

RAMAN SCATTERING SPECTRA OF PANAX GINSENG CHLOROPLASTS AND LIVING LEAVES

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We first studied the quasi-resonance Raman scattering of Ginseng LHA in living leaves. Possible molecular arrangement of LHA was proposed.

1. INTRODUCTION

The plant pigments can be classified into light-harvesting antenna pigments(LHA) and reaction center pigments(RC) according to their roles in photosynthesis. In this paper, the quasi-resonance Raman scattering spectra of Ginseng (*Panax Ginseng*) LHA in living leaves were first advanced and comparisons were made with those of Ginseng chloroplasts. Vibrational modes spectral lines originated from different conjugated groups, molecular chains and conjugated plants of LHA were researched. With the select stimulating of different laser wavelength, different patterns of molecule linkages of 3 - C = O groups and 9-keto carbonyl groups in their molecules were studied. The possible pattern of molecular arrangement of Ginseng LHA was proposed. This is an important step in the photosynthetic process in high plant and algae. It determines the ability and nature of the plant in which the energy is absorbed from sunlight and transported to the reaction center.

2. MATERIALS AND METHODS

The Ginseng chloroplasts were prepared by Arnon methods. The Resonance Raman Spectra were measured with TY-T800, excited with 457.9nm, 488.0nm and 632.8nm laser wavelength.

3. RESULTS AND DISCUSSION

3.1 The Raman spectra of Ginseng chloroplast under different excitation wavelengths

As Raman spectral intensity is indirectly proportional to tetrasquare of scattering frequency, the specimen can be excited with the laser waves at 457.9nm, 488.0nm and 632.8nm wavelength according to the character absorption bands of Ginseng pigments. The results are given in Fig. 1.

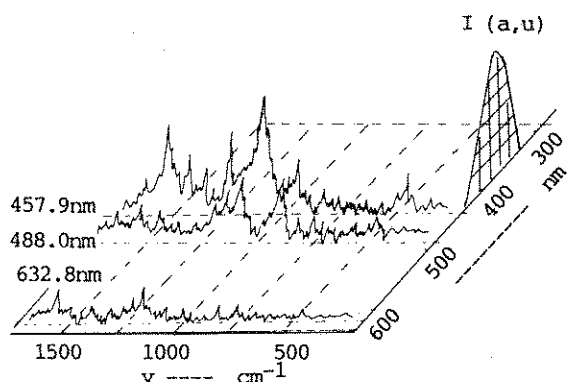


FIGURE 1
Raman scattering spectra of Ginseng chloroplasts under different exciting conditions

From the Raman spectra of Ginseng chloroplast under different exciting conditions, three active vibration regions can be divided:

(a) Active carbonyl region of chlorophyll (1550 cm^{-1} - 1750 cm^{-1}). Figure 1 shows the spectral bands at 1565 cm^{-1} , 1580 cm^{-1} , 1605 cm^{-1} , 1630 cm^{-1} , 1645 cm^{-1} , 1675 cm^{-1} , 1695 cm^{-1} , 1700 cm^{-1} , 1720 cm^{-1} , etc.. Among them, the bands at 1630 cm^{-1} , 1645 cm^{-1} and 1695 cm^{-1} are resulted from the drawing and stretching of 3 - C = O

groups and belong to the bands of antenna chlorophyll b. But the others are resulted from the 9-keto carbonyl groups and belong to bands of whole antenna molecules.

(b) The conjugated plane active region of porphyrin macroring (400cm^{-1} – 1550cm^{-1}). From this denser spectral groups, bands formed the stretching vibration of $\text{C}=\text{C}$ (1505cm^{-1} , 1530cm^{-1} , 1565cm^{-1}) bands of $\text{C}=\text{N}$ (1100cm^{-1} , 1600cm^{-1} , 1190cm^{-1} , 1220cm^{-1}) and bands with some characters of hydrate polymers (1450cm^{-1} , 1350cm^{-1} , 1280cm^{-1} , 1005cm^{-1} , 960cm^{-1} , 850cm^{-1} , 770cm^{-1} , 720cm^{-1} , 665cm^{-1} , 615cm^{-1} , 560cm^{-1} , 495cm^{-1} , 475cm^{-1}) etc. can be distinguished.

(c) Lower frequencies (200cm^{-1} – 400cm^{-1}) from the stretching movement of N_4 – Mg bands. The Raman lines of N_4 – Mg bands at 320cm^{-1} , 355cm^{-1} , 370cm^{-1} were determined.

Analyzing the above Raman spectra in three region and comparing the spectra of different assembled states (monomer, dimer and oligomer) of *in vitro* chlorophyll, the spectra composition and distribution of LHA molecules of Ginseng chloroplasts are similar to those of the hydrate polymers.

3.2 The Raman scattering spectra of Ginseng living leaves

Figure 2 shows the Raman spectra of Ginseng

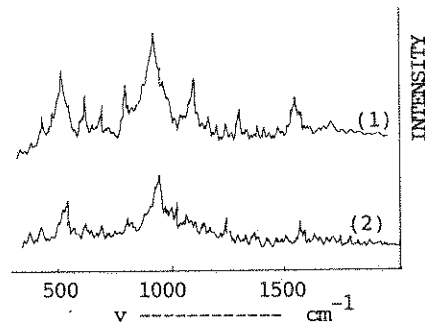


FIGURE 2
Raman scattering spectra of Ginseng chloroplasts (1) and living leaves (2)

living leaves under room temperature. It is easy to see that the Raman lines of Ginseng chloroplasts can also be seen in Raman spectra of living leaves. But in lower frequencies region more Raman lines appear for living leaves than for chloroplasts. The polymeric state of Ginseng LHA may be hydrate polymerized.

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