APPLICATION OF IR SPECTROSCOPY IN FOOD SCIENCE: STUDIES ON SUGAR HOUSE PRODUCTS AND FRUIT JUICES

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Infrared spectroscopy in both mid infrared (MIR) and near infrared (NIR) region is emerging as a highly potential qualitative as well as quantitative analytical technique in a wide range of applied areas. The potential has been recognized and researchers have established it as a valuable workhorse for the practitioners of detection, determination, separation and structure elucidation of materials. As applications of IR/NIR analysis are increasing in grain and food industries, more options are becoming available foe analysis of sugarcane juice; molasses and particle size of sugar can be a challenge. A uniform method is difficult to standardize for all the products since many variables exist between one product to another.

In this presentation we propose to perform the determination of constituents from juice and molasses from sugarcane and apple juice using ATR/FTIR and NIR spectropfotometer. The results are matched with the conventional analytical studies. Fast, convenient, specific and highly sensitive spectroscopy based methods have been developed in all cases. A fiber optic remote sensing approach, readily convertile into an on line technique has been developed for sugarcane juices.

Analysis of raw sugar cane juice has been done for pol measurement using FTIR spectroscopy in mid Infrared region. ZnSe ATR accessory is used for spectroscopic data collection. Sugar cane juice samples were collected from sugar industry. Different mathematical techniques are used for developing a calibration equation. PLS method is found to be most suitable for calibration in this case. The work has established the feasibility of MIR spectroscopy in ATR mode for analysis of raw sugarcane juice.

Determination of sugars and organic acid concentration apple juice has been investigated by Infrared spectroscopy. Calibration has been performed on synthetic samples, in mid-infrared region in ATR mode. Partial Least Square and principal component regression methods have been used to obtain these calibrations for mixtures of sucrose. Glucose. Fructose and citric acid in concentration ranges typically encountered in real apple juices. The calibrations have been used to determine the concentration of these components in real samples.

Near infrared transmittance spectroscopy were used with fiber optic probe for rapid and direct analysis of sugar cane juice for determination of sugar content. The spectral data and reference data were combined using chemometrics software, regression was performed to generate a model to predict pol in raw sugar cane juice samples. The NIR predicted results compare well with reference pol results as shown by reasonably good correction coefficient (0.9129). Feasibility of technique for applications in sugar industry is assessed. The biggest advantage is that remote sensing is possible and the length of the fiber can go up to as high as 500 metros.

A rapid and accurate method for determination of total sugar and reducing sugars (glucose and fructose) content has been developed. An indigenous ELICO NIR spectrophotometer, modified according to the requirements of sugar industry. A comparison is made between the actual values (chemical values) and the predicted values (NIR values).

Ability of near infra red diffuse reflectance spectroscopy is assessed for the measurement of particle size of sugar. Commercially available sugar samples with varying crystal size and powdered sugar samples were used for analysis. Three approaches were tried. A set of twenty-two samples was prepared by crushing and sieving subsequently using laser particle sizes analyzer and was used as reference values for calibration. NIR spectra for all samples in all three sets were recorded in diffuse reflectance mode. Partial Least Square method was applied for calibration. The best correlation (R^2 = 0.9939, RMSD = 1.6518) could be achieved in case of laser versus NIR values using powdered and sieved samples for calibration.