ISSN: 0975 -8542

Journal of Global Pharma Technology

Available Online at: www.jgpt.co.in

RESEARCH ARTICLE

Amphetamine Drug Analysis Using Raman Spectroscopy

Yaser Zuhair Tawfiq*, Samira Adnan Mahdi

University of Babylon/ College of science/ Physics Department/Iraq

***Corresponding Author: Yaser Zuhair Tawfiq**

Abstract

The main concept of this work is to analyze the illegal amphetamine drug by Raman spectroscopy. The samples of amphetamine were obtained from the drug control office in Iraq. Two different forms of amphetamine samples (a full tablet 167mg, and powder167mg) were chosen to investigate the sensitivity of Raman spectroscopy. The spectral of the two samples show no difference, and the amount of material does not constitute an obstacle in the way of measurements. The Raman shift spectrum of two forms has been reported in the region 2969.2 cm^{-1} for the powder form and 3009 cm^{-1} for the tablet form.

Keywords: *Raman spectroscopy, Amphetamine, Drugs.*

Introduction

There is substantial concern in the recognition of criminal drugs, especially the alkaloids heroin, cocaine, and amphetamine. The amount of illicit drugs that are inundating Iraq country is large and expected to increase even more in the future. Many government agencies and private industries test for drug use. The number of drug samples grabbed by the drug squad or the societies and suspected to comprise controlled ingredients is regularly increasing.

As a result, there is an important demand for prompt and truthful analysis means robust, with low costs to reduce analysis costs in criminal laboratories. In order to differentiate between drug kinds Raman spectroscopy has earlier been functional to the analysis of drugs of abuse [1]and between drugs of the alike sorts involving opiates [2], cocaine [3], amphetamines [4, 6], ecstasies [5], barbiturates [6] and benzodiazepines [7, 10]. Using their Raman spectra different polymorphs [5, 11, 12] and salt forms [3, 6] of drugs of abuse have also been classified.

For quantitative analysis of drugs of abuse in mixtures Raman spectroscopy has also been used [4, 5, 12, 14] and to attain spectra lamps, permitting determination of the consistency of seized tablets [12]. Raman spectroscopy is non-damaging and demands fewer no sample preparation, and drugs of abuse have been successfully examined inside glass [15] and thin plastic [3, 4] packaging.

The interference from fluorescence is considered the main disadvantage of Raman spectroscopy, either from the drug of abuse or the broad range of scums encountered in seized samples, which may obscure the Raman spectrum.

There are many ways to reduced fluorescence interference by photo bleaching, i.e. expanded exposure of the specimen to the laser beam before obtaining a spectrum [16], or by doing the measurements with an excitation wavelength in the UV [17, 18] or IR [4, 13] region of the Raman spectrometer. The Raman spectrum of a contaminant may also be over laid on that of the drug of abuse, impeding identification [1, 13, 14].If the scums is known, these interfering patterns can be eliminated by spectral subtraction [2, 4, 5, 15].In this work, amphetamine drug has been investigated using two forms which have same weight (tablet 167mg, powder 167mg).

Experimental Procedure

Raman Spectroscopy

Vibrational spectroscopy Raman and infrared are based on the interaction of

electromagnetic radiation with matter. Experiments are usually nondestructive, and

the samples can be reused for other investigations. The aim of both Raman spectroscopy and Infrared spectroscopy experiments is to probe the molecular vibrations probing the transition between the ground state and the excited vibrational states. The transitions are observed as bands in the vibrational spectrum Each molecule has a specific set of vibrational bands which are defined by their frequencies shapes, and intensities. By analyzing these properties, it is possible to get information about the local coordination of the atoms in a specific material. In this work the Raman spectroscopy (Horiba HR 800) see Fig 1.Was implemented to conduct the experimental measurements of the amphetamine material.

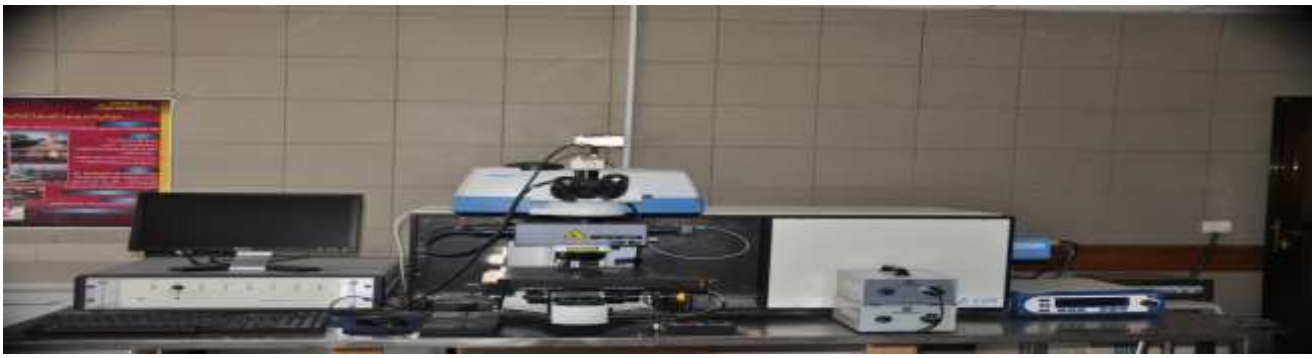

Fig. 1: Horiba spectrophotometer HR 800 contains two laser sources for 632nm and 785nm with RAMAN and FTIR

