Nanoparticle cluster manufacturing technique using DNA binding protein developed

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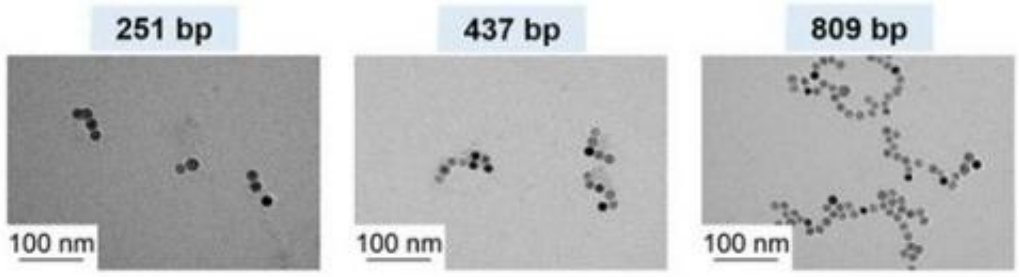


Transmission Electron Microscopy Images showing different sizes of NPCs depending on the length of the DNA. Credit: Korea Advanced Institute of Science and Technology

Scientists in South Korea used the Zinc Finger protein to develop a new manufacturing technique for size-controllable magnetic Nanoparticle Clusters.

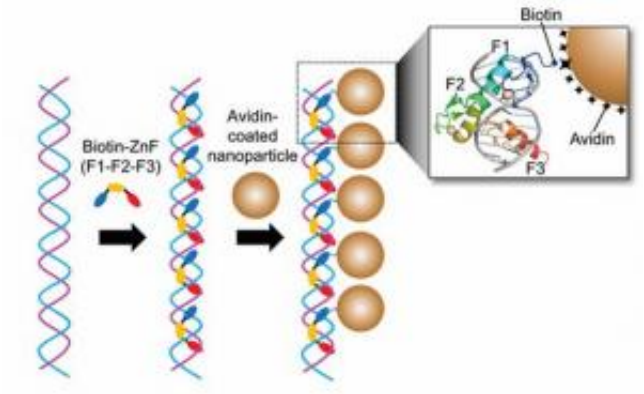
Professor Hak-Sung Kim of the Department of Biological Sciences at Korea Advanced Institute of Science and Technology (KAIST) and Yiseul Ryu, a doctoral candidate, used the Zinc Finger protein that specifically binds to target DNA sequence to develop a new manufacturing technique for size-controllable magnetic Nanoparticle Clusters (NPCs). Their research results were published in *Angewandte Chemie International Edition* online on 25 November 2014.

NPCs are structures consisting of magnetic nanoparticles, gold nanoparticles, and quantum dots, each of which are smaller than 100 nm (10^{-9}m). NPCs have a distinctive property of collectivity not seen in single nanoparticles.

Specifically NPCS differ in physical and optical properties such as Plasmon coupling absorbance, energy transfers between particles, electron transfers, and conductivity. Therefore, NPCs can be employed in biological and medical research as well as the development of nanoelectric and nanoplasmon devices.

To make use of these novel properties, the size and the composition of the cluster must be exquisitely controlled. However, previous techniques relied on chemical binding which required complex steps, making it difficult to control the size and composition of NPCs.

Professor Kim's team used Zinc Finger, a DNA binding protein, to develop a NPCs manufacturing technique to create clusters of the desired size easily. The Zinc Finger protein contains a zinc ion and specifically recognizes DNA sequence upon binding, which allows the exquisite control of the size and the cluster composition. The technique is also bio-friendly.



A Mimetic Diagram of NPCs Manufacturing Technique Using DNA Binding Protein Zinc Finger. Credit: Korea Advanced Institute of Science and Technology

Professor Kim's team created linear structure of different sizes of NPCs using Zinc Finger proteins and three DNA sequences of different lengths. The NPCs they produced confirmed their ability to control the size and structure of the cluster by using different DNA lengths.

The NPCs showed tripled T2 relaxation rates compared to the existing MRI contrast media (Feridex) and effectively transported to targeted cells. The research findings show the potential use of NPCs in biological and medical fields such as MRI contrast media, fluorescence imaging, and drug transport.

The research used the specific binding property of protein and DNA to develop a new method to create an inorganic nanoparticle's supramolecular assembly. The technique can be used and applied extensively in other nanoparticles for future research in diagnosis, imaging, and drug and gene delivery.

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