



# Fluorescence Detection of Counterfeit US Currency

Jasco, Inc.

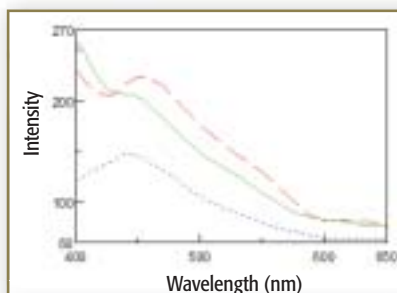
**Each year more money is stolen with a pen than with a gun. Much of the fraud due to counterfeiting is a result of the current technology available such as personal computers, scanners, and color copiers. Counterfeit currency costs governments and businesses billions of dollars a year. This application demonstrates how a simple fluorescence instrument can be used to verify US currency through the presence of the security thread and the background fluorescence of the bill.**

United States currency is the most counterfeited in the world. New security measures, including the security thread, have been implemented to hinder counterfeiters. A security thread is a thin thread or ribbon running through a bank note substrate. The thread in U.S. currency has printing and on the new \$20 note, micro-printing and graphics. The thread in these bills glows when excited by ultraviolet light. In the \$100 note the fluorescence is pink, in the \$50 bill yellow, in the \$20 bill green, in the \$10 bill red and in the \$5 bill blue. These security threads make it difficult to copy currency with a commercial color copier. Using a unique thread position for each denomination starting with the \$100 note prevents techniques such as bleaching ink off a lower denomination and "reprinting" it as a higher value one. The background fluorescence of several currencies is shown in Figure 1.

## Experimental

A Jasco FP-6200 fluorescence spectrophotometer equipped with a solid sample holder was used. Bills from \$5 to \$100 were placed in the sample holder such that the security thread was exposed to the excitation beam. Emission scans of both sides of each bill were collected and several locations on the security thread for each bill were also examined. Figure 2 shows the solid sample holder.

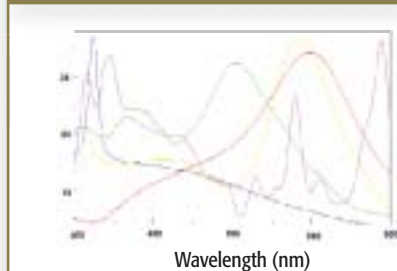
Spectra were collected from 400-565 nm. Instrument parameters were band width 5 nm (Ex,Em) 5 nm, measurement range from 400-600 nm, a data pitch of 1 nm, an excitation wavelength of 365.0 nm, and a scanning speed of 125 nm/min. Representative scans of the security threads are shown in Figure 3. The emission bands are wide and distinctly identify each bill. The fluorescence intensity of the security threads appeared to decrease with apparent use and handling of the bills, as newer bills displayed a stronger fluorescence intensity. The fluorescent threads examined in this study did not have a uniform intensity along the length of



**Figure 1.** Background from US (solid), Japanese (dashes) and Canadian (dots) currency.



**Figure 2.** Jasco solid sample holder with a \$20.00 bill.



**Figure 3.** Spectral scans of the fluorescent strands.

the thread. This suggests that fluorescence could be used for quality control of the production of these security devices.

## Conclusions

Simple fluorescence instrumentation can be used to evaluate the authenticity of U.S. currency. Using a fluorescence instrument as shown, the signal from the bill and its inherent security thread can be monitored to ensure currency validity and possibly provide a method for the examination of aging of a bill based on the changes in fluorescence intensity.

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