Gwangju Institute of Science and Technology
Official Press Release (https://www.gist.ac.kr/)

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Release Date	2020.06.25	

Professors Hohjai Lee and Jiwon Seo's joint research team develops a magnetic field-sensitive fluorescent molecule system based on protein mimetics

☐ GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) Department of Chemistry Professor Hohjai Lee and Professor Jiwon Seo led a joint research team that developed a protein mimetic-based fluorescent molecule system capable of detecting magnetic fields in a wide range of solution polarities.

- The results of this research are expected to be used in research on magnetic distribution of micro magnetic structures used in semiconductors or high-density information storage devices in the future.

☐ The peptoid* based bimolecular system uses exciplex** is a magnetic field-sensitive fluorescent molecule system, which varies the amount of fluorescence according to the intensity of the magnetic field and is the first to operate in a wide range of environments from non-polar solvent environments to very large polar solvent environments close to aqueous solutions.

* peptoid: A new material developed to artificially simulate the function of biological proteins. It is a peptide mimetic, a biopolymer composed of 40 or less amino acids. The advantage is that it is easy to synthesize and can precisely control the structure compared to the existing branched structure polymer or artificial protein.

** exciplex: An excited complex formed between two different molecules. When forming a complex, one is excited and the other is joined together in a bottom state.

- One of the most important reactions in chemistry is the electron transfer reaction, and the magnetic field-sensitive exciplex is a model system that is very useful for reaction mechanism research by allowing the electron transfer reaction process to be observed with fluorescence. Despite the academic importance of exciplex, the existing magnetic field-sensitive exciplex fluorescence molecular systems have been limited in their application and utilization because they operate only in a few organic solvents with very low polarity compared to water.

□ One of the limitations identified by the research team was that, until now, the magnetic field-sensitive exciplex system simply mixed electron donor and acceptor molecules or connected them with long carbon chains.

- The research team introduced electron donor molecules and acceptor molecules on the peptoid main skeleton structure. By adjusting the relative spatial relationship between the two according to the solvent environment at the molecular level, exciplex fluorescence responsive to the magnetic field can be observed. As a result, the team found that the exciplex fluorescence is brightened according to the strength of the magnetic field, not only in diethyl ether with very low polarity, but also in a mixed solution of acetonitrile and water with a very high polarity.

□ Professors Hohjai Lee said, "This study has the greatest significance in that it has provided a design principle of a magnetic field-sensitive fluorescent molecular system that can be used in a wide range of solvent polar environments. In particular, a magnetic field-sensitive fluorescent molecule system that operates in a solvent close to an aqueous solution can be introduced into a biological system, and it is expected to develop a technology that can quantitatively image the effects of electromagnetic waves on the human body in the future."

□ The study was conducted with support from the National Research Foundation of Korea and the GIST Research Institute, and the results were published on June 2, 2020, in *The Journal of Physical Chemistry Letters*, a prestigious international journal in physics and chemistry.

- Meanwhile, the research team of Professor Jong-Won Song of Daegu University has supported the interpretation of the results of this study and the introduced mechanisms by discovering the effect of the relative positional relationship between the electron donor molecule and the electron acceptor molecule through quantum calculation on the structure of the exciplex.

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