Application Note

No. 210MT0178-E

Mapping Analysis of Secondary Structure of Protein using Microscope FTIR

Introduction

JASCO developed new programs for secondary structure analysis of proteins from IR spectra (which is called IR-SSE). Presently, for the secondary structure estimation of proteins, the structural analyses of crystallized proteins using X-ray and the methods utilizing CD (Circular Dichroism) for proteins in aqueous solution, are widely used. However, it has been extremely difficult to estimate secondary structure of multicomponent proteins such as biological tissue. On the other hand, the method using FTIR enables secondary structure analyses of proteins contained in biological tissue. Moreover, using microscope FTIR enables mapping analysis of nonuniform samples. The distribution maps of secondary structures of proteins, based on the data of the mapping measurement using microscope FTIR, are shown in this Application Data.

Experimental

Sample:	Hair, Skin (human horny layer)
Measurement method:	Hair root was sandwiched between 2 KBr plates and compressed at 500 Kgf. Stripped tan skin as human horny layer was washed by chloroform and dried on KBr plate (7 x 7 x 1 mm). Each sample was measured by transmittance method.
Systems:	FTIR-470 + IRT-30 (IR profile system)
Measurement area:	Hair: 500 x 500 mm (10 x 10 points) Skin: 1000 x 1000 mm (10 x 10 points)
Measurement condition:	Accumulations: 32 times Resolution: 4 cm^{-1} Apodization: Cosine

Results

Figure 1 and 2 show the results. High contents of a-helix in hair root side are confirmed in Figure 1. In the skin measurement in Figure 2, though mapping distribution is almost in uniformity, in some site the contents of b-sheet are higher than a-helix. Combination of IR-SSE and Mapping enables mapping analysis of secondary structure of proteins in biological tissues, which has been considerd to be difficult. The methods using microscope FTIR and IR-SSE are anticipated to be applied to the analysis of tissue section and the evaluation of functional membranes including proteins.

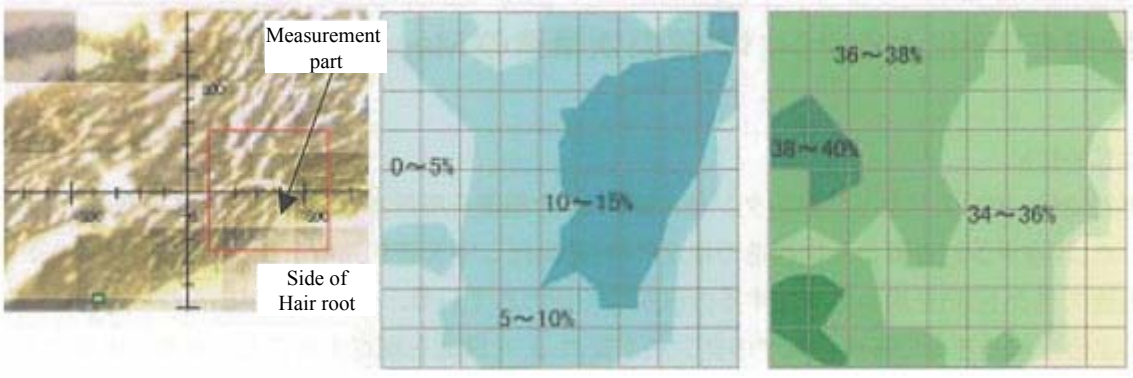

Image by Mycroscope Distribution map of a-helix Distribution map of b-sheet

Fig. 1 Mapping analysis of secondary structure of proteins in the vicinity of hair root

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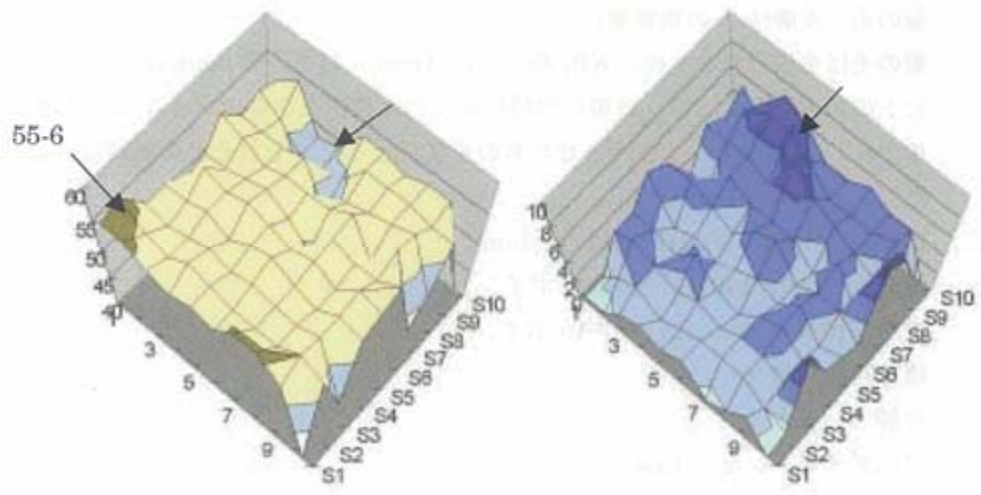

Distribution on map of a-helix　　Distribution on map of b-sheet

Fig. 2 Mapping analysis of secondary structure of skin proteins