Application Note AN MIC417

QA/QC in Beverage Production: Cocoa Mix and Powdered Drinks

Powdered Drinks are Everywhere

Powdered beverages have seen a significant increase in demand in all age groups over the past decades. Just think of a hot cup of cocoa, or the Greek Frappé, which almost evokes a Mediterranean feeling and whose main ingredient is instant coffee.

But there is a lot of science and analytics behind this „instant" path to delight. This includes a complex product development as well as quality control of the final product to ensure high production standards and customer satisfaction.

Keywords	Instrumentation and Software
Powdered Beverage	LUMOS II FTIR microscope
Instant Coffee	Focal Plane Array (FPA)
Cocoa Mix	Macro ATR Imaging
Instant Drink Mix	OPUS Software

The Challenge of Analyzing Instant Drinks

To achieve good solubility, the particulates contained in powdered beverages are most often engineered to be very fine. Thus, visual examination or a conventional macroscopic analysis usually cannot or only partially provide the necessary information about the product.

Advanced analytical methods are required to accurately analyze the composition of powdered beverages. FT-IR imaging enables identification of foreign contaminants as well as the individual major ingredients in a mixture by creating a chemical map to visualize the overall distribution.

The Game-Changer: ATR-FT-IR Imaging

Usually it is quite difficult to obtain an IR chemical image of such loose particles. However, it becomes a lot easier if a special germanium ATR hemisphere with a Ø 1000 µm crystal tip size is used. The large ATR crystal also helps to fix the powder in order to create a clear chemical image.

As soon as the accessory is mounted on the LUMOS II sample stage, it is electronically recognized and the user interface adapted automatically. After that, all that remains is to start the automatic imaging and mapping experiments via a point-and-shoot workflow.

The Chemistry Behind Instant-Cocoa-Mix

Instant cocoa mix is one of the most popular powdered beverages. Besides sugar and cocoa powder other ingredients are also commonly added to the mix.

This includes maltodextrin, which serves as filler and anti-caking agent and lecithin, which improves the solubility of the mix. The quality of the cocoa mix can be strongly affected by a lack of homogeneity of these ingredients.

Analytical Procedure and Preparation

We took a sample from a commonly available instant cocoa mix and analyzed its composition using the LUMOS II FTIR imaging microscope with the macro ATR accessory.

A small amount of sample was first placed, flattened and clamped with the accessory (Fig. 1). Afterwards the analysis was performed over an area of 160,000 µm² using an FPA (focal plane array) detector.

More than 100.000 IR spectra of the sample were collected in about 30 minutes (10 x 10 FPA tiles @ 20 seconds each).

The Result: Composition Check of Instant Cocoa

A false color representation makes the result of the FT-IR analysis crystal clear. (Fig. 2). By using an algorithm called WTA (winner takes it all), each individual pixel is assigned with a color representing the dominating component. Which component predominates, results from the integration of the specific spectral signals.

By comparing the IR spectra with those of a reference library (Fig. 3) the actual ingredients can be assigned to the spectral signals: maltodextrin (red), followed by cocoa powder (brown) and glucose (blue).

The yellow marked area is identified as lecithin. Even the smallest green particles in the sample have been resolved and are identified as theobromine, which is a frequent component of cocoa powder.

Conclusion and Summary

µ-FT-IR imaging plays an important role in the routine analysis of powdered beverage mixes for QA/QC purposes. It reveals foreign contaminants and yields a comprehensive composition and homogeneity analysis of various beverage mixes:

- Instant coffee
- Iced tea mixes
- Meal replacements
- Nutritional supplements

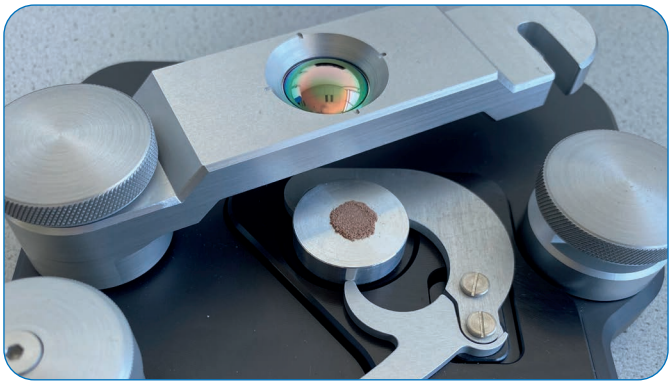

Fig. 1: Instant cocoa mix sample on the macro ATR imaging accessory ready for analysis.

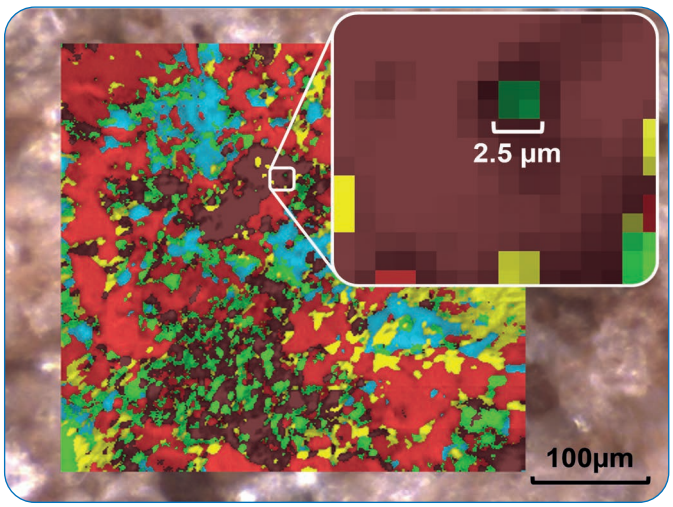

Figure 2: Chemical image of the instant cocoa mix superimposed on its visual image. Display of the content distribution as a false color image: maltodextrin (red), glucose (blue), cocoa powder (brown), lecithin (yellow) and theobromine (green).

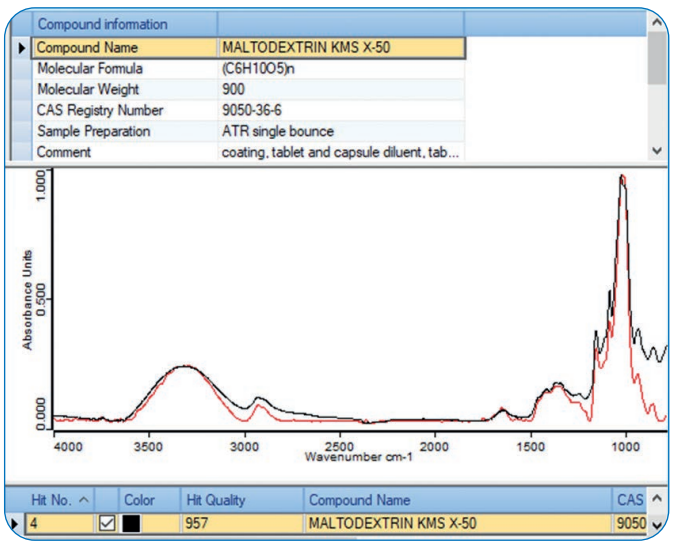

Figure 3: Spectra comparison of sample and reference library.