Source preparation of Actinides and Polonium using coins

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Introduction

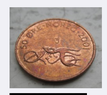
Electrodepositio is the major method for source preparation of actinides, Pu, Am, Th, U using stainless steel discs and spnntaneous deposition for Polonium using discs of silver. World wide coins are manufactured of bronze, steel, copper plated steel, cupronickel, brass and alloys of Cu-Ni-Zn.

The diameter varies but many of them, 16-25 mm, fit into our regular depositions cells. The price of the coins which can be used have a value between 0.0012 -0.2 Euro considerably cheaper than electropolished stainless steel discs, 0.8 Euro.

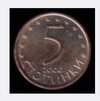
This investigation had the purpose to show the possibility to used coins from different countries for source prepartion, the energy resolution and deposition efficiency .

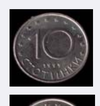
Material and methods

Coins werre collected after travel or were obtained by mail after contact with colleagues (Figure 1. The coins were selected after intrnet infromation about daimeter and metal composition.
The coins were rinced with normal washing detergent and placed in the aletrodeposition vials. NRPA uses a liquid scitillation bottles (Ø =20 mm) with the bottom cut off while MEL uses nalgene bottlesØ =17 mm.
Electrodeposition was performed at pH 2 from an ammonium sulphate solution at 1 Ampere during 2 hours accoding to the method by Hallstadius, 1984 (1). To the solutions we added known amounts our normal yield determinants Pu-242, Am-243, U-232, Th-229 and Po-209
When more than one isotope was used at the same time they were selectedso there would Not be any interference in the pulse height distribution
The discs were measured by alpha spectrometry using ion implated silicon detectors (PIPS) for 100 000-250 000 seconds.

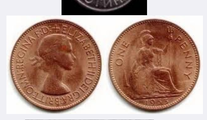

Noray, 50 Øre, Cu, Zn, Sn,

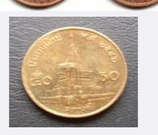

Bulgary, 2 stotinka, steel, bronze, 18 mm


Bulgary, 5 stotinka, steel, bronze, 20 mm


Bulgary, 10 stotinka, Cu, Ni, Zn, 18.5 mm


Bulgary, 20 stotinka, Cu, Ni, Zn, 20.5 mm


UK, 1 penny, copperplated steel or bronze, 20.3 mm


Thailand, 50 satang, Cu plated steel or Al bronze, 18 mm


Thailand, 1 bath, cuproplated steel or nickelplated steel, 20 mm.

Figure 1. Coins used in this study

Results

The recoveries ranged from 50-100% and the energy rsolution varied between 21 and 75 keV,FWHM.
The recoveries are similar to those for conventional stailess steel discs but the energy resolution is slightly poorer. This is explained by that the coins have a structure on the surface, pictures, numbers and text. If coins contain Al this will be dissolved at the cathode and give a poorer resolution.
The best coins seem to be Bulgarian stotinkas, for example 5 stotinka, 0.02 Euro, giving almost the same results as conventional stainless steel discs..

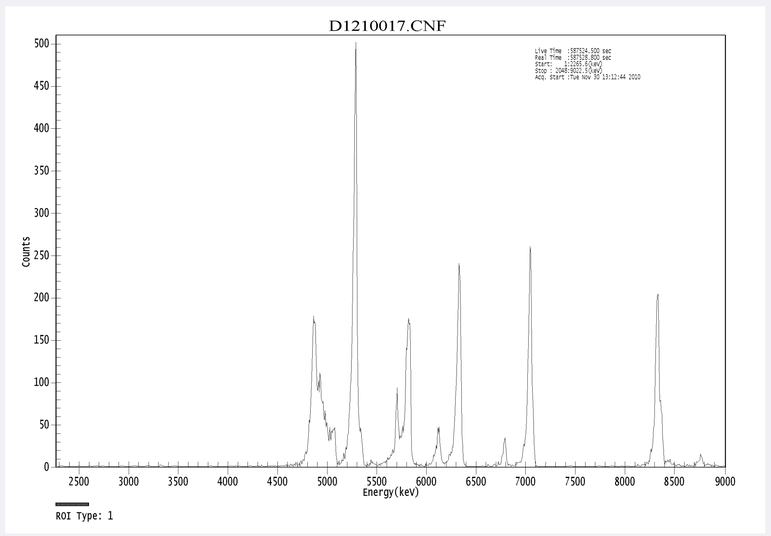


Figure 1. Pulse height distribution of Th-229 and Am-243 on Thai 1 bath.

