

FTIR Spectroscopy of Lipoproteins - A Comparative Study

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Lipoproteins are object of extensive research for last 40 years due to their active role in atherogenesis. The spherical particles consist of polar lipid monolayer which encapsulates apolar lipids. The apolipoprotein is mostly embedded in the lipid monolayer.

The presence of external compounds can induce structural changes in lipoproteins which can alter their normal metabolic pathways. These changes will be studied by FTIR and FT-Raman spectroscopy. The first step was to thoroughly describe the spectra of intact particles in all frequency regions. So far the studies on lipoproteins were limited to the amid I band which produces information about the secondary structure of apolipoprotein. The four major classes of lipoproteins were so far studied by FTIR spectroscopy: very low density lipoprotein (VLDL), low density lipoprotein (LDL) and two subclasses of high density lipoproteins (HDL₂ and HDL₃). The different position of amid A band in high frequency region of the spectra of particular lipoproteins reflects the influence of hydrogen bonds in β -sheets in Apo B (LDL and VLDL) on N-H stretching vibration. In fingerprint region (Fig. 1), the composition of amid I band was resolved by curve fitting method. The results are in agreement with the data about the secondary structure of Apo A I and Apo B. The comparison of the intensities of lipid ester bond at 1738 cm⁻¹ and amid I and amid II band give the information about the ratio of lipid and protein content in the particle. There are also some differences in the structure of the two bands, around 1240 cm⁻¹ and 1088 cm⁻¹ from phosphate group of phospholipids. In the region of skeletal modes the CH=CH bending vibration arises from the unsaturated fatty acids and the information about the intensity of this band reflects the ratio of these fatty acids in different lipoproteins. The bands assigned to amide V, amide IV and amide VI are also observed in this region but with low intensity.

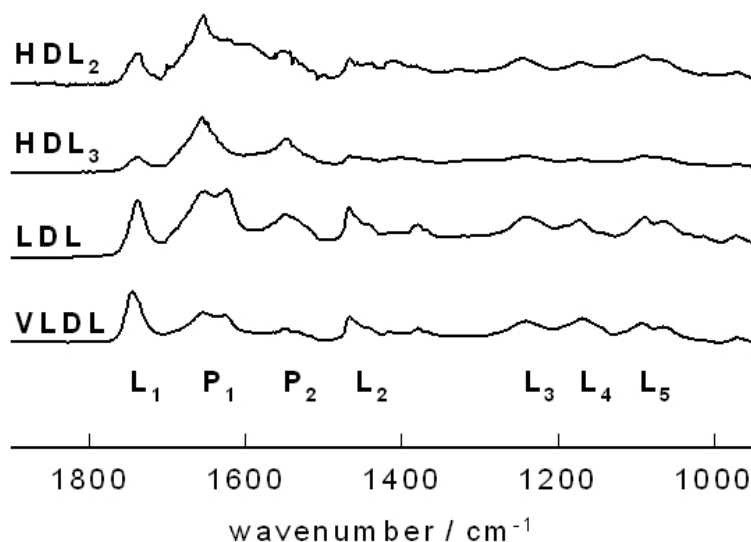


Fig. 1: IR spectra of dried lipoprotein films in fingerprint region. Lipid (L) and protein (P) bands are marked by the letters under the spectra: L₁ - C=O stretch, P₁ - amide I, P₂ - amide II, L₂ - CH₂ bend, L₃ and L₅ - phosphate group vibrations, L₄ - CH₃ rock