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Microbiology targets food safety

As producers and retailers increasingly source materials from around the world, the challenge of ensuring the microbiological safety and quality of the food supply has become a global one. Here we look at some of the methods helping to keep consumers safe

AMONG its many roles, a food microbiology laboratory will typically be involved in tests ranging from environmental hygiene monitoring and water quality analysis through to determining shelf-life and minimising food spoilage. However, it is the ability to quickly identify a potential pathogen in raw materials and final products that attracts the greatest attention. The public health consequences and commercial damage that can result from any failure in this area ensure a real focus on the continuing development of more effective and faster techniques.

As well as livestock, fresh fruits and vegetables can be the source of infection. Prepared salads and vegetables that are eaten raw can present a particular risk.

Good hygiene at source and during food processing is vital, and the microbiology laboratory has a central role throughout the production chain. Labs will normally be examining raw materials, finished products and environmental samples that should be free from pathogens and should harbour only limited numbers of spoilage organisms.

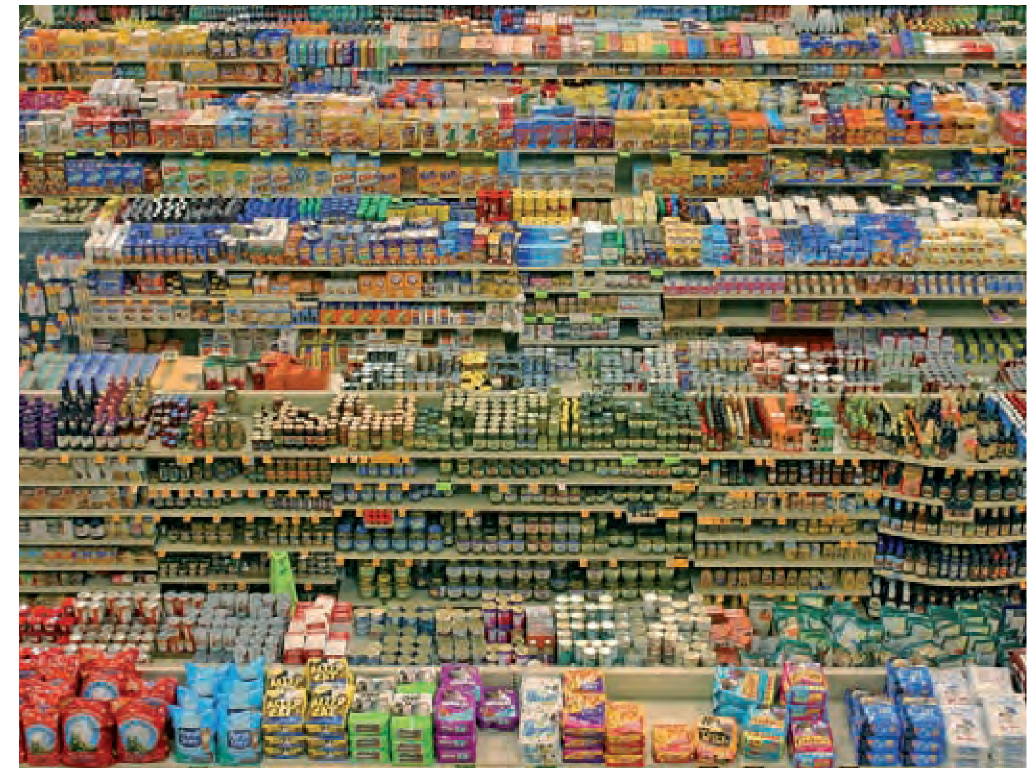
Recent years have seen the development of more reliable and rapid methods for the isolation, early detection, characterisation and enumeration of microorganisms. In food microbiology this translates as: reducing the time to producing a total viable count and arriving quickly at a presumptive negative or positive result for pathogens.

Rapid results are important, but equally high on the agenda is the quality and consistency of laboratory tools and techniques, as witnessed by the increasing application of ISO guidelines for the preparation and production of culture media (ISO/TS 11133 Microbiology of food and animal feeding stuffs). Part 1 sets out general guidelines on quality assurance for the preparation of media in the laboratory while Part 2 provides practical guidelines on their performance testing. The guidelines set out the minimum acceptable performance criteria and describe the methodology and organisms required for quality control of specific media.

A number of factors influence media quality. These include the basic ingredients, correct formulation and preparation, elimination of contaminants, as well as appropriate packaging and storage. The performance testing requirements set out in ISO/TS 11133-2:2003 apply both to commercially provided ready-to-use and dehydrated media, and to culture media prepared from basic constituents in the user's laboratory. However, more extensive methodologies apply to manufacturers than to end users, to achieve greater consistency in the quality of commercially made products and thereby reduce the burden of quality testing for the user.

Food industry laboratories are already moving to ISO-specified media in the knowledge that these meet strict formulation requirements and have undergone rigorous testing by the manufacturer. Standardising and maintaining the quality and consistent performance of culture media is an important step in continuing to assure the microbiological safety of food and food ingredients.

As well as the evolution of traditional culture media to meet ISO guidelines, there is a trend towards the use of chromogenic media in the isolation of foodborne pathogens. The first ISO standard to specify a chromogenic medium was in 2004, for the detection and enumeration of *Listeria monocytogenes*.



