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Application of Fourier Transform Infrared(FTIR) Spectroscopy in Foods

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Abstract

Fourier transforms infrared (FT-IR) spectroscopy is one of the most imperative and promising instrument used to analyze food for different quality parameters. FT-IR technique is speedy and responsive with a great variety of sampling techniques. In the present study different food were analyzed through. FTIR works on the basis of functional groups and provide information in the form of peaks.

Key words: FTIR, Food, Spectroscopy

Introduction

Infrared spectroscopy in food analysis led to the use (Wilson and TAPP, 1999, the Downey, 1998). Fourier transform infrared (FT - IR) spectroscopy is a flexible approach to provide qualitative and in some cases, quantitative information with little or no sample preparation (Wilson, 1990). Several different technologies are used to identify differences in wheat grain. These techniques include infrared spectroscopy, SDS - PAGE electrophoresis, atomic absorption spectrometry and other (Cubadda, 2004) the standard method. Fourier transform infrared (FTIR) spectroscopy is a powerful tool for composition analysis, and has been widely used to analyze the grain (Barron et al, 2005) of the cell wall. Recently a soft and hard wheat ingredients, the use of infrared spectroscopic imaging combined with multivariate statistical analysis, and determine the starchy endosperm tissue (Baron et al, 2005), limited to a particular cell type of spectral difference. Infrared spectroscopy has the advantage over other methods of minimum sample preparation, rapid analysis, and non-destructive analysis, especially when combined with photoacoustic (PAS) of the Annex. The latter involves the production; absorb the infrared radiation into the sample heat transfer within the sample and the photo acoustic signal of the direct measurement of heat, like gas atmosphere (Hruskova, 2001). Analysis of milk, meat, juice, butter, fat, oil (Van de Voort, 1992 years) FT - IR technical feasibility.

Most of the FT - IR techniques include attenuated total reflection (ATR), the diffuse reflection or transmission technology, all of which requires some sample preparation. Recently, infrared photoacoustic spectroscopy (FT - IR - PAS) has been used to study the complex and heterogeneous materials. The FT-IR - PAS technology is characterized by non-destructive, and they involve non-contact measurement, and require limited sample preparation. They also have high signal saturation limits and depth of analysis. The initial FT - IR - PAS discussed and adopted the principle of Rosencwaig (1980 years).

Widely used for qualitative and quantitative determination of quality attributes, such as moisture, protein, fat, and kernel hardness of agricultural and food products (Williams and Norris, 2001) as the infrared spectrum. Infrared spectroscopy can be used to determine the hardness, protein, whole wheat flour, water content (Manly, 2002) to determine. Than conventional grating near-infrared spectroscopy of the advantages of higher signal to noise ratio, high resolution, fast, accurate frequency determination (Armstrong et al, 2006).

Infrared spectroscopy is the most commonly used polymers spectrum of tools. The method is rapid, sensitive, and a wide range of sampling techniques, and instruments can still be considered cheap. IR spectra of compounds may be the most unique physical properties and the spectrum is

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often referred to as a molecular fingerprint. This is the first relatively pure compound as a recognition tool. However, new technology allows large molecules and the model of pure oligomers, polymers, mixtures and crude oil sample analysis, especially the interaction between the molecules more detailed investigation of structural analysis, although the simultaneous analysis of the laboratory or wheat The organic composition of the infrared microscope publications (Jamme etc., 2008) reported that only a small number of cells or sub cellular level, the analysis of elemental composition (Mills, 2005).

Infrared is a fast, nondestructive, time-saving method that can detect a range of functional constituencies, changes in molecular structure is very sensitive. Chemical mapping, the use of Fourier transform infrared spectroscopy (FTIR) has been successfully applied to a wide range of agricultural products, namely wheat, corn, oats, rye, corn, soybean seeds (Wetzel and Reffner 1993 Himmelsbach et al, 1998).

Infrared and chemical composition of the sample physical state (Cocchi, 2004), based on the information provided. Fourier transform infrared spectroscopy (FT - IR) is a useful technology, many wheat quality parameters measured. Fourier transform Raman spectroscopy is a molecular level, and provide additional information obtained by Fourier transform infrared micro-spectroscopy investigation of the characteristics of the primary cell wall forceful tool. FT - IR detector sensitivity and accuracy, in addition, with a variety of software algorithms to greatly enhance the practical use of infrared quantitative analysis McDowell et al, (2006).

