Inducing the polarization of monocyte (THP-1) into macrophages using polymer nanoparticles

Dr. Hye Kyu Choi, Prof. KiBum Lee
Department of Chemistry and Chemical Biology, Rutgers University, New Jersey, USA

General Description

Differentiated into macrophages

THP-1 is a monocyte isolated from peripheral blood of an acute monocytic leukemia patient. This cell line can be used in immune system disorder research, immunology research, and toxicology research[1]. Differentiation of THP-1 cells into M1 and M2 phages is important in the study of macrophage biology and the immune response. Macrophages are a type of immune cell that play a key role in the body's defense against infections and other foreign invaders. M1 macrophages, also known as classically activated macrophages, are involved in the defense against bacterial and viral infections, while M2 macrophages, also known as alternatively activated macrophages, are involved in resolving inflammation and promoting tissue repair[2,3]. Controlling the differentiation of THP-1 cells into M1 and M2 phages is important because it allows researchers to study the specific functions and roles of these different macrophage populations in health and disease[4,5].

In this research, the KBLEE group conducted controlling the THP-1 differentiation by using polymer nanoparticles.

Fluorescence level measurement (Transfection efficacy)

The polymer nanoparticle was synthesized in this research, and THP-1 cells were treated with the nanoparticles. The polarization of THP-1 was controlled by the polymer nanoparticle. The delivery of polymer nanoparticles into the cells was measured by utilizing Fluorescence level measurement (Transfection efficacy), one of the functions of the ADAMII LS instrument.

Methods

The polymer nanoparticle was synthesized to express green fluorescence (GF) after its delivery into the cells. After treating the cells with the nanoparticles for one hour, the nanoparticle delivery was measured using the GF intensity measurement and Transfection efficiency analysis functions in the ADAMII LS instrument.

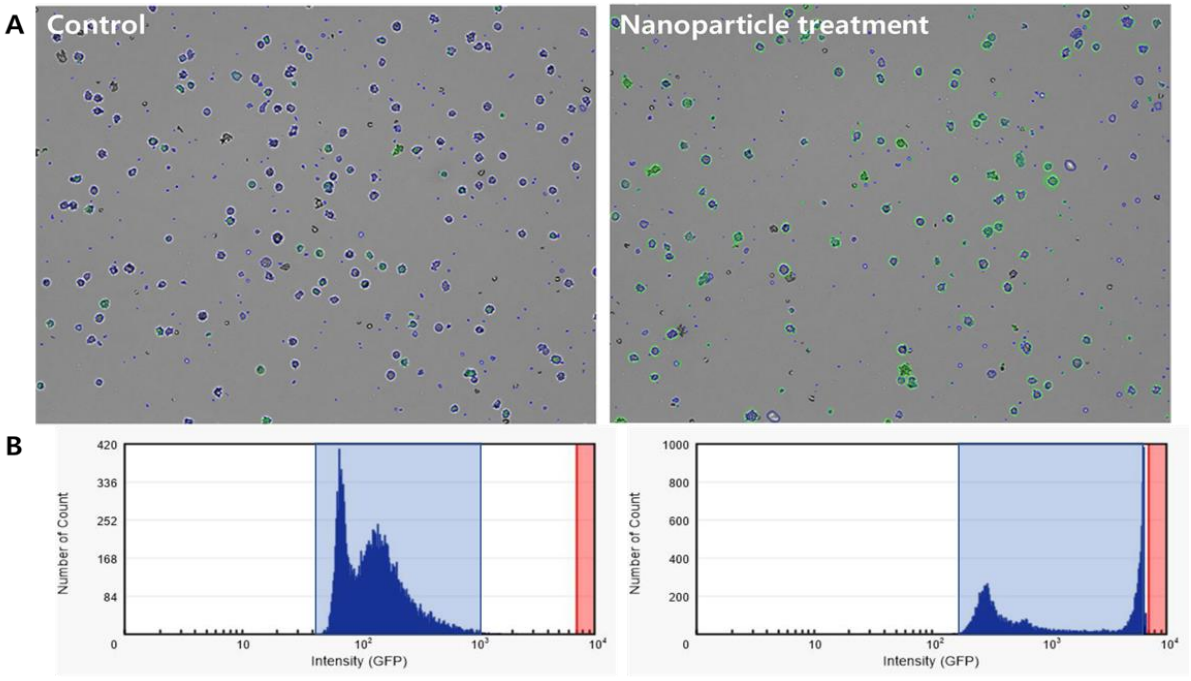

Figure 1. Cell images of control and nanoparticle-treated samples (A) and graphs of the number of cells with GFP intensities (B) measured using the GF intensity measurement and Transfection efficiency analysis functions in the ADAMII LS (NanoEntek Inc.).

