

Smart Textile Materials between Packaging and Security

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Abstract:

Background: In the future, smart textiles will be the main development direction and an important economic growth point for the textile and packaging industries. Smart textile textiles are classified as passive, active, or advanced. Passive smart textile textiles, such as anti-ultraviolet clothing and antibacterial textile textiles, are the first generation of smart textiles. Active smart textiles, also known as waterproof and moisture-resistant textiles, are the second generation of smart textiles. Advanced smart textile textiles are the third generation of intelligent textile textiles, which include communication, sensing, artificial intelligence, and other high-tech disciplines that can detect and respond to changes or stimuli in the external environment. Goods or products that are contained, transported, and stored in various industrial, agricultural, consumer, and pharmaceutical products are included in the packaging industry. Smart packaging connects the worlds of packaging and technology. Smart packaging is defined as traditional product packaging with additional functions. These functions include enhancements to increase shelf life, protect frail products, and track sales and actions taken with the product. Since mobile devices, particularly smart phones, have become an important part of our lives, the use of the QR code has increased dramatically, and we have developed the code to make it difficult to imitate, secure the product, and maintain user trust through printing insurance using QR Code Smart printed with thermochromics paste to change color with change The conditions surrounding the packaged product as a result of exposure to a different temperature. This will add value to pharmaceutical products and vaccines that require secondary packaging to maintain the temperature of the product packed inside the cooler bags, as well as by printing the QR code with smart materials that change color when the temperature rises above the permissible limit for keeping the product cool. This increases the packaged product's insurance value and boosts the confidence of vaccine users or patients whose medications require special storage conditions. Product insurance, on the other hand, has become an essential factor with the spread of markets selling products through websites. We will address the printing insurance factor for the QR code in this study by using smart materials on various textile materials and employing them in the field of pharmaceutical packaging and packaging of valuable products to ensure product authenticity and printing insurance for artistic paintings. Important in light of the widespread practice of copying and imitating works of art. The most secure security features are those that are hidden. Other factors, such as target audience, difficulty in imitation, and cost, must be considered when selecting the most appropriate features. Thermal Pastes and Inks, QR Code, Ultraviolet Inks, Infrared Inks, and RFID - Radio Frequency Identification are some of the most popular features. The confidential security features are chosen based on the target audience and the insured product, and the security features are discovered by experts, specialists, and customers. All security technologies and features can be identified by experts. Consumers, on the other hand, can only use and recognize secured QR codes and smart materials because all other technologies require specific detectors that are not widely available. Smart materials and secured QR codes are more complicated; for smart materials, special specification inks or pastes must be used; and for secured QR codes, security may need to be established during QR code creation. Printing will be secured using smart materials on textile materials in this study to improve product security. **Problem :** The research problem will be clear through trying to answer the following questions: - How can smart textile materials be used to improve pharmaceutical and value-added product packaging? - How can

the smart QR code be used on various textile materials to secure valuable products? **Objectives:** Utilizing smart, color-changing textiles to enhance the packaging of pharmaceutical and value-added products. - Employing the smart QR code on textile materials to secure products of value. **Significance :** Securing valuable textile products - Ensure the genuineness of valuable textile products. - Increasing consumer loyalty to international textile product brands **Methodology:** The study has taken an experimental approach, printing insurance using the smart quick response code on various textile materials and determining the extent of their response. And printing insurance using hydrochromic, photochromic, and fluorescent materials for valuable products to ensure product authenticity. **Results :** Following an examination of the theoretical and practical framework for securing textile materials using smart materials, it was discovered that sample no. (1) The readability of the QR code on canvas material is superior to burlap material, and it can be used to secure artistic paintings and valuable textile products. The effect of hydrochromic pastes on the canvas material is superior to that of burlap in sample No. 2. In light of the spread of counterfeit products, these pastes can be used as part of the design on textile products or to print the label printed on the fabric with smart materials to enhance the insurance aspect and ensure the authenticity of the products. The guiding and warning signs in Sample No. (3) Are printed with fluorescent materials that glow in the dark, can be used in places where it is difficult to provide energy and has a unique nature, such as some desert areas. **Conclusions:** Finally, because it can be used in a variety of ways, the rapid response code is one of the best means of printing and informational insurance. It can be printed on the textile product's label, linking the code when scanned to the company's website, and verifying the product code to become informational insurance in addition to printing insurance with smart materials. On the textile guarantee certificate, the code can be printed. With the option of printing it with smart materials on canvases printed with textile materials as one of the forms of insurance on textile materials and adopting this to preserve art and design intellectual property rights. As environmentally friendly materials, canvas and burlap were printed. The QR code was printed on the canvas with fluorescent materials that glow in the dark, photochromic materials that change colour when exposed to sunlight, and hydrochromic materials that outperform burlap.

Keywords:

Smart textiles, Smart QR Code, Valuable products, Photochromic Materials, Hydrochromic Materials, Fluorescent Materials

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