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Chemiluminescent Detection of Microorganisms in Food/Drug Product Using Reducing Agents and Gold Nanoplates

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Abstract : Microbial spoilage of food/drug has been a constant nuisance and an unavoidable problem throughout history that affects food/drug quality and safety in a variety of ways. A simple and rapid test of fungi and bacteria in food/drugs and environmental clinical samples is essential for proper management of contamination. A number of different techniques have been developed for detection and enumeration of foodborne microorganism including plate counting, enzyme-linked immunosorbent assay (ELISA), polymer chain reaction (PCR), nucleic acid sensor, electrical and microscopy methods. However, the significant drawbacks of these techniques are highly demand of operation skills and the time and cost involved. In this report, we introduce a rapid method for detection of bacteria and fungi in food/drug products using a specific interaction between a reducing agent (tris(2-carboxylethyl)phosphine (TCEP)) and the microbial surface proteins. The chemical reaction was transferred to a transduction system using gold nanoplates-enhanced chemiluminescence. We have optimized our nanoplates synthetic conditions, characterized the chemiluminescence parameters and optimized conditions for the microbial assay. The new detection method was applied for rapid detection of bacteria (E.coli sp. and Lactobacillus sp.) and fungi (Mucor sp.), with limit of detection as low as single digit cells per mL within 10 min using a portable luminometer. We expect our simple and rapid detection method to be a powerful alternative to the conventional plate counting and immunoassay methods for rapid screening of microorganisms in food/drug products.

Keywords : microorganism testing, gold nanoplates, chemiluminescence, reducing agents, luminol
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