Experiment	Control	W/ Nanoparticle
Total Cell	3.29 x 10^6	3.04 x 10^6
GFP expression	4.00 x 10^6	1.45 x 10^6
Non expression	2.89 x 10^6	1.6 x 10^6
GFP Transfection rate	12.17 %	47.53 %
Average Cell Size	7.77 μm	6.38 μm

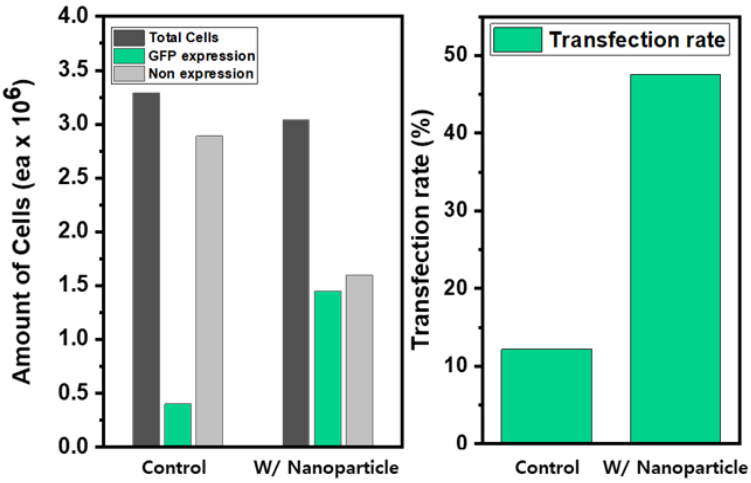

Figure 2. Quantitative data of GFP transfection rate of samples. cell transfer rate increased about four times (12.17% to 47.53%) after modifying the nanoparticles. All data was acquired from ADAMII LS (NanoEntek Inc.).

Results and Discussion

When comparing the nanoparticle treatment before surface modification (Control in Figure 1A) and after surface modification (Nanoparticle treatment in Figure 1A) of polymer nanoparticles, it was confirmed from the image that the modified nanoparticle transfer occurred more efficiently than the control sample (Figure 1A, ADAMII LS product's Imaging function, and Circle function). Efficient nanoparticle transfer after treatment of the nanoparticle was graphically confirmed. (Figure 1B)

Furthermore, the total cell volume, the amount of GF expressed/non-expressed cells, and the transmission rate were examined by reports from ADAMII LS, and the quantified value of these results was analyzed (Figure 2). The corresponding results analysis determined that the cell transfer rate increased about four times (12.17% to 47.53%) after modifying the nanoparticles.

References

1. ATCC THP-1 (TIB-202™) Product description. Available at, https://www.atcc.org/products/tib-202. (Accessed: 13th Feb. 2023)
2. Geissmann, F. (2003). Blood monocytes consist of two principal subsets with distinct migratory properties. Immunity. 2003 Jul;19(1):71-82. doi: 10.1016/s1074-7613(03)00174-2.
3. Gordon, S. Alternative activation of macrophages. Nat Rev Immunol 3, 23–35 (2003). https://doi.org/10.1038/nri978
4. Mantovani, A., Biswas, S.K., Galdiero, M.R., Sica, A. and Locati, M. (2013), Macrophage plasticity and polarization in tissue repair and remodelling. J. Pathol., 229: 176-185. https://doi.org/10.1002/path.4133
5. Murray, P., Wynn, T. (2011) Protective and pathogenic functions of macrophage subsets. Nat Rev Immunol 11, 723–737. https://doi.org/10.1038/nri3073

ADAMII LS

For more information on ADAMII LS, visit the LS (Life Science) product page at **www.nanoentek.com** or scan the QR code with your mobile for accessing the information page.
Disclaimer: Unless otherwise specified, all products are for RESEARCH USE ONLY. Not intended for use in diagnostic or therapeutic use.