**The Anti-HIV Nucleoside analogue d4T (Stavudine): Solid State Simulation of the FT-IR and FT-Raman Spectra by DFT Methods**

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A theoretical and experimental vibrational study of the anti-HIV d4T (stavudine or Zerit) Nucleoside Analogue was carried out, Fig 1. The bio-activity of d4T compound can be explained by considering that as d4T is attached to the DNA chain, no further growth can take place in the DNA chain due to the absence of the hydroxyl group (O3′-H group) in d4T [1-3].

The predicted spectra in the two most stable conformers of d4T in the biological active *anti*-form of the isolated state were compared. Comparison of the conformers with those of the natural nucleoside thymidine was carried out. The calculated spectra were scaled by using the linear scaling equation procedure (LSE) [4]. The crystal unit cell of the different polymorphism forms of d4T were simulated through dimer forms by using DFT methods. The scaled spectra of these dimer forms were compared. The FT-IR spectrum was recorded in the solid state in the 400-4000 cm-1 range. Its vibrational bands were analysed and assigned to different normal modes of vibration by comparison with the scaled vibrational values of the different dimer forms.

The knowledge of geometry and vibrational spectra of d4T and related prodrugs could lead to a comprehensive understanding necessary for the development of effective drugs for the future. The most important findings of this study are the following:

**1.-**In the isolated state the five first optimum conformers are the same by all the methods and levels. The spectra corresponding to the monomers C1 and C3 are very similar, with the exception of the modes corresponding to the O5′-H groups, the main structural difference between C1 and C3 conformers.

**2.-** The stretching bands corresponding to N-H modes in dimer G and dimer I appear at lower wavenumbers than those corresponding to monomer C1 and dimer V. This fact is due to these G and I dimers are stabilized by two N-H···O=C intermolecular hydrogen bonds.

**3.-** The wavenumber of the stretching mode ν(O5′-H5′) is higher for C3 than for C1 monomer in accordance to the calculated O5′-H5′ distance, lower for C3 than for C1. However the intramolecular O5′···H6 hydrogen bond distance is shorter for C3 than for C1 conformer. This fact is due to the repulsion between H5′ (sugar) and H6 (pyrimidine base) hydrogen atoms.

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# **References**

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