Keeping the supermarkets safe - food microbiology labs canidentify pathogens in products

Chromogenic media provide a rapid and accurate means of isolating and enumerating target microorganisms based on the detection of specific enzyme activities. They enable faster detection of target microorganisms compared with classical culture media, and also improve sensitivity. Identification can often be made with a reduced requirement for sub-culture or confirmatory tests.

In chromogenic media, bacterial enzymes specific to the target microorganism cleave synthetic chromogenic substrates within the medium. The chromogenic substrates themselves are colourless; only when cleaved do they release a characteristic coloured product. Growing colonies containing the relevant enzymes develop a distinctive colour. The combination of selective base medium and chromogenic substrate allows the design of specific media for the differentiation and identification of highly specific groups of microorganisms.

Chromogenic substrates are made by coupling a suitable chromogen with a substrate appropriate to the target enzyme. The most important features of a good chromogen, in addition to its chromogenic properties, are stability and insolubility. While the chromogen-substrate compound must be soluble, when it is cleaved the chromogen must be insoluble. This ensures a build up of colour within the organism, rather than diffusion (bleeding) into the surrounding medium. In certain media the interaction of two or more

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Feature: **Food and Beverage**

<< chromogens creates a diagnostic combination (palette) of colours.

The first step in isolating bacteria from food samples is normally enrichment. For organisms such as *Escherichia coli* O157:H7 the technique of immunomagnetic separation (IMS) can help accelerate the isolation process.

Associated mainly with raw and undercooked meats, *E. coli* O157:H7 causes diarrhoea, and can have more serious consequences in children, older people and those with compromised immune systems. Even when present in very low numbers, the organism can produce symptoms, so its identification is extremely important. IMS can help accelerate this process.

A sophisticated sorting process, IMS can be used to concentrate, isolate and/or purify microorganisms from food samples. It allows the omission of part of the standard enrichment process for conventional culture techniques (Figure 1). Traditional culture for *E. coli* O157:H7 can result in overgrowth of sorbitol-fermenting organisms, making it difficult to identify low numbers of the generally sorbitol-negative O157:H7 colonies. Applying specific IMS allows concentration of target cells from the larger samples while removing non-target cells, and thus improving the chances of isolation. Target organisms are generally obtained with IMS after 6 hour enrichment, although stressed cells may require up to 18 hours.

IMS techniques, such as Lab M's Captivate, use antibody-coated microscopic paramagnetic particles for the specific immunomagnetic separation of microorganisms. Antibody-coated beads bind to cell surface antigens forming an antibody-antigen complex and 'capturing' target cells. Using a magnetic concentrator these are separated from background organisms and interfering materials, are washed and then plated to selective media or analysed by other means.

As food safety issues continue to make news, food hygiene and the role of the microbiology laboratory continue to be scrutinised. ISO guidelines on media preparation and QA, currently in the form of a technical specification, are likely to become an essential standard, and we are seeing the increasing adoption of culture media that conform. At the same time, the use of chromogenic media is increasing, and the incorporation of rapid methods that accelerate, or bypass, conventional enrichment techniques reflects the pressure to reduce the turnaround time for results, a trend that looks set to continue. LN

"Chromogenic media provide a rapid and accurate means of isolating and enumerating target micro-organisms"

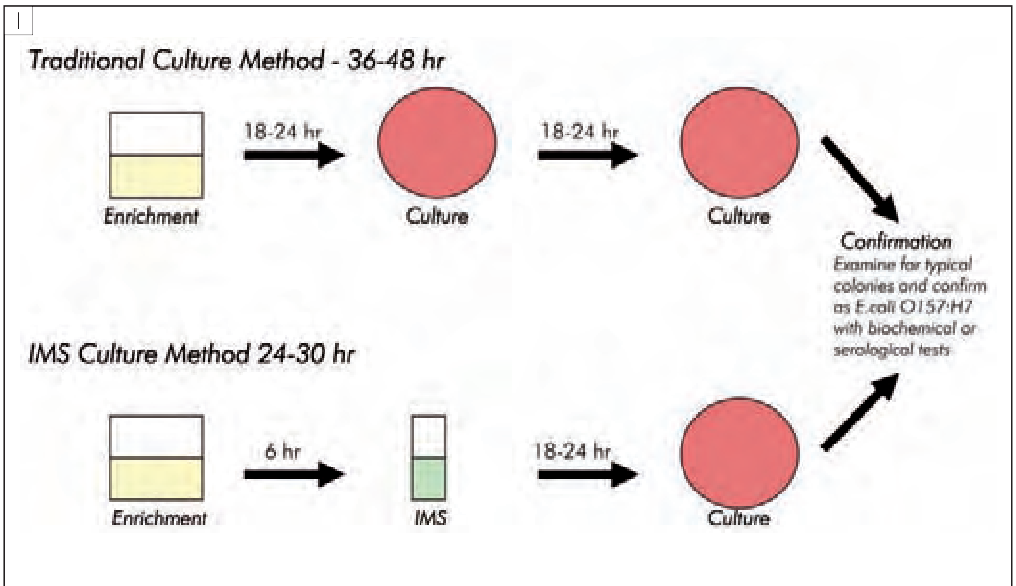

Figure 1: *E.Coli* **0157:H7 traditional culture method v IMS culture method**