QA/QC of flours using the Agilent Cary 630 ATR-FTIR analyzer

Application note

Food testing and agriculture

Zubair Farooq and Ashraf A. Ismail

McGill University
McGill IR Group
Department of Food Science and Agricultural Chemistry
Montreal, Quebec
Canada

Introduction

Food grains (cereals, legumes and oilseeds) are milled to get flours, which can be employed in the manufacture of an enormous variety of products such as pasta and bakery products. All the raw ingredients in a food product should ideally be authenticated in order to ensure consistent quality standards and to comply with regulatory labeling requirements. Flours are generally received as powders that need to be tested to ensure: firstly that the contents of the containers correspond with the label and shipping ledger; and secondly, that the product received meets the requirements of the formulator as to uniformity and purity (in terms of composition). Typically an advance sample is made available before bulk shipment and, in this case, it is incumbent upon the formulator to verify that the advance sample is indistinguishable in composition from that of the bulk shipment.

Flours and flour products are usually composed of carbohydrates, proteins, lipids, moisture and other minor constituents. Flour is typically mixed with water to form dough, which is then used in the production of bread and other baked goods. Differentiation among the various flour types (for example, gluten-free flour) can ensure quality and address mandatory labeling requirements.

Experimental

Materials

- Various types of flours (Figure 1) such as chickpea, oat, rice, chestnut (gluten-free), millet (gluten-free), soya, yellow and white corn, organic shelled hemp seed (gluten-free), wheat gluten, whole wheat, breadcrumbs and baking soda were obtained from different suppliers.

Figure 1. Various flour powders

- Various types of flour products such as biochoix, corn pasta (gluten-free), macaroni, penne quinoa (gluten-free) and penne with rice bran were obtained from different suppliers.

Instrumentation and method

All infrared spectra were recorded using the rugged portable Agilent Cary 630 ATR-FTIR analyzer (Figure 2).

The following procedure was used for all data acquisition:

1. A small amount of flour (without any sample preparation or weighing) was placed on the ATR diamond surface.

Figure 2. Agilent Cary 630 ATR-FTIR analyzer

2. The samples were pressed against the diamond crystal using the attached pressure clamp. A slip clutch on the clamp prevents overtightening.

3. Spectra were recorded by adding 64 spectra with a resolution of 4 cm^{-1} (measurement time ~30 seconds).

Results and discussion

Figure 3 shows several overlaid infrared spectra for selected flour samples. The infrared bands characteristic of major flour components such as proteins, carbohydrates, lipids and moisture content can be clearly discerned in the spectra. The intuitive Agilent MicroLab FTIR software provides the means by which sample spectra can be compared to spectra of flour standards already stored in a spectral database of flours. A spectral database (library) can be quickly and easily created on-the-fly in MicroLab PC. A new sample can then be identified immediately after recording its infrared spectrum (Figure 4).

The Agilent Cary 630 ATR-FTIR analyzer can be configured to report a pass/fail or percentage (%) spectral similarity with regard to a reference sample stored in the spectral database. Moreover, the spectral similarity among the infrared spectra of incoming new materials and previously recorded samples is particularly valuable in tracking batch-to-batch or lot-to-lot variability from the same or different vendors.

