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Early diagnosis of cancer in the middle Euphrates region: A Review

[1] **Allawi Hamead Harjan,** [2] **Azhar S Alaboodi,** [3] **Ali Abid Abojassim**
[1, 2, 3] Department of Physics, Faculty of Science, University of Kufa, Najaf, Iraq

Corresponding Author: **Allawi Hamead Harjan**

Abstract
There is an urgent need to develop new techniques for diagnosing and monitoring patients with cancer. Fourier Transform Infrared (FTIR) spectroscopy has great potential in early cancer diagnosis, as well as real-time monitoring of cancer progression and chemoresistance. As a non-invasive, simple and convenient method, it can not only distinguish the molecular differences between normal and malignant tissues, but can also be used to characterize different types of cancers. FTIR spectroscopy is also widely used in monitoring tumor cells in response to antitumor drugs, differentiating cells in different growth states, and identifying novel synthetic drugs. In this review article, the applications of FTIR spectroscopy for diagnosing different types of cancers and other work carried out so far are described in detail.

Keywords: Diagnosis, Fourier Transform Infrared Spectroscopy, Spectral Feature, Tumor Monitoring

Introduction

One of the important analytical techniques available to scientists is infrared spectroscopy (IR), and one of the advantages of this technique is the ability to study any sample in almost any situation, and to examine difficult samples or that were considered difficult in previous years in medical research Vital A variety of new sensitive technologies have been developed [1-4]. The formation of unknown substances on a molecular basis is achieved by seismic spectroscopy, and despite this fact, it is recent technical developments that have generated a very important interest in the possibility of applying molecular seismic spectroscopy.

Cancer is defined as disturbances in the biological structure, such as (uncontrolled cell division, growth of invasive cells in adjacent tissues and metastatic transplantation to other sites of the body). Cancer is one of the leading causes of death in the world. Cancer-related diseases affect people, but their risk increases with age. The highest rates of death were recorded from lung, colon, breast and prostate cancer. There are many factors that increase the risk of cancer, and among these factors is exposure to environmental chemicals, viruses, smoking, or social and economic conditions, and some of these factors can be eliminated by humans and thus can prevent cancer. Histological confirmation, which is the main diagnostic method for cancer, can be obtained through pathological examination of tissue samples obtained from a surgical biopsy [5, 6]. One of the methods used in early diagnosis that is complementary to traditional histopathology and especially early biomolecular modifications is infrared (IR) spectroscopy, this method is non-destructive, label-free, and provides a biochemical fingerprint of cells and tissues [7, 8]. Cluster images allowed the recovery of specific infrared spectral signatures representative of the non-neoplastic and neoplastic epithelial components compared with the reference histological images stained with conventional hematoxylin and eosin (HE). The main goal of early detection of cancer is to diagnose and treat it before it spreads outside the original organ, especially in the pre-surgical stage. Systemic therapy is the preferred method in attempting to control cancer, although early detection catches many tumors at relatively late stages in their natural history [9]. The reduction of mortality using the currently available detection methods is very modest, and as a result many studies have been conducted in optical techniques on a large scale as a proposal for cancer diagnosis, where the analysis is automated and based on the detection of biochemical changes rather than using an approach that depends on the morphological changes that occur In tumor tissues [10]. Fourier infrared spectroscopy (FTIR) is one of the optical spectroscopy techniques that can effectively provide information regarding the structure and chemical composition of biological materials at the molecular level. One of the advantages of this referral is that it serves as a diagnostic tool to detect and characterize various diseases or disease progression due to induced changes in chemical composition and structure as well as its work to distinguish cells and tissues based on their characteristic spectral properties that reflect their chemical structure and structure [11, 12]. In the case of proteins, which play a major role in the biochemistry of cells, the correlation of molecular structure and function is very important. In the infrared spectrum, structural changes can be easily detected, and a cellular molecular marker can be used to treat the pathology of tissues, and the understanding of the etiology of the pathological process comes from comparing the spectra between healthy and cancerous tissues. In recent years, infrared (IR) spectroscopy has emerged as an excellent analytical technique in various applications.

