Researchers use mass spectrometry to detect norovirus particles

Scientists have used mass spectrometry for decades to determine the chemical composition of samples but rarely has it been used to identify viruses, and never in complex environmental samples. Researchers at the Johns Hopkins Bloomberg School of Public Health recently demonstrated that proteomic mass spectrometry has the potential to be applied for this purpose. Using a two-step process, researchers successfully separated, purified and concentrated a norovirus surrogate from a clinical sample within a few hours. Nanospray mass spectrometry was used to demonstrate the feasibility of detecting norovirus particles in the purified concentrates.

Human norovirus is responsible for an estimated 23 million cases of gastrointestinal illness in the United States each year. This pathogen is a particular problem aboard cruise ships. The researchers believe that their mass spectrometric method could potentially be used for biodefense and public health preparedness as a tool for rapidly detecting norovirus--a category B bioterrorism agent--and other viral public health threats. The study is published in the April 2006 edition of *Applied and Environmental Microbiology*.

In simplified terms, mass spectrometry is essentially a scale for weighing molecules. A laser turns a sample into ionized particles, which are then accelerated in a vacuum toward a detector. The time lapsed prior to registering on the detector helps researchers determine the mass--or weight--of the particles. By targeting characteristic particles, or peptides, belonging to the viral coat protein, the virus can be positively identified by matching the results to entries in genetic databases.

In the Hopkins study, the researchers analyzed a stool sample treated with virus-like particles, which closely resemble norovirus but are noninfectious. Using mass spectrometry, the researchers were able to detect the norovirus capsid protein down to levels typically found in clinical specimens from sick individuals.

"This is the first report of the use of mass spectrometry for the detection of norovirus," said David R. Colquhoun, lead author of the study and research fellow with the Johns Hopkins Center for a Livable Future. "This is a significant step towards using mass spectrometry as an environmental surveillance tool for the detection of pathogenic human viruses in complex environmental samples such as human and animal waste."

Typically, bacteria and viruses are identified by cultivation on selective media and cell lines. However, this process does not work for human norovirus, which cannot be cultured outside the human body.

Rolf Halden, PhD, assistant professor in the Department of Environmental Health Sciences and senior author of the study, pointed out that proteomic mass spectrometry is appealing because it has the potential to identify different types and strains of viruses regardless of whether their presence is suspected or not. "Unlike other processes, we do not need to know what we are looking for in advance. Any pathogen whose genetic information is contained in online genetic databases represents a suitable potential target. This makes the technique ideal for situations where you have an emerging infectious agent or pathogenic strain, such as in a potential terrorist attack," said Halden.

Source: Johns Hopkins University Bloomberg School of Public Health