Abstract

Food products consist of a well-organized structure of different organic and inorganic substances that are highly sensitive and susceptible to being affected by variations in the product's internal and external environments. Alteration of food quality results due to the action of microorganisms, food enzymes, chemical reactions, and physical changes. The consumption of food with altered quality may cause serious negative impacts on the consumer's health as well as industrial market relations. Thus, food quality assessment is of critical importance to preclude public health issues and monetary losses to the Government. Conventional methods of food quality testing employed in the present food industry are mostly invasive, time-consuming, and require special sample treatment. Consequently, most of these cannot be adapted into a field-deployable platform for the same. On the other hand, optical spectroscopic techniques have shown great potential in studying the different aspects of food products as a rapid, non-destructive, label-free, and non-contact means of quality assessment. However, the applicability of a particular spectroscopic tool depends on several factors. Thus, prior knowledge of feasibility is important for the judicious selection of targeted optical techniques with aligned applications in order to obtain optimal details about the sample.

Therefore, the present dissertation explores the feasibility of two specific optical spectroscopic techniques, namely, Raman and Terahertz (THz) spectroscopy, towards developing a successful model for rapid food assessment. While THz spectroscopy is based on the absorption of the resonant frequencies lying in the THz region, Raman spectroscopy is related to the inelastic scattering of the excitation radiation from the molecules. These techniques are complementary in nature and their simultaneous implementation may provide broad information about the intermolecular and intramolecular interactions. These are essentially related to the compositional

and structural parameters, and hence, to the authenticity and quality of the food product. In the present dissertation, different classes of food products were analyzed to investigate the applicability of these spectroscopic techniques on the basis of the factors examined in corresponding experiments: these include identification, quantification, moisture measurement, adulteration, and spoilage detection. Our results demonstrate that their selectivity and specificity are limited by system parameters and physical characteristics of the sample, suggesting the need for some improvements and modifications in terms of instruments and data processing to implement them in the food industry.