

NIR Biosafe QR Codes with Bioinkjet Printing and Tagging

Edible, invisible QR tags printed on pills for on-dose drug authentication by patients and pharmacists.

Researchers at Purdue University have developed an edible and invisible printing method for quick response (QR) codes that can identify and authenticate medicines. Fake and counterfeit medicines threaten patient safety and health worldwide, in addition to causing significant economic losses. While there are some regulatory measures in place, these only address the exterior box security and do not allow patients themselves to verify the medications they may be taking. To address this risk, Purdue researchers introduced camouflaged biosafe QR code bioprinting and taggant construction for on-dose authentication of medications. This not only enhances the security of traditional QR codes but also addresses challenges such as printability, imperceptibility, stability, biocompatibility, digestibility, and tamper resistance. Camouflaged biosafe QR code taggants affixed to each medicine can serve as serialization, track and trace, and authentication at the dosage level, empowering every patient to personally authenticate their medication. This, combined with an inkjet printing method for QR code production, ultimately enhances pharmacy security, reduces errors, and empowers patients to have increased autonomy in their care.

Technology Validation:

The QR Biocode Taggants were verified and optimized in several key stages. Researchers used biologically safe coloring and NIR absorbing dyes, maintaining dye viscosity compatible with inkjet printers. The printing process was then developed using silk fibroin sheets, which are FDA approved as a safe food additive and suitable for large-scale commercial printing. The biocompatibility of the main constituent materials used in a QR code taggant was investigated using hemocompatibility tests and digestibility tests by examining enzymatic degradation in vitro. Both tests supported the biocompatibility of QR code taggants.

Advantages:

Technology ID

2024-KIM-70421

Category

Artificial Intelligence & Machine
Learning/Computer Vision &
Image Recognition
Cybersecurity/Threat Detection
& Incident Response
Pharmaceuticals/Pharmaceutical
Packaging & Delivery Systems

Further information

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- Camouflaged so as not to be immediately obvious to the naked eye
- Optimized for readability by standard smartphone cameras under normal light conditions
- Silk fibroin print sheets optimized for large-scale commercial production
- QR codes placed directly on or in medication doses
- Empowers consumers to directly verify their own medication
- Inks are biosafe and compatible with currently available inkjet printers

Applications:

- Combats counterfeit medication crisis
- Enhances pharmaceutical security
- Allows pharmacists and consumers to directly verify medications

Publications:

J.J. Kim, Y. Ji, D.L. Guo, Y.L. Kim, and J.W. Leem, "Bioinkjet printing and protein tagging of camouflaged biosafe quick response codes for medicine authentication," *Advanced Materials Technologies* 9(3): 2301438, 2023.

TRL: 4

Intellectual Property:

Provisional-Patent, 2023-10-06, United States

Utility Patent, 2024-09-14, United States

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