Fourier transform infrared spectroscopy (FT - IR) has also been used to investigate starch gel retrogradation of starch model system (Ottenhof et al, 2005; Smits et al, 1998), protein and water mixture and their interaction (Wei Grassley and Blakeney, 2001), and wheat gliadin of mechanical deformation of the secondary structure changes.

Microscopy can be used both qualitative and quantitative information. Some organic compounds and functional groups can identify their unique pattern of absorption and the absorption intensity can be used to sample the relative concentration of each entity (Wetzel and Levine, 1999) calculations.

To save time, do not destroy the sample, inexpensive and accurate method for food analysis of LED infrared spectroscopy in food analysis using (TAPP and Wilson, 1988; Downe, 1998 years). FT-IR analysis has been successfully used to study starch gel (Wilson et al, 1987, Wilson and Belton, 1988), to determine the individual sugar content in the starch hydrolysis.

In the IR spectra of carbohydrates, can be traced back 50 years to open up the investigation and technological advances in the field of carbohydrates are summarized (Koenig, 1992).

Most of the scientists involved in different infrared and Ramen carbohydrate data interpretation (Mathlouthi and Koenig, 1986) of the conventional application-related work. However, their limited number of monomers and polymers, cellulose and starch. The current biochemical, biological and food industry applications cover a wide range of carbohydrates, including a variety of commercial sugars, cellulose, pectin, starch, hemicellulose, carrageenan, hyaluronates and low molecular weight model.

Now commonly used multivariate calibration routine NIR analysis to determine the wheat flour (Osborne and Fearn, 1986; Archibald and Keith, 2000; Manley, 2002) of the protein, moisture, gluten, fiber content and hardness. Near-infrared regions of the calibration purposes, until now, has been the preferred medium infrared (MIR), because it is in a different intensity of the absorption, so that the same chemical information (Cocchi, 2004) with a rich regions.

Wheat is composed of different chemical and biochemical composition, ie, protein, carbohydrates, lipids, minerals, vitamins and enzymes, etc. These groups play a crucial role in determining the quality of wheat and its products. Have a profound impact on end-use quality (Harry et al, 2004) of wheat varieties of physical, chemical, rheological and technological properties of significant differences. Wheat varieties showed significant antioxidant capacity and significant differences observed in different varieties of antioxidant activity evaluation system (Iqbal et al, 2005).

Infrared has been used to distinguish the wheat grain in a variety of organizations, organization-specific functional group mapping (Wetzel and Reffner 1993 年;. Marcott et al, 1999). Kernel hardness in wheat is the most important quality, which is graded as whole grains factors used to determine the type of characteristics. Wheat hardness (Armstrong, 2006) using Fourier transform infrared spectroscopy (FT-IR). There are three ways to analyze the protein secondary structure. The first method is to use the normal Fourier transform infrared spectroscopy (FTIR), but this method may be accurate, because the spectrum is from the feed meal protein secondary structure analysis. Second method is to use a standard. Global Sources infrared micro-spectroscopy, but this method can not reveal the chemical properties of microscopic biological materials. In addition, infrared spectroscopy, is usually subject to other biological components, such as carbohydrates, which has a scattering effect (Wetzel, 2003). The third method is to use synchrotron light source procurement of infrared microscopy to estimate the relative protein secondary structure.

IR decided to structural changes, including succinlyation, acetylation can enhance its functionality and maleination value, and expanding its physical and chemical properties (record, etc., 2001) led to the range of chemically modified starch. Infrared spectra of the light generated from the degradation of starch and starch crystallinity changes in correlation (kerf, 2001).

