OPINION

Viable and dead foodborne pathogens can be found using PCR-mediated nucleic acid molecular recognition technology

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ABSTRACT

The public and population's health are seriously threatened by living foodborne germs. It is required to finish the identification of live bacteria in a short period of time (a few hours to a day) in order to verify the safety of the food. Although bacterial culture is the gold standard, conventional procedures are laborious and time-consuming. The development of PCR-mediated nucleic acid molecular recognition technologies, such as RNA-based reverse transcriptase PCR (RT-PCR) and DNA-based viability PCR (vPCR), has helped to alleviate the ensuing research bottleneck. They discriminate between live and dead bacteria in addition to swiftly reporting detection findings and amplifying detection signals with sensitivity. Therefore, from the nucleic acid molecular recognition principal level, this review introduces these PCR-mediated techniques independent of culture for the detection of viable and dead foodborne pathogens and describes their whole-process applications in food quality supervision. This review serves as a useful resource for the advancement of the detection of foodborne pathogens in the future.

Key Words: *Polymerase chain reaction; Food safety; Foodborne; Pathogens*

INTRODUCTION

Bacteria are minuscule and have a high reproduction capability, therefore they may be found in food, feed, drinking water, and and practically anywhere else where there is human life. Viable, dead, and Viable But Nonculturable (VBNC) cells are the other two live stages of foodborne pathogens in addition to spores. However, only active bacteria may contaminate food or the environment or infect animals and agricultural goods. Therefore, it is perfect to remove the influence of dead bacteria from the matrix in the quantitative detection of live bacteria

The classic microbiological detection approach necessitates the long-term, standard-step culture of the foodborne pathogens in the sample before counting the colonies on the medium. Long-term use has demonstrated that the conventional culture method is the best available, although there are still difficulties related to the tedious and time-consuming needs. The identification of several diseases uses the Polymerase Chain Reaction (PCR), a highly sensitive and focused molecular biology tool. PCR allows for the effective identification of target bacteria by using the concept of DNA double-strand replication to amplify certain DNA fragments outside of the organism. The accuracy of PCR in differentiating between living and dead bacteria in the samples is constrained by the possibility that DNA from dead organisms is also intact. Therefore, there is an urgent need for high-quality programmes to close the gaps in the detection of live bacteria. Molecular Activity Test (MVT) and viability PCR are two examples of the several types of molecular approaches based on PCR that have been developed in recent years for the detection of living bacteria. accuracy of PCR in differentiating between living and dead bacteria in the samples is constrained by the possibility that DNA from dead organisms is also intact. Therefore, there is an urgent need for high-quality programmes to close the gaps in the detection of live bacteria. Molecular Activity Test (MVT) and viability PCR are two examples of the several types of molecular approaches based on PCR that have been developed in recent years for the detection of living bacteria.

By monitoring the variations in the synthesis of precursor ribosomal RNA, MVT ascertains if living bacteria are present in the sample in accordance with the idea that only viable cells can actively transcribe RNA. DNA amplification-based vPCR, which is often employed in the detection of diverse bacteria, has effectively discriminated the physiological state of foodborne pathogens with the use of nucleic acid intercalation dyes. In conclusion, this paper explains the benefits and drawbacks of RT-PCR and vPCR, as well as the applications of the two techniques in the detection of foodborne pathogens in the food chain. This information serves as a useful reference for the application of molecular amplification technology to detect live bacteria in the future. vPCR, which is a potential detection technique based on resilient DNA, differs from RT-PCR. The vPCR method uses two reaction stages, PCR amplification, and nucleic acid intercalating dye pretreatment, to swiftly detect live

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bacteria from the sample. Due to the bacteria's damaged or deceased cell membrane, dyes that include light-activated nucleic acids, such as Ethidium Monoazide (EMA) or Propidium Monoazide (PMA), which may enter cells and create permanent bonds with DNA molecules obstruct subsequent PCR amplification, making it difficult to distinguish between living and dead bacteria. Due to the ease of use and simplicity of vPCR .It has been routinely utilized to identify live bacteria without considerably lengthening the detection time.

CONCLUSION

In the process of finding food-borne diseases, accurately separating the living from dead bacteria is crucial. It will aid in the proper assessment of the growth of pathogenic bacteria in food by food regulatory authorities, the prompt control of food safety issues, and the enhancement of the wholesome and sustainable expansion of the food sector. Numerous alternatives to conventional cell culture methods have been put forth, but they haven't been successful because of their many evident drawbacks. Now, thanks to cutting-edge PCR techniques, significant progress has been achieved in speeding up the detect-ion process and increasing the detection signal. We thereby offer a distinctive viewpoint on PCR-based biochemical techniques for the identification of live and dead foodborne pathogens. Modern live and dead foodborne pathogens detection technology has been evolving quickly. It is based on many distinguishing concepts (the use of DNA/RNA probes, certain phages, and aptamers), as well as the potent support of PCR in the signal amplification process following recognition. Better universality and stronger operability for the DNA/RNA-based PCR detection technology are advantageous for finding several applications in bacterium identification. Even though several isothermal and non-enzymatic nucleic acid amplification methods are continually being developed, there is little question that PCR opens the door for the identification of both live and dead foodborne pathogens. The role of PCR in ensuring food safety continues to be impregnable thanks to its outstanding adaptability and reliable amplification capabilities. However, it is still anticipated that developing amplification technologies would expand application scenarios with practical detecting operation and robust signal output.