Scale-down of environmental conditions encountered during road transportation in the Canadian food supply chain

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Canada faces unique challenges, in part because of its climate, its long transportation distances and its hundreds of Northern Communities. Major Canadian food retailers reach 82.2% of the Canadian population throughout a four-step road supply chain consisting of growers/suppliers, processors, distribution centers, and retail stores. Few years ago, CanGRASP tool (Canadian GIS-based Risk Assessment, Simulation and Planning for food safety tool) was developed using real field data including namely: product volumes handled by Canadian stakeholder, flow of product between stakeholders, temperatures of product each season, and times products spend in each step or during transit between steps. Such database is costly and laborious to assemble which makes it difficult for the industry to implement road transportation studies in real conditions. The objectives of this study were (1) to scale-down at the pilot plant level the real environmental conditions encountered during road transportation and (2) to assess the impact of random vibrations on the food safety of products. To achieve the scale-down, all the broken cold chain events were identified in the CanGRASP database and quantified using a transient heat transfer approach. This information has been used to create programs into environmental pilot chamber to mimic the heat transfer rates of the real road conditions. A vibration table (0-40G) was placed inside the chamber to generate random vibrations during road transportation as an additional parameter that impacts food product shelf-life. Broken cold chain simulations were conducted on fresh cut lettuce in clamshells inoculated with *Listeria innocua* ATCC 33090 (5-Log cfu/g). Results showed that the environmental pilot chamber can simulate the temperature of real broken cold chain events with a RMSD = 0.09 and a $R^2 > 0.99$. Adding random vibrations can induce an increase of temperature over 2°C due to friction between fresh cut lettuce leaves during road transport simulations. Survival of *Listeria innocua* was not impacted by random vibrations themselves. However, the persistence of *Listeria innocua* inside clamshells throughout the cold chain was affected by the thermal impact of vibration. In the near future, this pilot-scale platform will be made available to allow the industry to conduct their own studies.