RAMAN INVESTIGATION OF 10 NEAT NARCOTICS WITH EXCITATION 514.5 nm

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Abstract: This report is aimed at Raman investigating of 10 neat narcotics including Amphetamine, Methamphetamine, Ephedrine, Papaverine, Narcotine, Morphine, Codeine, Thebaine, Heroin and Caffeine. Raman spectra of all samples are obtained with incident light 514.5 nm. Although some narcotic samples have fluorescence, it can be suppressed to an extent by applying appropriate measurement condition, such as controlling laser power on the sample, choosing proper point for Raman data and depositing trace quantity of narcotic on the surface of Al slice etc.

A wide range of techniques is available for the identification of narcotics [1~5]. The primary disadvantage of these techniques is that they require pretreating the sample, hence limiting the potential for routine use by unskilled users. Moreover the sample is easily destroyed and can be not repeatedly used in other analysis. Some drugs have strong fluorescence when visible light 514.5 nm is employed as excitation. Usually red or infrared light is applied to avoid the fluorescence, but which may reduce the Raman efficiency because of the intensity of scattering light [6].

\[
I_{\text{Stocks}}^{\text{Raman}} = \frac{2\pi^2 \hbar}{c} \left( \nu_0 - \nu \right)^4 \frac{\nu}{\nu \left[ 1 - \exp(-h \nu/kT) \right]} g_s \left( \frac{\partial \alpha_{ij}}{\partial Q_k} \right)_0^2
\]

Where \( \nu_s = \nu_0 - \nu \), \( \nu_0 \) and \( \nu \) are the frequency of incidence light and vibrational molecule. In our work, with incidence 514.5 nm we only seek the way to decrease fluorescence and obtain Raman spectra of 10 neat narcotics without any treatment to the sample.

Fig.1 Raman spectra of Amphetamine, Methamphetamine, Ephedrine, Papaverine and Narcotine
Measurement for all samples are carried with using a Renishaw micro-Raman system MKI 1000 with excitation light 514.5 nm. Laser power on the sample is controlled to about 1–3 mw.

Raman spectra of Amphetamine, Methamphetamine and Ephedrine displayed in fig.1 show that these narcotic molecules have little fluorescence. Raman lines appeared at about 624 cm⁻¹, 1000 cm⁻¹, 1028 cm⁻¹, 1208 cm⁻¹, 1600 cm⁻¹ and 3054 cm⁻¹, can be assigned to the single substituent Benzene belong to the symmetry group Cy₂v. In Papaverine result, Raman lines with strong intensity mainly locate within 1200 cm⁻¹~1700 cm⁻¹, which is different from other drugs, see Fig.1. The valuable Raman lines are 743 cm⁻¹, 1347 cm⁻¹, 1407 cm⁻¹, 1509 cm⁻¹, 1606 cm⁻¹. For Narcotine, Raman line 1752 cm⁻¹ is with the strongest intensity and it is easy to use this spectral line to distinguish it from other narcotics. It is found that Narcotine is sensitive to strong radiation of laser, which can cause the color of sample changed and produce strong fluorescence in Raman spectrum.

![Raman spectra of Morphine, Codeine, Thebaine, Heroin and Caffeine](image)

As see in fig.2, five obvious Raman peaks in Morphine are 625 cm⁻¹, 1634 cm⁻¹, 2857 cm⁻¹, 2944 cm⁻¹ and 3047 cm⁻¹. Raman result of Thebaine, which has one more methyl than Codeine shows that spectral line 1601 cm⁻¹ is with more strong intensity than any other peaks. Otherwise in Codeine, three main Raman lines appear at 630 cm⁻¹, 2945 cm⁻¹ and 3031 cm⁻¹. Heroin is the two acetyl's substitutent hydroxyl groups in Morphine and some new Raman lines appear in Heroin such as 619 cm⁻¹, 1659 cm⁻¹, 1736 cm⁻¹ and 3081 cm⁻¹. Raman result for Caffeine is recorded with satisfactory low fluorescence and spectral lines ranging from 400~1800 cm⁻¹ and around 3000 cm⁻¹. The valuable lines are 555 cm⁻¹, 1326 cm⁻¹, 1598 cm⁻¹, 1696 cm⁻¹, 2957 cm⁻¹.

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