimetric analysis); X-ray diffraction data (Phillips X'pert Pro diffractometer (Panalytical)); Differential Scanning Calorimetry (Discovery DSC, TA Instruments)*
Data format	*Analyzed data*
Experimental factors	*Spray-dried blends of Octenyl succinic acid-modified starch and sucrose in the anhydrous weight ratios 100/0, 90/10, 80/20, 60/40, 45/55 and 25/75.*
Experimental features	*Spray-dried blends were water activity-equilibrated at water activities 0.11, 0.22, 0.33, 0.43, 0.54, 0.68 and 0.75 (T = 298 K). Water vapor sorption was determined gravimetrically until equilibrium was achieved (1200 hours). Water activity-equilibrated samples were analyzed for eventual crystallinity by X-ray diffraction and for the glass transitions of the phase separated blends (sucrose-rich and modified starch-rich phases) by Differential Scanning Calorimetry.*
Data source location	*NA*
Data accessibility	*NA*
Related research article	*D. J. Hughes, G. Badolato Bönisch, T. Zwick, C. Schäfer, C. Tedeschi, B. Leuenberger, F. Martini, G. Mencarini, M. Geppi, M. A. Alam, J. Ubbink, Phase separation in amorphous hydrophobically-modified starch - sucrose blends: Glass transition, matrix dynamics and phase behavior, Carbohydrate Polymers (in press)*

Value of the data

- We present a broad set of water vapor data on blends of hydrophobically modified starch and sucrose with a systematic variation in composition. The water vapor data are obtained in the range between 0.11 and 0.75 at $T = 298$ K.
- Data on the glass transition temperatures of the phase-separated blends is valuable in the context of the understanding of the phase behavior of amorphous phase-separated systems.
- These data allow the exploration of the effect of composition on water vapor sorption behavior in the glass transition range.

1. Data

Spray-dried blends of hydrophobically-modified starch and sucrose were water activity-equilibrated at water activities 0.11, 0.22, 0.33, 0.43, 0.54, 0.68 and 0.75 ($T = 298$ K). Water vapor sorption was determined gravimetrically until equilibrium was achieved (1200 h). Water activity-equilibrated samples were analyzed for eventual crystallinity by X-ray diffraction and for the glass transitions of the phase separated blends (sucrose-rich and modified starch-rich phases) by Differential Scanning Calorimetry (Tables 1–4 and Fig. 1). Q2

The water vapor sorption data in Fig. 2 are fitted by the GAB equation:

$$Q'_w = \frac{KCW_m a_w}{(1-Ka_w)\cdot(1-Ka_w+KCa_w)}$$

where K, C and W_m are fitting coefficients [3].

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