HARRICK SCIENTIFIC PRODUCTS

No. 21152

EXAMINING THERMALLY INDUCED CHANGES IN AN AQUEOUS SUGAR SLURRY

Figure 1. The DiaMaxATR™ with its heated cell and temperature controller.

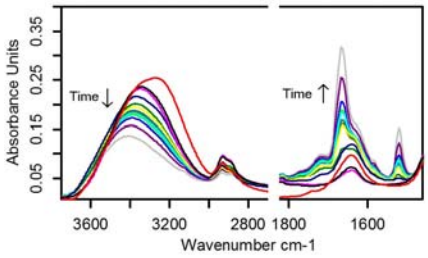

Figure 2. ATR Spectra of Sugar Slurry over Time at 100 °C.

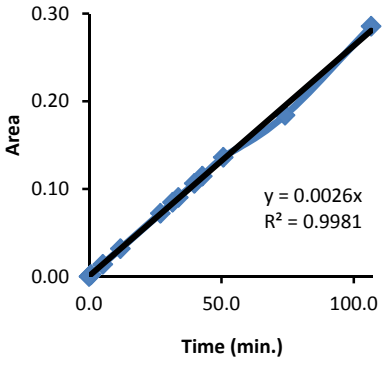

Figure 3. Peak Area vs Time at 1519 cm^{-1}.

INTRODUCTION

ATR is frequently used for quantitative, qualitative and kinetic studies. The newer, higher throughput accessories are expanding the scope of experiments with their improved signal-to-noise.

This applications note demonstrates the potential of using high-throughput single-reflection diamond ATRs to study reaction kinetics by examining the thermally induced changes in an aqueous sugar slurry.

EXPERIMENTAL

Infrared spectra were collected on an FT-IR spectrometer equipped with the Harrick DiaMaxATR™ single-reflection diamond ATR accessory with its Temperature Controlled Liquid Cell and Temperature Controller (Figure 1). The system was purged to remove water vapor and CO_2. Spectra were collected at 8 cm^{-1} resolution and signal averaged over 32 scans. A background was collected from the clean ATR crystal under ambient conditions.

A slurry of Confectioner's sugar in water was injected into the cell and a sample spectrum was collected. Then the sample was heated to 100 °C and spectra were collected at 2 minute intervals.

RESULTS AND DISCUSSION

The resulting spectra shows changes in the band shapes around 3276 cm^{-1} and 1640 cm^{-1} with time, as the water is evaporates and the primary component becomes that of the bound O-H in the sugars. The spectra show the expected peaks from sugars: those in the 900-1150 cm^{-1} region are from the C-O and C-C stretches and those in the 1400-1200 cm^{-1} region are from the O-C-H, C-C-H and C-O-H bends. The band at 1519 cm^{-1} results from the aromatic compounds that form over time. It is interesting that, despite the complexity of the reaction, the change in peak area over time can be fit reasonably well by a linear curve.

As seen herein, the DiaMaxATR high throughput, single reflection diamond ATR is a valuable tool for examining thermally induced changes in materials. In the case of an aqueous sugar slurry, it can be used to extract kinetic information. Further analysis is possible to obtain more rigorous identification of the heat-induced structural changes.

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applications note