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Her research interests revolve around predictive microbiology, quantitative microbial risk assessment, microbiological quality evaluation of food using classical and instrumental techniques (such as impedance, photometry, and PCR), biofilm formation, and the effect of metal nanocolloids on microorganisms.

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Scientific Support for the Food Industry

Predictive mathematical models have useful applications in the food industry – preventing the loss and wastage of food, thereby conserving resources.

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The field of predictive microbiology is based on the underlying concept that the presence of microorganisms in food results from a combination of various environmental factors – primarily temperature, pH, and water activity. Predictive microbiology assumes that the way in which microorganisms respond to such environmental factors determining their growth is replicable, therefore predictable. This means that, under repeatable environmental conditions determined by raw materials, manufacturing technology, materials, packaging atmosphere, and storage conditions, microorganisms' response can be predicted and described using mathematical models. Such models can be applied extensively to various food groups and individual products. It has been demonstrated that predictive models provide results at least 1000 times faster than the popular microbial challenge tests, which evaluate the microbiological quality of a product under the conditions in which it will be distributed. Moreover, a developed mathematical model significantly reduces the number of analyses that are traditionally performed. By making use of such a mathematical model, food producers can conserve resources by reducing the consumption of materials for analysis, electricity, and water, as well as significantly minimizing laboratory waste.

The development of predictive microbiology is closely linked to the regulations of the European Parliament and the European Council, which led to the introduction of microbiological criteria for food, the Hazard Analysis and Critical Control Points (HACCP) system, and risk analysis. The incorporation of predictive microbiology into food safety and product risk management programs is recommended by international organizations such as the International Commission on Microbiological Specifications for Foods (ICMSF), the Codex Alimentarius Commission (CAC), and the International Life Science Institute (ILSI).

Responding to demand

ProgFood is a startup affiliated with the Warsaw University of Life Sciences (SGGW). Its story began in March 2020, when the company was registered with the National Court Register, followed by its incubation in the Eastern Business Accelerator as part of the Eastern Poland Operational Programme (POPW). Incubation is a crucial stage during which an initial idea gets transformed into a business plan and a proposal for a Minimum Viable Product (MVP). Thanks to EU funding available through the Eastern Business Accelerator, ProgFood received support in the form of a virtual office, accounting and legal services, visual identification, as well as numerous workshops and training sessions.

The product developed by ProgFood is the service of evaluating the microbiological safety of food products. Based on the fundamentals of predictive microbiology, the company has developed the tool of a predictive mathematical model describing the behavior of microorganism populations present in products in response to specified internal and external environmental factors (production and packaging conditions, the technologies and raw materials used).

The services provided by ProgFood allow the shelf life of products to be assigned based on detailed data characterizing the microbiota of products. This innovative approach relies on quantitative data from the cycle of the product's presence on the market, and also considers possible interruptions in the cold chain. The practices used by food producers to estimate food safety and assign expiration dates vary widely, and may be unobjective or susceptible to influence. Each facility assigns an expiration date according to its own criteria and bears responsibility for introducing any

The lab of ProgFood, a SGGW start-up where project-related analyses are performed

products threatening public health into the market. However, the lack of external support institutions for estimating expiration dates poses a problem. In the absence of such institutional support, food producers often underestimate the expiration dates out of a fear of legal liability, which can lead to increased food wastage. The service of assigning expiration dates based on a mathematical predictive model developed by ProgFood offers a systematic approach, grounded in scientific principles, recommended by legal regulations (Regulation 2073/2005, Annex II). An expiration date is assigned based on the duration of the lag phase (the time it takes to prepare a population for growth) and the growth rate after such a population begins to multiply.

Unique services

ProgFood's laboratory also provides other services of interest to food producers, including microbial challenge tests assessing growth potential, growth rate and lag phase length. These tests are conducted in accordance with the guidelines of the International Organization for Standardization (ISO) and are used to evaluate the growth potential of pathogenic bacteria in a given food product. They are particularly crucial when any changes are made to a product's recipe or production technology, especially in terms of the selection of preservatives or preservation methods.

Another category of analyses performed in the lab involves storage tests and aging tests, conducted for products with lengthy expiry dates or use-by dates. These tests take into account the extreme conditions that can sometimes occur in the supply chain. ProgFood also offers analyses identifying the sources of product contamination, including microorganism identification. The most effective identification of microorganisms is carried out using molecular and spectrometric methods, such as MALDI-TOF MS. The laboratory also performs tests to detect and quantify microorganisms using horizontal methods, and also tests of package sealing and the composition of modified atmosphere packaging (MAP) during product storage, evaluating its impact on microbiological quality and product safety.

These services are designed for businesses in the food industry, especially producers of meat and dairy products, minimally processed foods, and ready-to-eat products. The services offered can be utilized for estimating and/or optimizing the expiry dates or use-by dates of food products, assessing microbiological risks of particular products, developing food safety plans, reducing food losses and wastage, and designing the composition of new products. ■

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