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Case Report

A New Approach of Monitoring Vaccine Temperatures

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Abstract

Common gynaecological diseases, endometriosis, though known for last 300 years, it's etiology, diagnosis and treatment are still not very well established, often mistaken with other diseases. In this short review, recent developments are focused. For the benefit and privacy of the patients Apps like "Citizen Endo" "Phendo" designed. Recently in the growth of endometriosis compounds such as, estrogens, cytokines, growth factors and lipopolysaccharides (LPS) were shown involve. Since no specific treatments are available, recently developed Fecal Microbiota Transplant (FMT) technology was also tried successfully albeit in few cases.

Keywords: FMT technology; "Phendo" and "Citizen Endo" Apps; Endometriomas; Fusobacterium

Introduction

The efficacy of vaccines is susceptible to degradation when exposed to suboptimal temperature conditions, necessitating a meticulously orchestrated sequence of events for their global transportation. The process of monitoring time and temperature can serve as an indicator of potential exposure of a vaccine to non-standard temperatures during any point of its transportation and storage. To combat such issues, there is tremendous progress in Time-temperature indicators (TTIs). They have been created using a combination of electronics and diverse materials to signify the cumulative impact of time-temperature history on product quality. Despite the ability of electronic time-temperature indicators (TTIs) to monitor temperature information wirelesslythrough antenna sensors, their efficacy is limited by human intervention and the production of significant electronic waste. Material-based Time-Temperature Indicators (TTIs) have emerged as a novel paradigm that offers a convenient means of providing visual information on the time-temperature history with the aid of active additives such as chemical reactants, microorganisms, enzymes, or dyes. This technology has the potential to increase consumer awareness and reduce electronic waste. Nevertheless, these two technology transfer initiatives that are based on materialshave their own significant drawbacks. Thermochromic time-temperature indicators (TTIs) that rely on chemical reactions are typically triggered within elevated temperature thresholds, rendering them unsuitable for vaccines that necessitate storage at subzero temperatures. Furthermore, the potential hazards of leakage and deactivation that are linked to the utilization of these reactive additives continue to be a significant area of apprehension. The time-temperature history can be indicated by dye-diffusion-activated time-temperature indicators (TTIs) through color changes induced by melting and diffusion when subjected to temperatures exceeding their melting points (Tm). Despite their ability to function at low temperatures, the melting dye-diffusion-activated time-temperature indicators (TTIs) possess notable limitations such as vulnerability to photobleaching, reduced temperature sensitivity, and restricted tracking temperature ranges. Hence, there is an urgent requirement for the development of novel materials that exhibit high stability, sensitivity, and broad tracking temperature ranges to facilitate the construction of dependable intelligent time-temperature indicators. All these necessitate an alternative for sensingthe efficacy of vaccines. This concise report details a effective way of sensing vaccine temperatureand time [1-2].

Structural Colors

In a recent study [2], there is report on the development of a new category of structural-color materials by researchers from the United States and China. These materials exhibit potential to produce advanced time-temperature indicators. The study's proof-of-concept showcases the broad temperature tracking range, heightened sensitivity, and exceptional stability of the subject in question. Maintaining a specific temperature range is crucial for vaccines from the point of their production until their administration. Traditional vaccines necessitate storage temperatures rangingfrom 2°C to 8°C, whereas messenger ribonucleic acid (mRNA) vaccines mandate subzero temperatures to prevent degradation.Nevertheless, the present time-temperature indicators based on materials exhibit restricted stabilityand reliability. Certain devices exhibit limited temperature tracking capabilities, whereas others are unsuitable for use in extremely low temperatures. In contrast, time-temperature indicators that are electronic in nature require manual intervention by individuals and produce substantialquantities of waste. The objective of the research team was to investigate novel materials that could enhance the monitoring of time and temperature in vaccines and other pharmaceuticals. A novel category of structural-color material has been created, which is referred to as self-destructive structural-color liquids. This material combines the benefits of both fluidic nature and structural color. Structural-color liquids are composed of two constituents, namely, aqueous solutions of nontoxicpolyethylene glycol (PEG) or ethylene glycol (EG) and liquid colloidal photonic crystals that are highly reflective. The present study utilized PEG or EG aqueous solutions that exhibit notable sensitivity to distinct temperatures and were blended to generate fluids with varying melting points, serving as the triggering agents. Meanwhile, colloidal photonic crystals were employed asthe indicating agents [2-6]. Photonic crystals typically exhibit bright green or red hues. However, when subjected to self- destructive structural-color liquids at their melting point, these crystals disintegrate and undergo an irreversible loss of color. The materials possess the capability to indicate the time-temperaturehistory, exhibiting a broad tracking temperature range spanning from -70°C to +37°C. Additionally, the time of the materials can be largely adjusted, ranging from 40 minutes to 5 days. The investigators conducted an experiment utilizing time-temperature indicators on standard vaccines (with a storage temperature of 8°C), mRNA vaccines (with storage temperatures of -20°Cand -70°C), and transported organs (with a storage temperature of 0°C). The technology exhibiteda notable degree of sensitivity and effectively detected instances when the products exceeded the appropriate temperature threshold. The combination of gradual color changes and reflectance spectra shift presents a synergistic approach to effectively disclose the precise time-temperature history of different vaccines, both qualitatively and quantitatively. The structural-color liquids exhibit self-destructive properties and offer a solution to the limitations of traditional time- temperature indicators. This advancement leads to achieving a more efficient cold supply chain.

Concluding remarks

The utilization of structural color liquids with thermally triggered destruction capabilities has demonstrated superior performance in tracking temperature range, sensitivity, and user- friendliness, thereby establishing a fundamental design principle for the development of next- generation intelligent indicators. This technology holds significant potential for ensuring dependable cold chains. Furthermore, it is expected that the implementation of structural color liquids will yield advantages in diverse fields including but not limited to wearable sensors, dropletrobots, and photonic display [7-10].

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