The high acquisition speed and superb spectral sensitivity have been combined by analytical infrared spectrophotometers developed due to the above factors. Showing the structural changes of cells at the molecular level in various human cancers is one of the results of FTIR spectroscopy, and that the carcinogenesis caused by different patterns of vibration in the molecules of cells and tissues is the cause of these structural changes, as these frequency vibrations are characterized by changes in the FTIR spectra, and as a result The FTIR spectra of normal or malignant cells can be present with a distinctive spectral appearance [13]. FTIR spectroscopy as a tool to distinguish between normal and malignant cells was one of the main aims of this review, but with varying degrees of dysplasia, published between 2009 and 2014.

Theoretical part

In this study, we will address some research papers to conduct a diagnostic survey of types of cancers in which FTIR technology was used to distinguish between healthy and malignant tissues in the central Euphrates region of Iraq. In 2015, researchers from Anbar governorate used *Enas S. Yousif et al.* analysis of cancerous breast tissues. Spectra of 91 breast tissue samples were taken by a pathologist, and these samples were as follows: 63 normal samples (N), 8 samples with hyperplasia (H), 10 samples with benign fibroid (F) and 10 samples She suffers from ductal carcinoma (DC). It was found that the spectrum of cancer is significantly different from the normal and benign tumor, where it was found that there are spectral changes in the content of fats, proteins, nucleic acids, collagen and carbohydrates, for example, the concentration of fat cells and carbohydrates in cancerous breast tissue is less than in normal breast tissue at a time when The content in patterns of DNA, protein and collagen was increased in benign and cancerous tissues [14]. In 2017,where a study was conducted in Babylon governorate by researchers *Khalid Hussian and Shaymaa Awad* on 47 samples of blood samples from 25 healthy people and 22 patients with breast cancer Some remarkable differences are elucidated in terms of FTIR-ATR spectral profiles, absorption bands, wave numbers and the intensity ratio parameters and satisfactory analysis has been made. Noticed that in the case of breast cancer samples, the absorbance for the various fundamental modes of vibrations of fourth vital regions is larger than that for the normal samples [15]. In 2019, the researchers *Ammar Alhasan, Tammar Hussein Ali* obtained the 10 normal lung tissue biopsy specimens were obtained from the participants who also provided the lung cancer specimens. A total of 35 fresh specimens after surgery from patients diagnosed with stage 1 lung cancerthe obtained results indicated degradation of the biochemistry component (protein) of the tissue due to carcinogenic disease.The identification of a biochemical component from either normal or cancerous lung tissue would help to evaluate malignant tissue [16]. In 2022 researchers *Furqan A. Tawil et al.* made early detection of lung cancer using FTIR spectroscopy through spectroscopic analysis of 80 blood serum samples from 30 healthy controls and 50 patients in Karbala governorate. The secondary architectures of proteins in malignant and normal serum were different. Some ratios of band intensity can be used as markers to predict lung cancer occurrence. As a result of the aforesaid findings, serum IR spectram may be effective in identifying lung cancer [17]. Also, In 2022 researcher *Allawi. H. Harjan et al*. conducted tests on 100 blood serum samples, 50 of which were healthy and 50 for prostate cancer patients, for the purpose of diagnosing this disease through a technique FTIR. Most of the coefficients of severity ratios for the spectrum of healthy and prostate cancer patients were statistically significant for the presence of the disease [18].

Conclusion

Infrared spectrum can be used in many medical applications, and among these applications is the diagnosis of cancer diseases, which is one of the best medical applications, as it is done by studying and comparing changes in the infrared spectra between normal and abnormal tissues, which may provoke several reasons. The spectral changes are caused by specific changes in the genetic code (DNA, RNA) of the cancer cells as well as the increase or decrease in components such as lipids, proteins and carbohydrates, and finally, differences between healthy and cancerous samples can be observed from different intensities of the infrared spectra transmitted for different curvature bands and peaks functional group. In the future, work is underway to manufacture a portable sensor that measures the infrared spectrum with high accuracy that will enable early diagnosis of cancer.

