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Rapid, simple detection of oseltamivir-resistant influenza-A virus (H275Y mutation) using gold nanoparticles-based colorimetric probe capable of specific recognition to the H275Y NA mutation

Eun-Kyung Lim
Korea Research Institute of Bioscience and Biotechnology, Republic of Korea

Recently, an oseltamivir-resistant pandemic H_1N_1 virus has emerged because of the increased use of oseltamivir. This oseltamivir-resistant virus has spread around the world and is being highly contagious. Therefore, for immediate virus control and prevention, accurate detection techniques that can rapidly identify oseltamivir-resistant virus are required. The currently used assays, which are dependent on genomic-based assays because of drug-resistant viruses caused by a genomic mutation in viral Neuraminidase (NA) (H275Y mutation), are time consuming and require trained personnel for sample preparation and analysis. We have developed a novel nanoprobe consisting of Gold Nanoparticles (GNPs) modified with an oseltamivir derivative (oseltamivir hexylthiol; OHT) as a targeting moiety (OHT-GNPs) enabling a simple colorimetric assay for oseltamivir-resistant virus (H275Y mutation) detection. This assay is based on the colorimetric change of GNPs in the presence of oseltamivir-resistant virus due to the specific interaction with OHT of nanoprobe (OHT-GNPs) and the mutated viral NA site. OHT exhibited 250-fold-higher binding affinity to the NA site of the mutant virus (H275Y mutation) than to the Wild-Type Virus (WT) according to NA activity and modeling analysis. Our results showed a color change of OHT-GNPs from deep red to purple because of OHT-GNPs aggregation by interacting with OHT structure of OHT-GNPs and NA on the surface of H275Y mutant virus. Especially, these colors were gradually changed to purple as the mutant virus concentration increased, which allowed determining the presence of the virus with the naked eye. Using OHT-GNPs, it was possible to sensitively detect oseltamivir-resistant virus (H275Y mutation) at low virus concentrations by changing its absorbance; the Limit of Detection (LOD) of this assay was 10 Plaque-Forming Units (PFU). Furthermore, OHT-GNPs-based dipstick assay could detect H275Y mutation as well as obtain their qualitative analysis. This assay may provide accurate information whether this virus is oseltamivir resistant that could support choosing appropriate treatments using Point-of-Care (POC) diagnostics.

Biography

Eun-Kyung Lim has completed her PhD degree in chemical engineering from Yonsei University, Republic of Korea. She has joined Bio-nano technology Research Center in KRIBB. Her research efforts are on development of smart theranostics nanosystems for cancer metabolism regulation and sensing nanoprobe for bacteria/virus.

eklim1112@kribb.re.kr

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