Infrared spectroscopy is a new analysis technique, which is in the early development of food to determine grain hardness (Turnbull et al, 2003). (Manley, 2002) reported

that infrared spectroscopy can be used to determine the hardness, protein and moisture content of whole wheat flour. Infrared spectroscopy is a powerful tool in the form of components analysis, and complementary to other imaging techniques can provide information about cell wall components in the spatial distribution of information, such as Raman microscopy (Piot et al, 2001). Characterization of oil to determine the degree of unsaturation, free fatty acid content, saponification number and solid fat content (Guillen and Cabo, 1997), the applicability of infrared spectroscopy were reviewed.

Infrared technology is also a useful "molecular structure of starch to provide a detailed structural confirm the type of understanding. Previously used to study a mixture of starch and starch (such as Belton, 1991; Goodfellow and Wilson, 1990; 1988 Wilson and Belton). Infrared spectroscopy measures the absorption of radiation in the frequency range from about 4000-400 cm. Absorption related to molecular vibrational energy state and the transition between the rotating substrate. A choice of rules apply to these conversions, if the vibration lead to changes in the molecular dipole moment, infrared light absorption, can occur. It is possible to assign specific functional groups absorb, so that the infrared spectral structure identification is very useful. As the absorption intensity is proportional to the concentration of absorbing species, quantitative analysis is possible (Wilson, 1988).

Food analysis, infrared spectroscopy in food analysis led to the use (Wilson and TAPP, 1999, the Downey, 1998). Fourier transform infrared (FT - IR) spectroscopy is a flexible approach to provide qualitative and in some cases, quantitative information with little or no sample preparation (Wilson, 1990). Near-infrared (NIR) spectroscopy and chemometrics have been successfully used to describe since the late 1970s, grain samples. Near-infrared spectroscopy is now commonly used multivariate calibration routine analysis to determine the protein, moisture, gluten, fiber content and hardness of the flour (Osborne and Fearn, 1986, the Archibald and Keith, 2000 Manley et al, 2002). Near-infrared regions of the calibration purposes, until now, until the mid-infrared (MIR) region of choice, because it is a different intensity of the absorption band to bring the same wealth of chemical information (Reeves and Zapf, 1999). Sample by radiation and measuring the different energy levels of radiation absorbed by a small portion of an infrared spectrum. Fourier transform infrared spectroscopy (FTIR) is based on the fact that organic substituents in the infrared (MIR) region of the electromagnetic spectrum (wave number 4000 ~ 400 cm - 1 Office) related to the frequency of vibration, resulting in the characteristic absorption band. Infrared spectroscopy has been applied to the analysis of food and determine their qualitative and quantitative attributes (Van de Voort and Ismail 1991)

IR is the most studied polysaccharides cellulose, α and beeta - (1-4) connected glucan, which is universal in plants and in algae and bacteria (1983 Aspinall,). Cellulose type of FT - IR study covers identification (Langkilde and Svantesson, 1995), the crystallinity and determine the source and batch variation on microcrystalline cellulose (Luo et al, 1994) Crystallization. Infrared spectroscopy is a particularly useful tool to connect to the polymer chain and the proportion of direct measurement of the color separation is an important parameter in the direction of the functional constituencies. Polarized radiation recorded in the native cellulose crystal orientation of the sample spectrum to provide a variety of functional groups and the fiber axis (Mathlouthi and Koenig, 1986) the transition moment direction of the information. Cellulose and glucose are normal coordinate analysis has been run several carbohydrates (Zhbankov 1992 years). (OH) stretching and 1200-1000 cm region of 4 - O - methyl - glucuronoxylan absorbent reported earlier (Kalutskaya 1988 years). With the xylans are usually found in lignin and other phenolic compounds. Lignin, ferulic acid and protein can be detected in the 1500-1500 cm region, however, a combination they appear, so these are not easy to distinguish or quantitatively determined.

Potato starch gel retrogradation kinetic monitoring and FT - IR spectrum compared to waxy corn starch. Spectrum shows a C - C and C - O stretching region 1300-800 cm-sensitive regenerative process. Retrogradation rates were different amylopectin and amylose, amylose crystallization occurred in a few hours, the slow crystallization of amylopectin, spent a few weeks (Rindlav, 1997). . FT - IR spectrum suggested as a possible way to estimate the purity of glucan glucan preparations (Kacurakova, et al, 1999) This is a very important α and beeta - glycosidic linkages relative proportions of determination.

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