Challenges for foodborne virus prevention

by Franck Chatigny, Ceeram SAS, 1 allée de la Filée, 44244 La Chapelle sur Erdre, France.

Each week, at least one new foodborne outbreak (FBO) linked to viruses comes out in the media. These food poisoning cases usually implicate norovirus (NoV) or hepatitis A virus (HAV). For example, several food infections involving oysters or scallops were reported in the last 10 years by the Rapid Alert System for Food and Feed (RASFF).

The latest published data from EFSA (European Food Safety Agency) and CDC (Center for Disease Control) in the US confirmed these observations.

In Europe, norovirus have been responsible for 16% of food poisoning with a large share from unknown origin. In the US, viruses are the first cause (38%) of food contamination ahead of bacteria; 42% of outbreak-associated foodborne illnesses are due to norovirus. We are therefore facing a global foodborne safety issue for the whole food chain.

High resistance

Foodborne viruses are different from bacteria. Once present in food, viruses will neither modify the taste nor the quality of the produce. So there are no observable indicators of contamination.

These enteric viruses, of which NoV and HAV are the most important, are very infectious, and 10-100 viruses are enough to get sick, leading to very high excretion of viruses in stools for several weeks.

These viruses have a high resistance to several chemicals and physical treatments; hence they can resist sewage treatments and persist in the environment such as in irrigation systems, and surface, sea or irrigation waters leading to food contamination.

Because they are significantly resistant to a number of food processing systems, consumption of contaminated food products may lead to increasing numbers of outbreaks.

Infected persons may also represent a risk because a great number of FBOs are linked to contaminated food handlers. The virus contamination cycle shows several routes of viral contamination and several types of food at risk, ranging from raw material to ready-to-eat meals, that may represent a potential risk for human health.

A number of European regulations (CE 2073/2005) state that foodstuffs should not contain micro-organisms or their toxins or metabolites in quantities that present an unacceptable risk for human health, underlining that methods are required for foodborne virus detection.

In 2004, the CEN (European Committee of Normalisation) created an expert working group in charge of the development of a standard method for the detection of norovirus and hepatitis A virus in food products, including shellfish.

The standard method, including a qualitative and a quantitative part, should be published this year.

In addition, the Codex Alimentarius will publish guidelines for the application of general principles of food hygiene for the control of viruses in food.

These regulations and recommendations associated with the high number of outbreaks have also forced international food companies to implement their own guidelines to include viruses in their HACCP plan.

Reliable protocols developed

To answer these diverse regulations, analytical methods are required. Ceeram, a private French laboratory, has developed reliable and sensitive protocols based on the future standard method for routine applications. The routine analytical framework includes several steps:

- Step 1 – Virus elution and concentration.
- Step 2 – Nucleic acid extraction and purification.
- Step 3 – Virus identification and detection using CeeramTools detection kits.

These kits have been developed by Ceeram and validated at the international level by several reference laboratories. At each step, controls have been implemented to guarantee reliable, sensitive and reproducible results. In addition, Ceeram methodologies have been validated on diverse food matrices including shellfish, ready-to eat food, surfaces and fomites and environmental samples.

More than 1000 samples collected from food companies have been tested by Ceeram demonstrating levels of prevalence of 8.3, 18.5 and 10.1% for norovirus genogroup I, norovirus genogroup II and HAV respectively, confirming CDC and EFSA data.

Integrated approach needed

Food producers and processors should have an integrated approach concerning viral food safety issue. This integrated approach has to take into account different points:

- Risk assessment of matrices.
- Evaluation of countries of origin for produce.
- Risk measurement, analytical control plan.
- Determination of food process impact.

As validated methods are available for all types of food and environmental samples, routine analytical laboratories have the possibility to implement virus testing methods and offer analytical services to food companies. It is now possible for food producers to perform viral risk measurement and integrate foodborne viruses in their analytical surveillance plan. HACCP plans can be applied at all levels of the food chain; the major issue being to limit the entrance of contaminated raw materials in the food process.

Verification and validation of the virucidal effect of food and cleaning processes can also be performed to ensure food safety.

Ceeram has a worldwide recognised expertise on foodborne viruses. The company is offering services such as:

- Theoretical training to understand and implement virus food safety issue in industrial HACCP plans.
- Practical training for virus testing implementation in laboratories including commercialisation of CeeramTools detection kits.
- Validation of processes at the industrial level by using the mengo virus, a non pathogenic virus with properties identical to HAV.

Foodborne viruses are no longer emerging but constitute a real food safety issue that should be taken into account in quality control plans. ■