

## **A Study on Banknote Paper Deterioration Factors by Circulation Simulator Method (A case study on the 5 Egyptian banknotes)**

**Prof. Mahmoud Mahmoud Yousry Ahmed**

Professor of full-time printing technology - Department of Printing, Publishing and Packaging - Faculty of Applied Arts - Helwan University.

**Prof. Dr. George Nubar Simonian**

Professor of digital printing technology - Department of Printing, Publishing and Packaging - Faculty of Applied Arts - Helwan University.

**Eng / Amr Ahmed Shehata**

Designer - Cash Printing House - Central Bank of Egypt.

### **Abstract:**

The banknote damage factors were analyzed in the trading cycle and the factors that cause this are to determine the main elements that lead to banknote damage in the actual trading cycle, as well as to verify the factors that can be simulated when simulating the trading cycle. The factors to consider when simulating circulation are the mechanical and chemical systemic effects on banknotes. An advanced trading simulation method was used to evaluate bank notes of the Arab Republic of Egypt (the five-pound category most commonly traded in the Egyptian trading market) and to obtain industrially damaged samples of banknotes so that their optical properties and change in weight are within the limits of the corresponding banknotes changes in the trading cycle the Actual. This methodology consists of a number of multiple mechanical damage that is inserted on the test banknote by rotating them in a closed container that contains the damage element in the presence of a mixture that causes dirt. The proposed approach can be used to determine the tolerance of materials and to develop industrial processes in the production of banknotes. Where the mechanical effect on banknotes is simulated by repeated contact with the agent that causes damage inside a closed container, so that banknotes are wrapped around the axis of the container. Through this type of banknote processing, we obtained multiple types of chemical damage, such as friction, rewinding, folding, tearing, crunching, cracking, puncture or marking, and bending. Simulation of twisting, bending, and cutting has been enhanced due to the centrifugal force exerting during rolling by placing roughening bars with added load on the shorter sides of the banknote. Through the results, we were able to reach an in-depth analysis of the banknote notes' damage in trading and the factors that cause it, and identify the main factors in these operations and determine the factors that can be simulated through artificial damage. Factors that should be considered when simulating damage include those that have a systemic effect. In the acquisition of the trading cycle simulation, the sequential effect of different factors on banknotes, especially mechanical and chemical factors, should be checked. The data and our findings regarding the test of weight change also indicate that the weight increases as the state of deterioration of the currency increases, and this increase in weight is analyzed as a result of the increase of pollutants on the surface of the most deteriorating currencies. The change in tonal tone) that the banknote's color in the optical deterioration phase is yellow / brown. The change in the color of the banknote results from two processes: the oxidation of cellulose fibers and the natural aging of the existing layer of fat and grease. Cellulose oxidation means oxidized cellulose fibers. Such oxidation leads to an increase in oxygen-containing groups such as carbonyl and carboxylic acids. Oxidized cellulose fibers usually cause a yellowing effect on the paper

### **Keywords:**

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