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Review Article

Smartphone-integrated lateral flow assays for food safety assessment: Recent trends and future perspectives

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ABSTRACT

Lateral flow assay (LFA) is a single-use diagnostic instrument designed for the detection of specific analytes while utilizing minimal resources. Numerous sensing assays based on LFA have been developed by integrating LFA with electronic readers to facilitate quantitative evaluations through LFA systems. An efficient reader for the quantitative of LFA must meet several features such as portability for convenient on-site diagnostics and assessments, user-friendly operation, and rapid processing capabilities to promote results. Smartphones are increasingly being adopted as readers in the quantitative evaluation of LFA due to their advanced advantages and functionalized. Their high-resolution cameras can convert optical signals into electrical impulses. Undoubtedly, the extensive global penetration of smartphones represents accessible devices, facilitating their application as diagnostic tools for the acquiring, analyzing, storing, and transmitting test results. This study review sensing approaches based on using smartphones as readers for quantitative LFA systems specifically applied in food safety contexts. The systems are categorized based on the type of labeling particles employed in these assays, and efforts to enhance the quantitative analytical performance for each category are evaluated.

1. Introduction

Worldwide, foodborne diseases pose considerable challenges to public health, economic, and social well-being. According to the first estimates of the World Health Organization (WHO) in 2015 regarding the global and regional burden of these diseases, were identified 31 foodborne hazards that have contributed to these issues. It is estimated that numerous microorganisms and chemical agents have caused illness in approximately 10 % of the global population annually [1,2]. These hazards include biotoxins [3] and pathogenic bacteria [4] veterinary drugs [5], pesticides [6], antibiotics [7], heavy metals [8] and polycyclic aromatic hydrocarbons [9], and the inappropriate use of food additives [10–13]. Furthermore, changes in global food distribution networks and regulatory frameworks may worsen the hazards related to foodborne infections, emphasizing the critical need for improved surveillance techniques. Hence, the advancement of detection techniques is essential to reduce the prevalence of foodborne illnesses [14,15].

Traditional food safety analysis methods, such as microbiological, chemical analysis, and immunological methods, have played critical role in food safety analysis [16,17]. Although these approaches remain

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