Abstract

The thesis is an attempt to apply spectroscopic methods for the investigation of a few commonly used food items having beneficial or harmful effects on the human body. The food materials chosen for this study are chilli (Capsicum annum L.) and its seeds, turmeric (Curcuma longa L.) and black pepper (Piper nigrum L). The selected spectroscopic methods used here are X-Ray Fluorescence (XRF), visible emission, Atomic Absorption, Fourier transform infrared (FT-IR), Fourier transform Raman (FT-Raman) and fluorescence spectroscopy. Through XRF, AAS and visible emission spectroscopy qualitative elemental analysis of the sample has been done. For qualitative structural information FT-IR and FT-Raman spectroscopic methods are used which provide complete information about the functional groups (bonding type between elements) of the samples. The static fluorescence method has been used for getting large scale molecular information. The objectives of the above analyses are: first, to provide a satisfactory spectroscopic characterization of the samples and secondly to substantiate popular beliefs regarding the use of the sample for medicinal and nutritional purposes as well as different scientific reports on these items.

In the introductory chapter of the thesis, a brief description from the point of view of the application in medical, pharmaceutical and food sciences of the food samples is presented. An attempt has also been made to review different
publications on the above mentioned items. The aim, objective and scope of the thesis have also been presented in this chapter.

In chapter 2, a detailed view of the theoretical aspects and instrumentation techniques of the different spectroscopic techniques used in the present investigation, viz, XRF, visible emission, atomic absorption, Raman, fluorescence spectroscopy are included. Also their important applications have been discussed.

In chapter 3, the spectroscopic studies of chilli have been presented. XRF spectra of the seeds of chilli reveal the presence of a new mineral magnesium, as well as elements sulphur and chlorine. The most significant finding through FT-IR and FT-Raman spectra is the absence of ascorbic acid (vitamin C) in the seeds, whose amount at 63.70 mg/100 g has been the maximum among the vitamins present in chillies [1]. Absence of the four OH bands on the FT-IR and FT-Raman spectra of ascorbic acid leads us to conclude that it is present in the chilli-skin only! The 440 nm excited fluorescence emission spectrum from raw seeds has given rise to bands in the green and red regions, while the same from ripe seeds has shown a strong green band only! The fluorescence intensity ratio between the green and the red bands could be of use as an indicator of ripening [2-3].

In chapter 4, the spectroscopic studies of turmeric are presented. The elemental analysis performed using XRF and Atomic Absorption spectroscopy is in conformity with some earlier results. Fluorescence spectra show bands due to riboflavin. Based on the correlations with the infrared spectra of its individual components and other compounds already published, assignments of the observed bands of the FT-IR and FT-Raman spectra of turmeric are done. The infrared
spectrum is shown to be very similar to that of triolein, a triglyceride of oleic acid. This result should encourage the consumption of turmeric to decrease the LDL-cholesterol level in human body [4-5].

The chapter 5 contains the spectroscopic analysis of black pepper. Analysis of the XRF spectra confirm the presence of the elements Fe, Mn, Ca and K and the trace elements detected with AAS are Cu, Ni, Zn, Cr, Mn, Se, Mg and Na. FT-IR and FT-Raman spectra reveal the presence of some specific functional groups, attributed to different bands present in the spectra. Vitiligo or leucoderma is an acquired skin disorder with the loss of native skin pigment. Elevated epidermal H$_2$O$_2$ levels in the mM range inactivate epidermal and systemic catalase. Occurrence of certain bands suggests the sample to have enough carboxyl dimer character which may behave as reaction centres to react with the increased H$_2$O$_2$ level on the epidermis of the skin leading to its reduction as action of a dimer with alkaline hydrogen peroxide is a dehydration reaction. Piperine, the compound that gives black pepper its spicy, pungent flavour and its synthetic derivatives has been discovered to stimulate pigmentation in the skin. The present report, thus, can add to this finding to promote black pepper as an effective remedy in the treatment of vitiligo [5-6]. Moreover, as an effective treatment for vitiligo, a patented drug named pseudocatalase is prescribed which is usually advised to take with calcium owing to the fact that by taking the drug in that way increases its efficiency level from 60 percent to 95 percent. Our report on the elemental composition of black pepper shows a high content of calcium too. High percentage of calcium in black pepper strongly advocates its use in the treatment of vitiligo [7].
References:


