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FTIR: A Novel Bio-Analytical Technique

Ashish Chauhan*

National Institute of Pharmaceutical Education and Research, NIPER, Punjab, India

Fourier Transform Infra Red (FTIR) spectroscopy is a magnificent technique. Infrared spectroscopy is based on the fact that molecules absorb specific frequencies that are characteristic to the structure. These absorptions are resonant frequencies of the absorbed radiation that matches with the frequency of the bond or group that vibrates. The energies are determined by the shape of the molecular potential energy surfaces, the masses of the atoms and the associated vibrational coupling. In particular, in the Born-Oppenheimer and harmonic hypothesis when the Molecular Hamiltonian corresponding to the electronic ground can be approximated by a harmonic oscillator in the neighborhood of the equilibrium molecular geometry, the resonant frequencies are determined by the normal modes corresponding to the molecular electronic ground state potential energy surface. The resonant frequencies can be related to the strength of the bond and the mass of the atoms. Thus, the frequency of the vibrations can be associated with a particular bond type.

It is a versatile tool for bio-analytical and pharmaceutical sciences, with a wide field of applications ranging from characterization of drug formulations to elucidation of kinetic processes in drug delivery. Recent developments in applications of these methods include study of drug delivery systems and in particular topical drug delivery system. Advance techniques of FTIR are Fourier Transform Infrared-Attenuated Total Reflectance (FTIR-ATR), Fourier Transform Infrared-Photo acoustic Spectroscopy (FTIR-PAS), Fourier Transform Infrared Imaging Spectroscopy, Fourier Transform Infrared Micro-spectrometry. FTIR-ATR method is used to study drug release in semisolid formulations, drug penetration and the effect of penetration modifiers and also *in vivo* studies. It is especially useful for liquid and powder sample. It needs no sample preparation. FTIR-PAS has been used to access the drug content in semisolid and solid formulations, to determine drug penetration into artificial and biological membranes. The advantage of this technique is the possibility of spectral depth profiling. Recently, FTIR imaging has also been used to visualize the drug and excepient distribution in pharmaceutical formulations such as tablets and therapeutic transdermal system, the mechanism of drug release, study of penetrability of cosmetic ingredients in human hair. ATR-FTIR imaging is also used to obtain images of the surface of the skin and the spatial distribution of protein and lipid rich domains. FTIR has also been used widely in disease diagnosis *in vitro* and *in vivo* studies. It has now widely been studies for cancer. Cancer cells are easily characterized by FTIR and a number of studies are in process. I hope the fruitful use of FTIR to characterize malignant disease like cancer can help explore better results for cancer treatment in the near future.

***Corresponding author:** Ashish Chauhan, Jr. Scientist, National Institute of Pharmaceutical Education and Research (NIPER), Punjab, India, E-mail: aashishchauhan26@gmail.com

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