Label-free detection of norovirus virus-like particles using long-period fiber grating biosensor

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Introduction:

Human norovirus (HuNoV) belonging to the Caliciviridae family is main causative agent of acute viral gastroenteritis worldwide. Traditionally used methods of norovirus detection include reverse transcription-polymerase chain reaction (RT-PCR) and enzyme immunoassays (EIA) which cannot be used in-field and require expensive equipment and reagents. Therefore, fast and reliable biosensing methods are strongly needed.
HuNoV major capsid protein VP1 self assembles into VLPs (virus like particles) that have the same morphology and antigenicity as native virions without containing genetic material but provide excellent and safe platform for antigen presentation. In this work we report rapid, sensitive and selective biosensor based on antibody-modified long-period fiber grating LPFG for norovirus detection using VLPs.

Methods:

Norovirus VLP were produced in *Sf9* insect cells using baculovirus expression system, purified by ultracentrifugation and size exclusion chromatography. The LPFG sensor with anti-VP1 antibody immobilized on the surface was used for the detection of VLPs in solution.

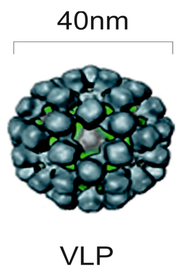

Fig.1 Schematic representation of VLP

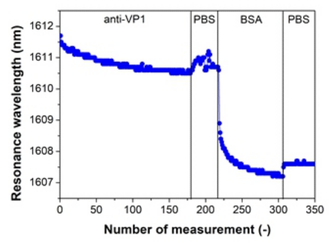

Fig. 2 Resonance wavelength at subsequent steps of surface biofunctionalization for left resonance.

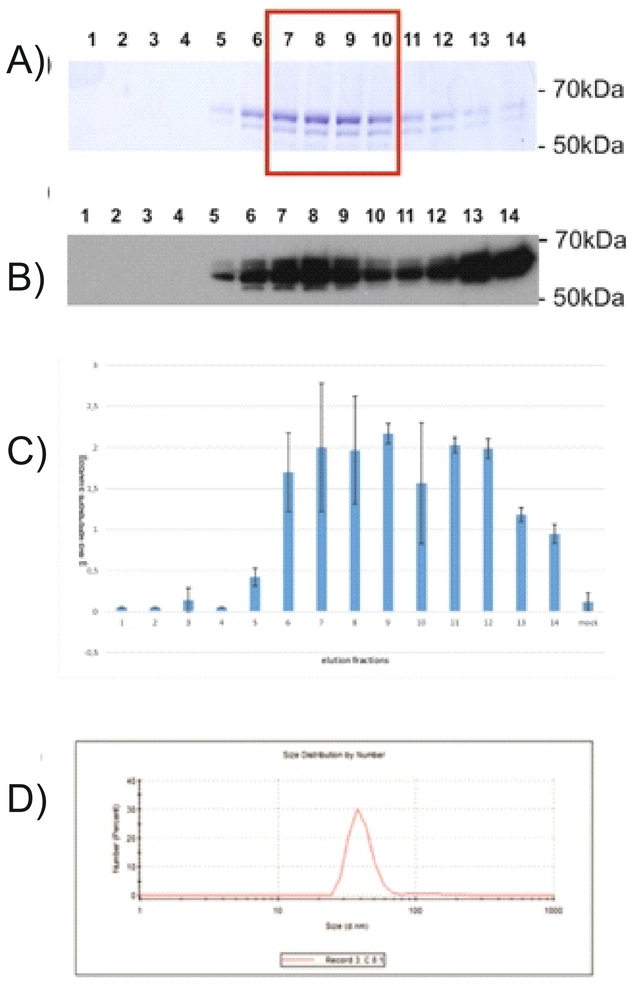

Fig. 3 Production and characterization of NoV VLPs in insect cells. (A) purification of NoV VLPs using size exclusion chromatography (B) western blotting analysis (C) characterization of NoV VLPs in ELISA test (D) DLS

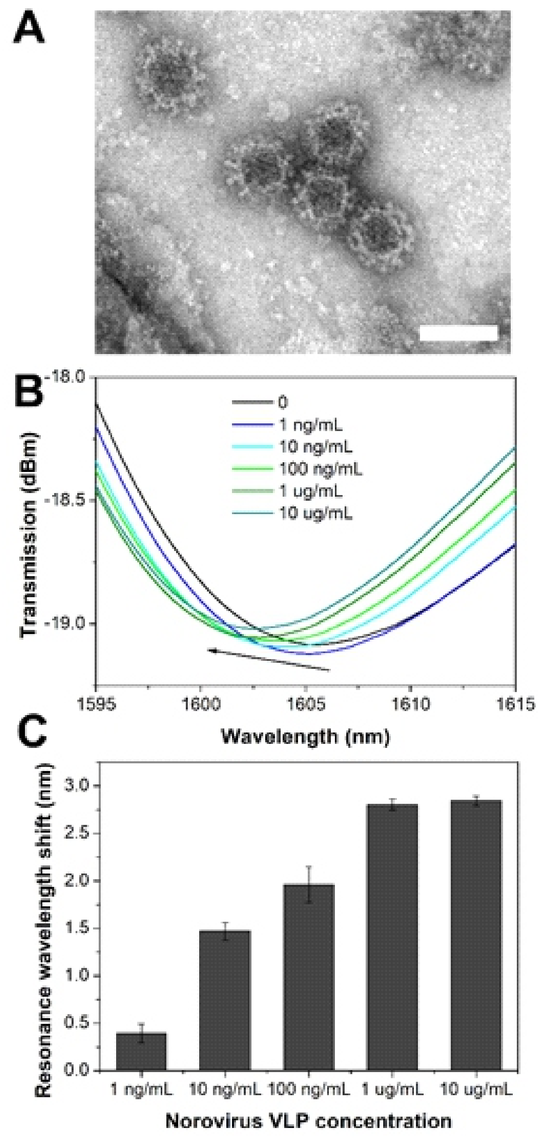

Fig. 4 (A) Electron micrographs of purified norovirus VLPs (scale bar 50 nm). (B) Spectra measured in PBS before VLPs addition and after incubation in different concentrations of VLPs. The most representative spectra were shown for each concentration. (C) Resonance wavelength shift for left resonance referred to measurement performed in PBS before VLP addition for different VLPs concentration.

Results:

Utilization of antibody-modified LPFG for norovirus detection enabled obtaining rapid, sensitive and selective biosensor. In this label-free approach we were able to detect 1 ng/mL norovirus VLPs. Due to the morphological and antigen similarity between VLPs and native norovirus, LPFG biosensor can be used for fast norovirus detection.

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