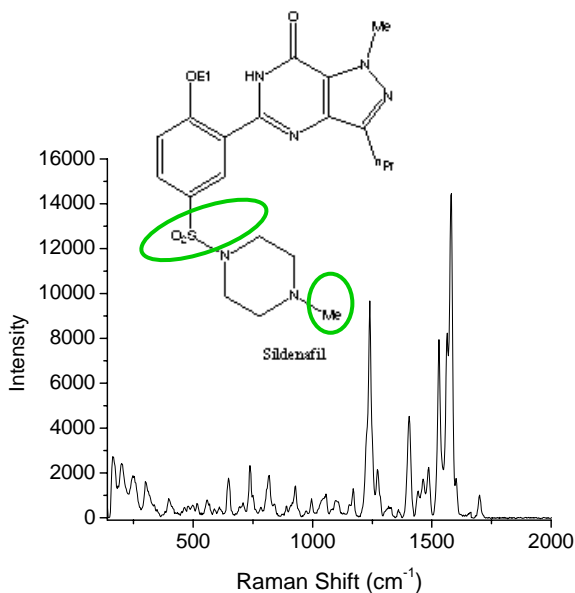# Raman Analysis of Viagra and Cialis-like Drugs

Sildenafil and its analogs are potent phosphodiesterase PD-5 inhibitors and are active in the treatment of erectile dysfunction. The recent appearance of these drugs in nutraceuticals and fruit drinks makes their rapid identification an important safety issue. This study reveals that the LSI Dimension-P1™ (SR) Raman System equipped with the LSI Vector Raman Probe™ can rapidly identify and distinguish individual members of the Sildenafil family of Viagra and Viagra-like compounds. Raman can therefore be used in conjunction with molecular separation techniques to detect these pharmaceuticals.
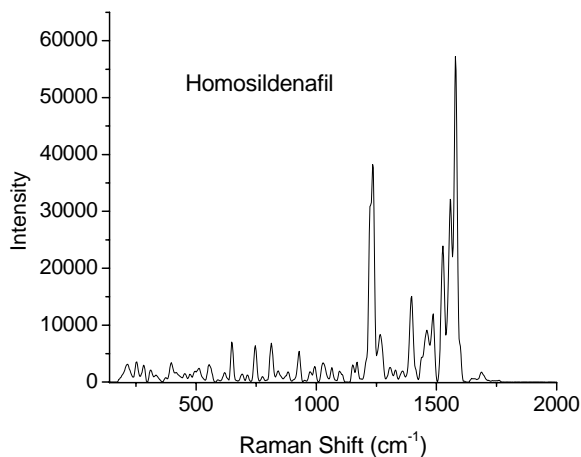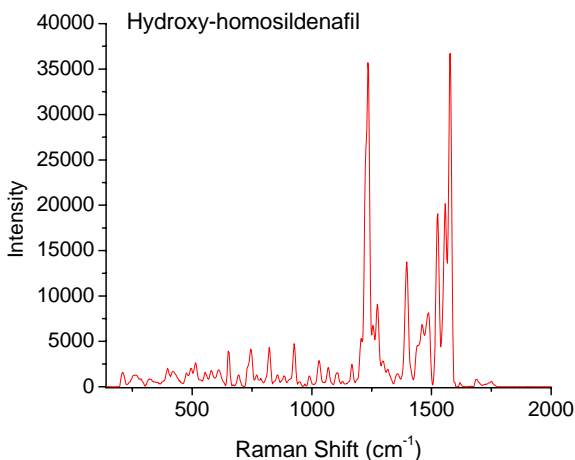
The substitution of an ethyl group for the methyl moiety on the piperazine ring in homosildenafil, the addition of an hydroxy to this ethyl group hydroxy-homosildenafil or the substitution of an acetyl bridge to the phenyl ring instead of sulfate, all yield detectable changes in the Raman spectra. Three regions of these spectra show differences in either peak distribution or in relative peak intensities. Expansion of these spectra will show details of these differences.
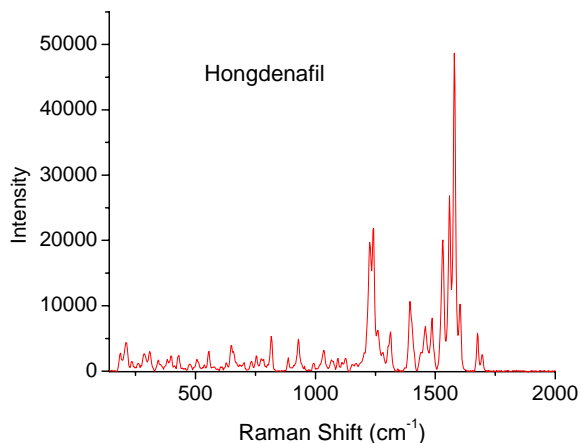
Expansions of different regions of the Raman spectra illustrate the extraordinary signal to noise characteristic of the Dimension-P1 permitting clear identification of the unique molecular features within the Sildenafil family.
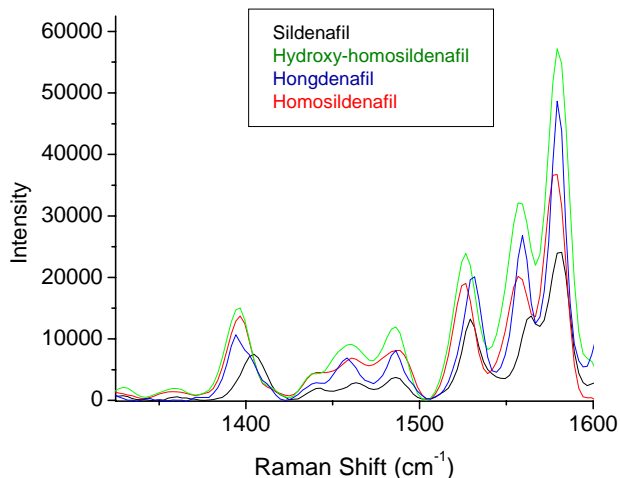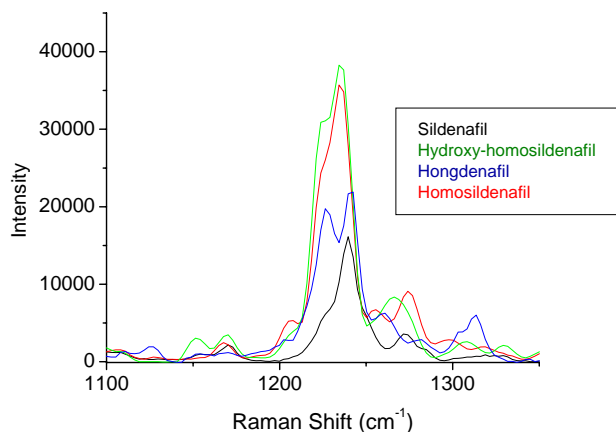
The Taladafil Family

The Taladafil (Cialis) is a related the family of Viagra-like drugs. They are also PD-5 inhibitors but they differ from the Sildenafil family in several ring structures, as illustrated here. Comparison of the Raman spectra of Taladafil and its amino analog, Aminotaladafil, illustrates that Dimension-P1™ can easily identify the similarities and differences (green circles) between these two analogs. Both taladafils are clearly distinguished by Raman spectra from the Sildenafil-like drug, Vardenafil, for example in the region marked by the green rectangle.

Tadalafil

Aminotaladafil

Vardenafil