Asian Journal of Chemistry Vol. 21, No. 4 (2009), 2811-2814

Forensic Examination of Counterfeit New Turkish Lira Bimetallic Coins

ISMAIL CAKIR* and H. BULENT UNER
Institute of Forensic Sciences, Istanbul University, 34098 Istanbul, Turkey
Fax: (90)(212)5880011; Tel: (90)(212)4143000-22842
E-mail: icakir@istanbul.edu.tr

In this study, total 200 (100 genuine and 100 counterfeit) coins (1 YTL) were quantitatively analyzed by scanning electron microscope with energy dispersive X-ray spectrometer (SEM/EDS) after determinations of their diameter, thickness, weight and appearance. The weight of each One New Turkish Lira (both genuine and counterfeit coins) was measured to sub-milligram using an electronic balance. The diameter and rim thickness of each One New Turkish Lira (both genuine and counterfeit coins) was measured twice employing a vernier caliper. SEM/EDS is a widely used nondestructive elemental analysis method. SEM sample stub using double-sided carbon adhesive tape. The samples were then subjected to morphological observation and elemental analysis *via* SEM/EDS without any coating. The working distance and magnification powers were varied while secondary image observation. A fixed working distance of 15 mm and 200 times magnification were employed during energy dispersive X-ray analysis. The major elements detected in the outer ring of both genuine and counterfeit coins were Cu, Ni and Zn while the elements detected in the inner disc of genuine and counterfeit coins were also Cu, Ni and Zn. The major elements percentage detected in the genuine coins were Cu, Ni and Zn which were significantly different from the counterfeit coin samples. Present work demonstrates, therefore, the possibility of discriminating genuine and counterfeit coins using SEM/EDS, by means of a relatively rapid and effective method.

Key Words: Forensic Science, Counterfeit coins, New Turkish Lira, Elemental analysis, SEM/EDS.

INTRODUCTION

The New Turkish Lira (Yeni Türk Lirasi, YTL), introduced on January 1, 2005. The New Turkish Lira is equivalent to one million (old) Turkish Liras (Türk Lirasi, TL). In other words, six zeros were dropped from the old TL to make the YTL. Old Turkish liras were withdrawn from circulation during 2005. However just within 1 year after launching, counterfeit 1 YTL coins started to be found in Turkey. Counterfeit coins are usually produced by casting and show morphological details with less precision than those on genuine coins.

Since the advent of the new coin with a face value of One New Turkish Lira (1 YTL), a compound coin composed of a brass-coloured inner disc and silver-coloured outer ring, crime cases involving counterfeiting and use of fake coins have increased in Turkey.

In recent months, Turkish Police have seized many counterfeit 1 YTL coins that look like the genuine coins because of their pictures and letters and because the feeling to the touch and weight are very similar to those genuine coins (Figs. 1 and 2). Some of the counterfeit 1 YTL coins were not similar to those genuine coins (Fig. 3). The colour and shape of counterfeit 1 YTL coins so closely resembled those of genuine coins that they could not be distinguished from genuine coins by the naked eyes. The small details of stamped markings were blurred or absent on counterfeit 1 YTL coins but were clear and definite on genuine coins.

Fig. 1. Front faces of One New Turkish Lira, (left) genuine (right) counterfeit

Fig. 2. Back faces of One New Turkish Lira, (left) genuine (right) counterfeit

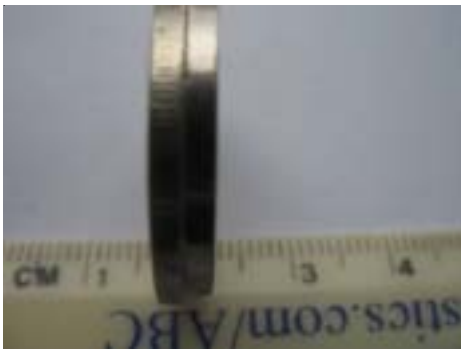

Fig. 3. Lateral sides of One New Turkish Lira, (left) genuine (right) counterfeit

In this study, counterfeit coins (1 YTL) were quantitatively analyzed by scanning electron microscope with energy dispersive X-ray spectrometer after determinations of their diameter, thickness, weight and appearance[1,2]. The weight of each One New Turkish Lira (both genuine and counterfeit coins) was measured to sub-milligram

using an electronic balance. The diameter and rim thickness of each One New Turkish Lira (both genuine and counterfeit coins) was measured twice employing a vernier caliper[3].

EXPERIMENTAL

Jeol 5600 scanning electron microscope (SEM), Japan Accelerating voltage: 20KV Tilt of sample: 00 Working distance: 20 mm Images observed: Secondary electron and back scattered electron images.

