Predictive microbiology: Modeling microbial responses in food

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Accepted 02 November 2011

ABSTRACT

Predictive microbiology is the integration of traditional microbiology knowledge with those found in the disciplines of mathematics, statistics and information systems and technology to describe microbial behaviour in order to prevent food spoilage as well as food-borne illnesses. The behaviour of microbial populations in foods (growth, survival, or death) is determined by the properties of food (e.g., water activity and pH) and the storage conditions (e.g., temperature, relative humidity, and atmosphere). The effect of these properties can be predicted by mathematical models derived from quantitative studies on microbial populations. Using predictive models changes in microbial populations in foods from production/harvest to consumption can be estimated from changes in product parameters (temperature, storage atmosphere, pH, salt/water activity, etc.). Predictive microbiology models have immediate practical applications to improve microbial food safety, quality, and are leading to the development of a quantitative understanding of the microbial ecology of foods. While models are very useful decision-support tools it must be remembered that models are, at best, only a simplified representation of reality. Because of the complexity of microbial behaviour and food systems, predictive microbiology presents some limitations. Predictive microbiology provides a powerful tool to aid the exposure assessment phase of ‘quantitative microbial risk assessment’ and it can be concluded that predictive models, successfully validated in agreement with defined performance criteria, will continue to be an essential element of exposure assessment within formal quantitative risk assessment.

Key words: validation, applications, limitations