Irradiation Effect of Sub-Terahertz Radiation on Amyloid Peptide

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Amyloid fibrils have critical roles in various biological phenomenon such as onset of serious amyloidosis in human and gene expression in microorganisms. The structure of amyloid fibril state is β-sheet stacked conformation, and the rigid structure is so stable under physiological conditions. The formation and regulation mechanisms are not fully understood although several kinds of amyloid fibrils are known in human, and those primary sequences are well investigated. We study about the interaction of strong electromagnetic wave in the far infrared (FIR) region with the amyloid fibrils. Previously, we found that a mid-infrared (mir) free electron laser (FEL) can dissociate the fibril structure of peptide [1]. In this collaboration study, we irradiated the amyloid fibrils with 419 GHz gyrotron and compared the effect with the mir-FEL and thermal treatment.

As shown Fig. 1, β-sheet conformation was increased by the irradiation for 30 min. On the contrary, heating at 308 K and 318 K little changed the secondary conformations from the non-treatment material. In previous study, we observed that mir-FEL could reduce β-sheet conformation at amide I wavelength. In contrast, this result by irradiation of sub-terahertz radiation increased the β-sheet conformation. This effect is not achieved by only thermal effect. It can be considered that the fibril formation could be promoted by the sub-terahertz irradiation, and our next subject will be investigation of the interaction mechanism of gyrotron with amyloid fibrils in future.

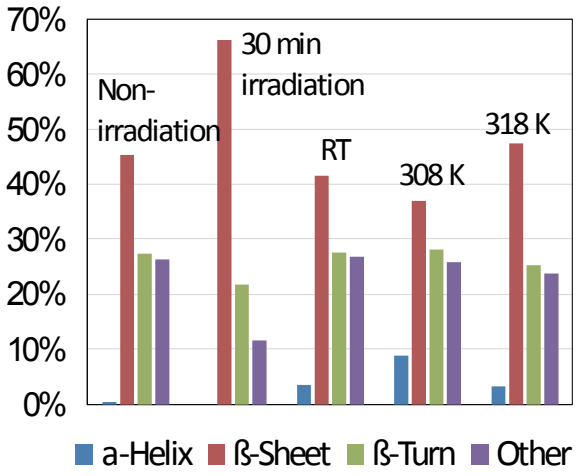

Fig. 1 Protein secondary structure analysis based on amide I peak intensity of amyloid peptide in SR-infrared spectrum. The peptide sample was irradiated or heated on slide base, and the infrared spectrum was recorded by reflection mode.

References

[1] T. Kawasaki, T. Yaji, T. Ohta, K. Tsukiyama, and K. Nakamura, *Cellular and Molecular Neurobiology*, **2018**, *38*, 1039.