(i) LINK ISIS energy dispersive X-ray spectrometer (EDS) Oxford, UK X-ray signals were collected from 0 to 20 KeV, 10 eV per channel peak identification: manually and automatically, (ii) Electronic balance: XB 220 A Precisa, Swiss, (iii) Vernier caliper: CD-6CS, Mitutoyo Digimatic Caliper, Japan, (iv) Coin samples: 100 counterfeit 1 YTL coins and 100 genuine 1 YTL coins collected from a local bank and confiscated evidence, respectively.

Methods: (i) Measurements of weight and dimension: (a) The weight of each coin was measured to sub-miligram using an electronic balance. The mean was calculated. (b) The diameter and rim thickness of each coin was measured twice employing a vernier caliper. The mean was calculated. (ii) Scanning electron microscope/energy dispersive X-ray analysis: The coins were brushed and sequentially rinsed with distilled water and acetone. Each cleaned coin was mounted on a scanning electron microscope sample stub using double-sided carbon adhesive tape. The samples were then subjected to morphological observation and elemental analysis *via* scanning electron microscope with energy dispersive X-ray spectrometry without any coating. The working distance and magnification powers were varied while secondary image observation. A fixed working distance of 15 mm and 200 times magnification were employed during energy dispersive X-ray analysis.

RESULTS AND DISCUSSION

The weight and dimension results are shown in Table-1. The major elements detected in the outer ring of both genuine and counterfeit coins were Cu Ni and Zn. Elements detected in the inner disc of genuine and counterfeit coins were also Cu, Ni and Zn. (Figs. 4 and 5).

TABLE-1
RESULTS OF WEIGHT AND DIMENSION MEASUREMENTS

Sample name	Weight (g)	Diameter (mm)	Rim thickness (mm)
Genuine coins	8.4759 ± 0.053	26.12 ± 0.04	1.94 ± 0.03
Counterfeit coins	8.3709 ± 0.384	25.74 ± 0.18	1.97 ± 0.21

The major elements percentage detected in the genuine coins were Cu, Ni and Zn, which were significantly different from the counterfeit coin samples. Present work demonstrates, therefore, the possibility of discriminating genuine and counterfeit coins using SEM/EDS, by means of a relatively rapid and effective method.

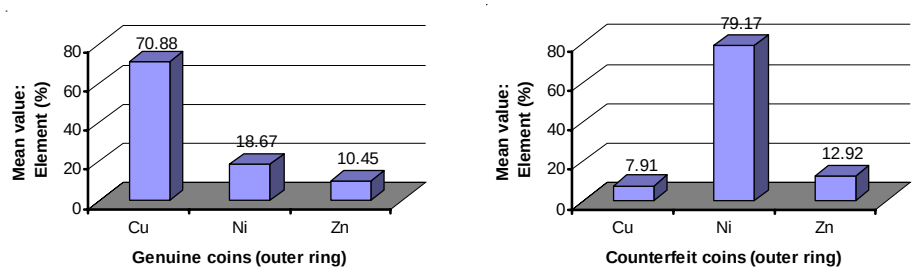

Fig. 4. Major elements detected in the outer ring of One New Turkish Lira, (left) genuine (right) counterfeit

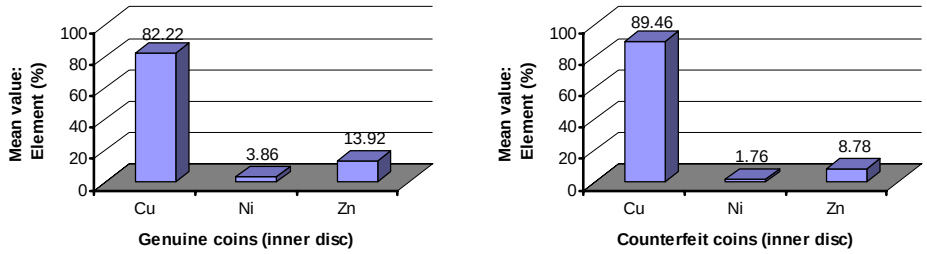

Fig. 5. Major elements detected in the inner ring of One New Turkish Lira, (left) genuine (right) counterfeit

ACKNOWLEDGEMENT

This work was supported by Research Fund of the Istanbul University (Project number UDP-1723).

REFERENCES

1. M. Hida and T. Mitsui, *Forensic Sci. Int.*, **119**, 305 (2001).
2. H.H. Meng, K.C. Gheng and H.S. Chen, *Forensic Sci. J.*, **1**, 39 (2002).
3. M. Hida, H. Sato, H. Sugawara and T. Mitsui, *Forensic Sci. Int.*, **115**, 129 (2001).

(*Received*: 5 May 2008; *Accepted*: 16 January 2009) AJC-7125