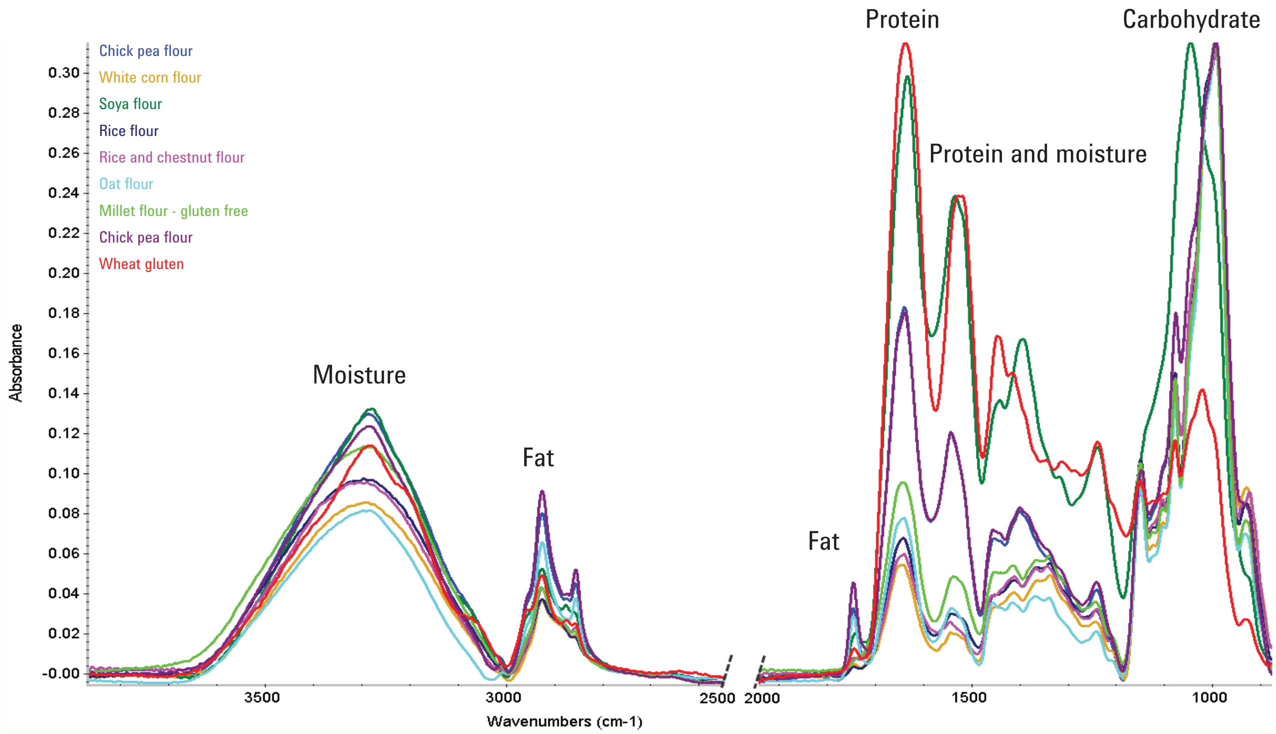

Figure 3. Overlapped infrared spectra of selected flour powders recorded on the Cary 630 ATR-FTIR analyzer

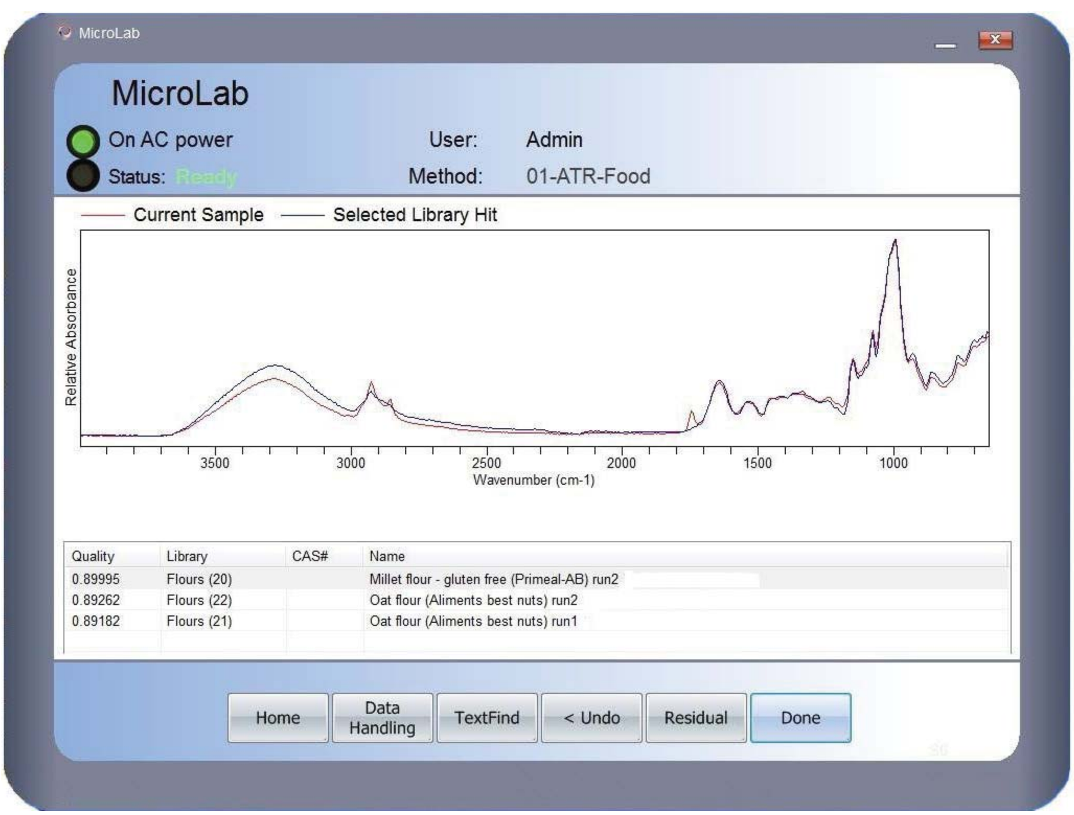

Figure 4. Agilent MicroLab FTIR software correct identification of an unknown flour sample

Conclusion

The Agilent Cary 630 ATR-FTIR analyzer is an FTIR spectrometer with a built-in rugged diamond surface. It rapidly produces high quality spectra and it provides a rapid and robust method to differentiate between different flours. Moreover, the Cary 630 ATR-FTIR is quite portable and can be equally employed at the receiving dock, in the storage facility or in the process line to ensure the highest possible product consistency.

Suggested references

1. Karoui, R., Downey, G. & Blecker, C. (2010). Mid-infrared spectroscopy coupled with chemometrics: a tool for the analysis of intact food systems and the exploration of their molecular structure-quality relationships — a review. *Chem. Rev., 110*, 6144–6168.

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