References

1. Ellis DI, Goodacre R. Metabolic fingerprinting in disease diagnosis: biomedical applications of infrared and Raman spectroscopy, Analyst. 2006; 131:875-885.
2. Petibois C, Déléris G. Chemical mapping of tumor progression by FT-IR imaging: Towards molecular histopathology, Trends in Biotechnology. 2006; 24:455-462.
3. Wang J, Sowa M, Mantsch H, Bittner A, Heise H. Comparison of different infrared measurement techniques in the clinical analysis of biofluids, TrAC Trends in Analytical Chemistry. 1996; 15:286-296.
4. Mantsch HH, Chapman D. Infrared spectroscopy of biomolecules: Wiley-Liss New York, 1996.
5. Luna LG. Manual of histologic staining methods of the Armed Forces Institute of Pathology, 1968.
6. Kendall C, Isabelle M, Bazant-Hegemark F, Hutchings J, Orr L, Babrah J, *et al*. Vibrational spectroscopy: a clinical tool for cancer diagnostics, Analyst. 2009; 134:1029-1045.
7. Martin FL, Kelly JG, Llabjani V, Martin-Hirsch PL, Patel II, Trevisan J, *et al*. Distinguishing cell types or populations based on the computational analysis of their infrared spectra, Nature protocols. 2010; 5:1748-1760.
8. Khanmohammadi M, Garmarudi AB. Infrared spectroscopy provides a green analytical chemistry tool for direct diagnosis of cancer, TrAC Trends in Analytical Chemistry. 2011; 30:864-874.
9. Bishop JM. The molecular genetics of cancer," Science. 1987; 235:305-311.
10. Brennan JA, Boyle JO, Koch WM, Goodman SN,

Hruban RH, Eby YJ, *et al*. Association between cigarette smoking and mutation of the p53 gene in squamous-cell carcinoma of the head and neck, New England Journal of Medicine. 1995; 332:712-717.

11. Bunaciu AA, Aboul-Enein HY, Fleschin S. Application of Fourier transform infrared spectrophotometry in pharmaceutical drugs analysis, Applied Spectroscopy Reviews. 2010; 45:206-219.
12. Shaw RA, Mantsch HH. Vibrational biospectroscopy: from plants to animals to humans. A historical perspective, Journal of molecular structure. 1999; 480:1-13.
13. Bunaciu AA, Fleschin S, Aboul-Enein HY. Biomedical investigations using Fourier transform-infrared microspectroscopy, Critical Reviews in Analytical Chemistry. 2014; 44:270-276.
14. Yousif ES, Fawaz NI, Mohamed BJ. Human breast tissue cancer diagnosis by FT-IR spectroscopy, Journal of university of Anbar for Pure science. 2015; 9.
15. Hatif KH. Study The Differences of Sera between normal and malignant in human Breast using FTIR-ATR, Journal of Kufa-Physics. 2017; 9.
16. Alhasan A, Ali T. Valuable Modern Strategy (ATR-IR) Spectroscopy Technique to Distinguish Between Normal and Lung Cancer Tissue, Middle East Journal of Cancer. 2019; 10:54-59.
17. Tawil FA, Awad S, Hashim AK, Almayahi B. Lung Cancer Serum Spectra Using FTIR ART in Karbala, Iraq: A Comparative Study, Journal of Pharmaceutical Negative Results, 2022, 836-842.
18. Harjan AH, Kadhim SA, Almayahi B. Prostate Cancer Serum Spectra as Indicators of Early Diagnosis Using FTIR-ATR Fourier Transform Infrared Spectroscopy, Journal of Pharmaceutical Negative Results, 2022, 829-835.