Automation aids nationwide surveillance system for virus outbreaks

Dr Doo-Sung Cheon of KCDC.

The Korea Center for Disease Control and Prevention (KCDC) in Seoul, Korea, conducts research to identify the etiology of communicable diseases and to find effective control, prevention, diagnosis and treatment for them. In its efforts to build a more advanced and specialized surveillance system, KCDC has chosen Tecan's Freedom EVO® workstations to standardize automated protocols for the efficient detection of enteric viruses.

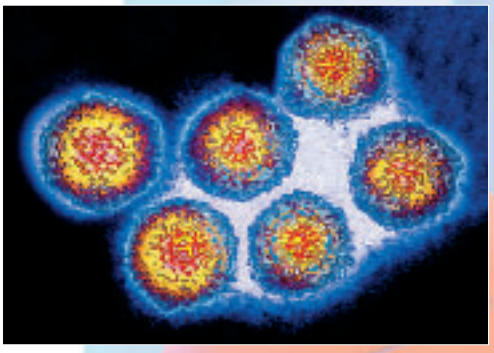
The Korea Center for Disease Control and Prevention in Seoul, Korea.

KCDC is a leading institute for the control and prevention of infectious diseases in Korea and consists of six centers and 33 divisions, and is building close partnerships with other governmental agencies, international organizations, research institutes, private health corporations and academia, with the primary goal of protecting the health of the public. Within KCDC, the Division of Enteric and Hepatitis Viruses is responsible for the management of nationwide surveillance systems for enteric virus infections, such as enteroviruses and noroviruses. Laboratory scientists perform molecular epidemiological research, and develop rapid diagnostic methods using various techniques such as ELISA-based immunoassays, immunochromatography and real-time reverse transcription PCR (RT-PCR). The division is also involved in basic research on the pathogenesis of enterovirus-induced myocarditis, and the development of vaccine candidates for norovirus infections using recombinant virus-like particles, and for smallpox using live attenuated vaccinia virus, in a bio-defense study.

Dr Doo-Sung Cheon, senior researcher in the Division of Enteric and Hepatitis Viruses, explained: "Our main task is to organize and perform nationwide surveillance for enterovirus and viral gastroenteritis, collaborating with sentinel hospitals and 17 regional laboratories that belong to local institutes of Health and Environment. To perform this effectively, we wanted to improve our diagnostic methods by enhancing sensitivity in the detection of viral genomes in clinical specimens. We also needed to develop robust, unified methods that yield reliable results, irrespective of the regional laboratory's environment such as the level of skill and experience of the staff, or the equipment available to them."

In 2006, the laboratory automated its viral nucleic acid purification protocol based on silica-coated magnetic beads, using a Tecan Freedom EVO platform combined with the Te-MagS™ module. This system offered a standardized procedure from nucleic acid extraction to the detection of the amplified viral genome, with reduced process complexity to minimize human error and false positive results caused by carryover.

Dr Doo-Sung Cheon and his colleagues in the Division of Enteric and Hepatitis Viruses at KCDC.



Hepatitis A (HAV), caused by an RNA virus found in bodily fluids and characterized by jaundice, weakness, and fever.

The protocol has been optimized to yield sufficient viral nucleic acid to be used as RT-PCR templates, and can be adjusted using Tecan's integrated software. To complement the automated method, the researchers developed a ready-to-use RT-PCR premix kit for the specific and sensitive detection of enteroviruses and noroviruses, and the Freedom EVO is also being used to formulate this mix.

Dr Cheon explained: "Before automation, we extracted nucleic acid manually using TRI Reagent® or column-based methods. Although we could process more samples using TRI Reagent, it is tremendously labor intensive and often led to false results due to experimental error. The automated system is both cost- and labor-effective compared to column-based extraction methods. The automation, together with our own reagent mixture, yields better RNA purity and concentration, and requires less investigator intervention; the eluates are automatically transferred to PCR tubes after nucleic acid extraction, and the researcher only needs to move the PCR tubes from the Freedom EVO to the thermal cycler."

"The Freedom EVO in our laboratory is typically used five times per week and 48 samples per day, taking 2.5 to 3 hours to process 48 specimens in one run so, if we were to encounter a large outbreak caused by a norovirus contamination, we would be capable of processing about 150 samples per day with the automated process. A collaborating laboratory located in Seoul uses a Freedom EVO equipped with eight probes, and that system is able to process 96 samples per run within three hours, allowing the processing of about 300 specimens per day."

The Division of Enteric and Hepatitis Viruses subsequently developed an automated system for the detection of norovirus genome using the same, Freedom EVO-based set-up. As a critical part of its project to establish an early detecting and alerting system for food-borne norovirus-induced outbreaks, the laboratory supplied all of the 17 collaborating regional laboratories with the Freedom EVO-based systems during 2007 and 2008. "Because our surveillance program relies on the network with the regional laboratories, the standardized protocol, made possible by automation, is very important to maintain the consistent quality of results. The Tecan workstation achieves reliable and consistent yields of RNA, giving assurance of quality for our laboratory data and the surveillance system overall, and it is now a critically important device for the work we do," Dr Cheon concluded.

TRI Reagent is a registered trademark of Molecular Research Center, Inc.

The Freedom EVO platform at KCDC.