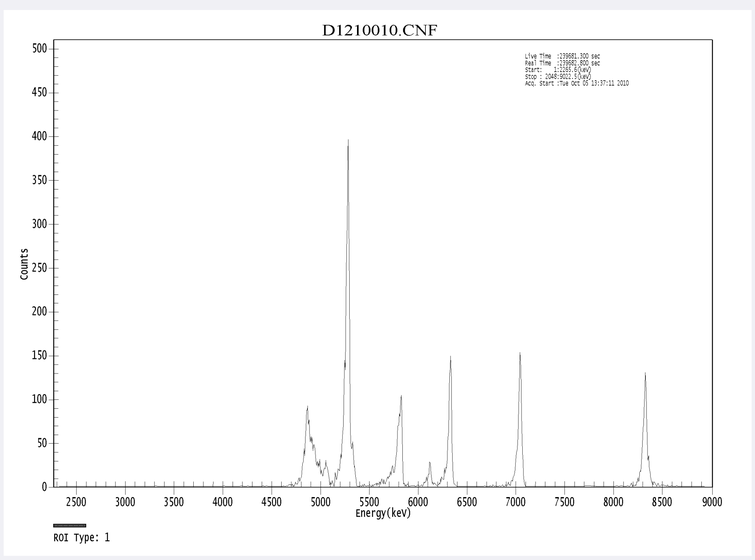


Figure 1. Pulse height distribution of Th-229 and U-232 on UK 1 penny, bronze

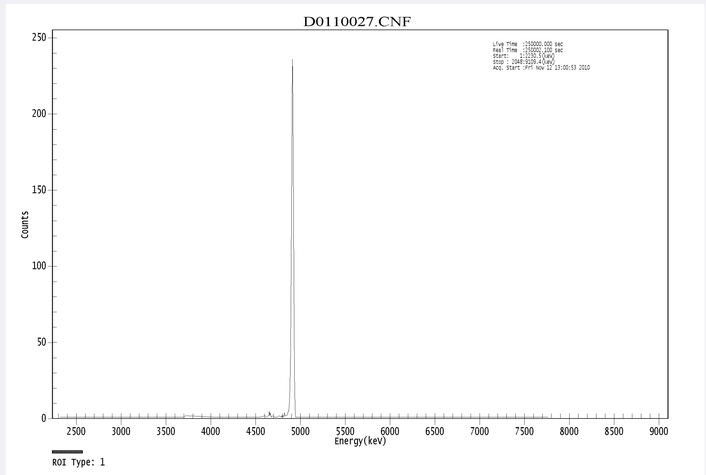


Figure 3. Spontaneous deposition of Po-209 on Thai 1 bath

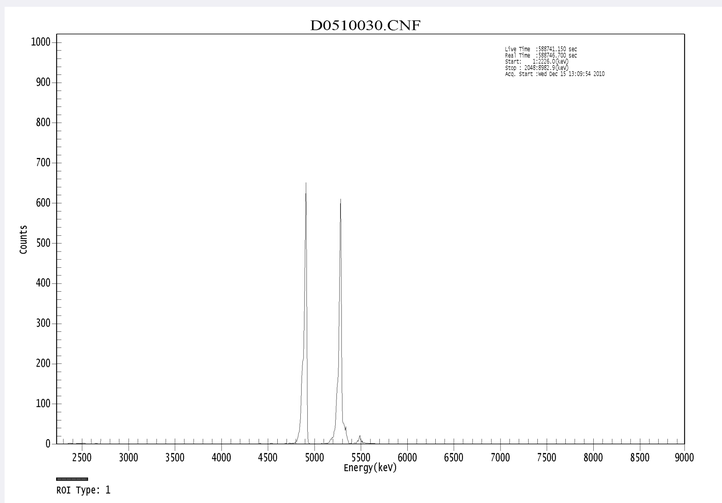


Figure.4. Pulse height distribution of Pu-242 and Am-243 on Bulgarian 5 stotinka

Conclusions

Coins can with advantage be used for source preparation of actinides and polonium.
There is also a considerable cost-diffference compared to electroplated steel discs.
Other coins such asEuro coins 0.01 Euro, 0.02 Euro, Icelandic 10 Aurar-0.0005 Euro and Indian 10 paise-0.0014 Euro should be tried if still existing.

References

Hallstadius L., 1984.
A method for the eectrodeposition of actinides.Nucl. Instr. Methods in Phys. Res. 223, 266.