Samples Preparation

An amphetamine sulfate samples have been obtained from the General Directorate for Combating Drugs and Psychotropic Substances. The weight of amphetamine tablet is 167mg, and the chemical construction of the amphetamine sulfate is displayed in Fig.2a. Sample was placed on a cleaned glass plate as shown in Fig. 2b. However, the powder form of the sample was obtained after grinding the amphetamine tablet 167mg using an electrical crusher. In the same way the powder form of the sample was placed on a cleaned glass plate as shown in Fig.2c.

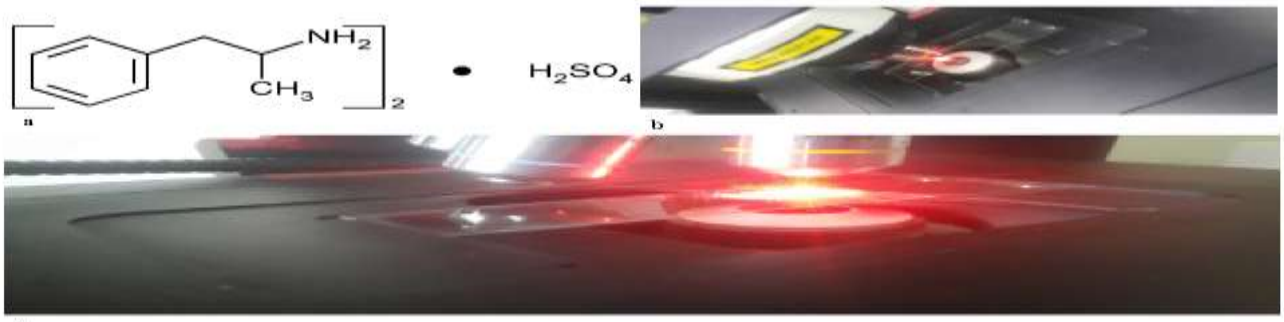

Fig.2. a. displays the chemical construction of amphetamine drug. B. illustrates the shape of the tablet sample under the microscope, and c. shows the powder sample on the glass plate under the laser beam

Results and Discussion

Raman Spectrum of the Samples

The next step of samples examination procedure is the Horiba HR 800 device operation; the Raman spectrometer that used in the analysis has a single laser wavelength 633 nm. However, an alternative the wavelength of laser has been available, for example a near infra-red laser. This may have overcome the problem of fluorescence that observed in a tested sample. The presence of other excipients in the seized samples caused a lengthening of the detection process as some of the particles found were not the drug of interest. The intensity of the Raman scattered light has been detected using an air cooling CCD detector.

Spectra were generally collected in 1-min collection time, with 4 mW of laser power in a 0.5mm diameter spot on the sample. Fig. 3 shows a Raman spectrum of pure amphetamine drug obtained from powder samples. Raman spectra of each compound are preserved which proofs that the spectra are characteristic for the investigated

compounds and not perturbed by impurities or reaction by products. For example, The Raman spectra of amphetamine powder sample, shown in Fig. 3, are dominated by features of a secondary amine hydrochloride, which appear near 2500- 3000 cm^{-1}.On the other hand, Fig.4. Shows the Raman spectra of the tablet form of amphetamine drug, the spectra approximately exhibit the same behavior of the powder sample.

