Instantaneous identification of forged valuable documents using an advanced spectroscopy technique: Application to banknotes

Antoine Ghauch*
American University of Beirut | Faculty of Arts and Sciences | Department of Chemistry
P.O. Box 11-0236 Riad El Solh – 1107-2020 Beirut – Lebanon
antoine.ghauch@aub.edu.lb

Abstract

The present work describes an innovative method for the instantaneous detection of counterfeited banknotes based on the use of an advanced spectroscopy technique. The technology is nondestructive and ready for use in forensic science laboratories, in central banks and at borders. The instrument receives a US patent. It can also be miniaturized for integration in the new smart phones generation limiting thereby the spread of criminal activities fed by the usage of faked banknotes.

Background

Documents examination has always been a challenging science where several analytical techniques can be used. Each of them can provide information reflecting for example the chemical composition of a specific area of the document embedded with a particular chemical probe. Among several security features that a valuable document can hold, fluorescent ink is one of them. It is characterized by the emission of visible light under UV irradiation. A controller can therefore check the presence of a pattern such as a number or a picture confirming thereby the authenticity of the document e.g. banknote, passports, visa, etc.

Description

The instrument we recently developed is a Smart Anti-Counterfeiting Optical System baptized SACOS. It is a combination of several high tech components allowing the excitation of a secure dye and the collection of its emission in the visible region of the spectrum. The main technological tools incorporated in SACOS are: A pulsed flash lamp, a specially designed bifurcated optical fiber achieving high level of light transmission, a spectrometer equipped with an imaging sensing system and coupled to a fast shutter, a CCD detector able to quickly analyze the striking emitted light diffracted on the holographic grating and a customized software for data analysis and data treatment (Fig. 1).

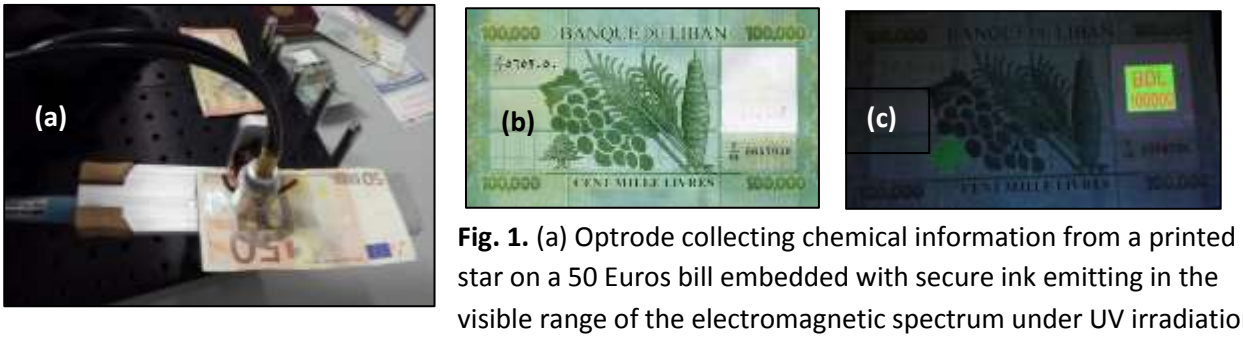

Fig. 1. (a) Optrode collecting chemical information from a printed star on a 50 Euros bill embedded with secure ink emitting in the visible range of the electromagnetic spectrum under UV irradiation through central optical fiber. (b-c) Banknote of 100,000 Lebanese Pounds under day light (b) and under UV irradiation (c). The UV irradiation shows clearly the CEDAR pattern in green along with the denomination of the banknote in red. Both ink used are fluorescent inks.

Discussion

Although the pattern seen in Fig. 1c is giving a close idea on the authenticity of the document, however, it is not as accurate as needed since the naked eye cannot distinguish green or red colors of different wavelengths. Therefore, the need of a smart spectroscopy tool is mandatory especially that fluorescent dyes are available for anyone to purchase. Then counterfeiters are able to design and produce similar documents.

Conclusion

SACOS is an invention that recently received a US patent because of its high accuracy based on the detection of the room temperature phosphorescence signal obtained from the irradiated area rather than the fluorescence signal. The technology was positively tested on tens of banknotes and currencies of different denominations allowing net distinction between the forged and the authentic notes. The patent was also filed in China, South Korea and in Europe seeking its miniaturization for wider and more impactful applications.

References

A Ghauch, A Ammouri - US Patent App. 15/582,295, 2017, http://www.freepatentsonline.com/y2017/0301169.html