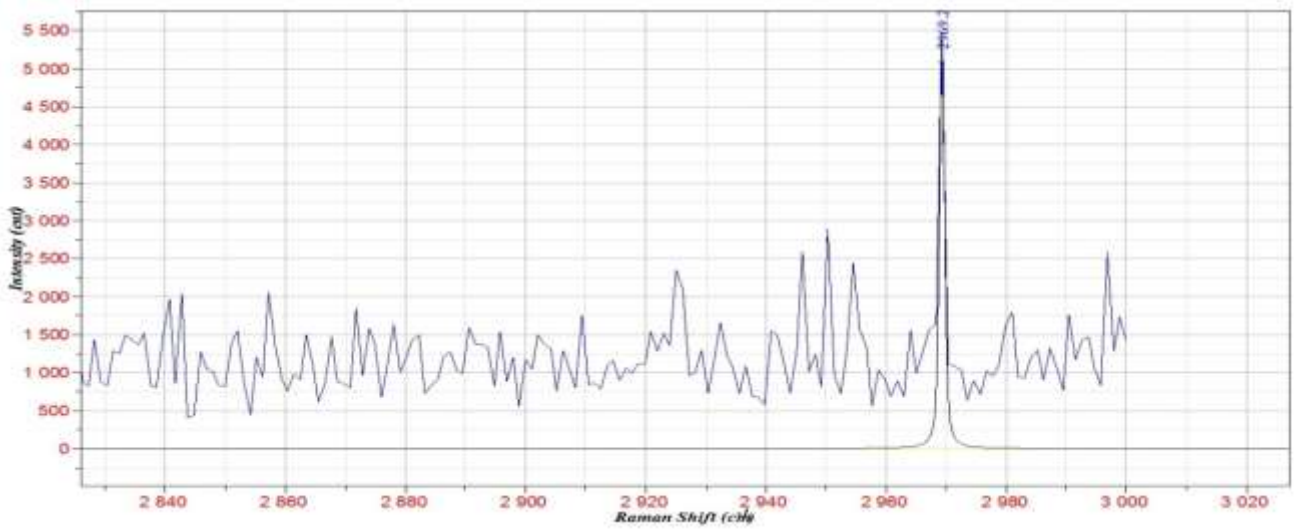

Fig.3: Illustrates the Raman spectra of amphetamine powder samples, Raman shift 2969.2 cm^{-1}

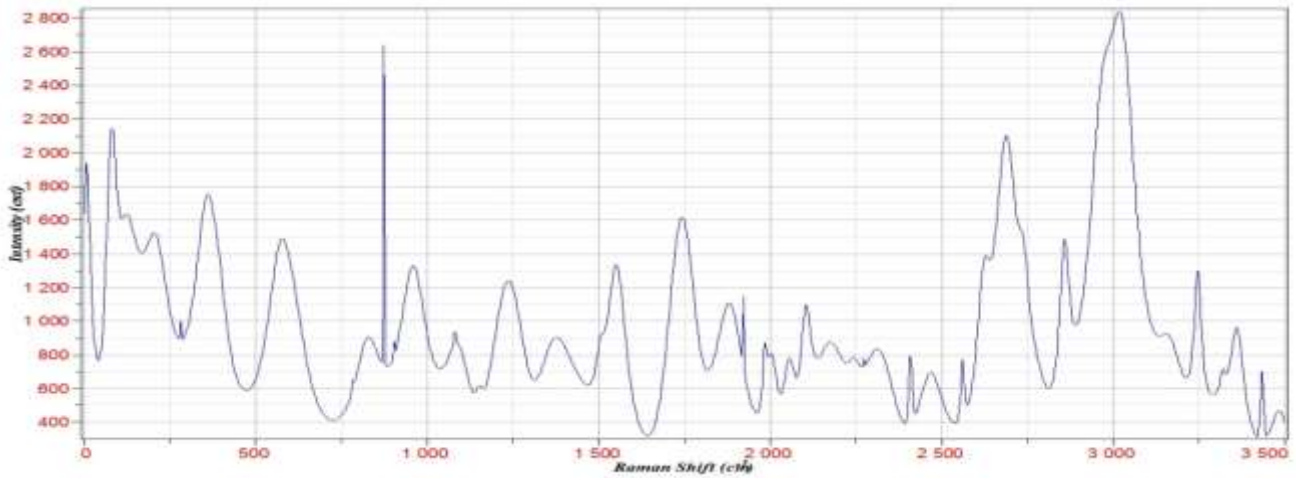

Fig.4: Illustrates the Raman spectra of amphetamine tablet samples, Raman shift 3009 cm^{-1}

Conclusion

Now a day a considerable progress has been made in the application of Raman spectroscopy to drug analysis. The technique is efficient of distinguishing and investigation of trace verification and quantification of bulk samples in a fast and undamaging manner. Drugs can be detected and identified in a wide range of forensically important environments. Instrument development design will increase the Raman spectroscopy move out of the specialized laboratory and into the field with the use of portable systems. Automated database identification algorithms to recognize drugs are a helpful method to get valuable information about the materials chemical structures.

Number of Figure	Title
1	Horiba spectrophotometer HR 800 Contains two laser sources for 632nm and 785nm with RAMAN and FTIR.
2	a. displays the chemical construction of amphetamine drug. b. illustrates the shape of the tablet sample under the microscope, and c. shows the powder sample on the glass plate under the laser beam.
3	Illustrates the Raman spectra of amphetamine powder samples, Raman shift 2969.2 cm^{-1}.
4	Illustrates the Raman spectra of amphetamine tablet samples, Raman shift 3009 cm^{-1}.

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