Selenium Identification by Gamma Ray Spectrometry on Brazil Nuts Irradiated on IEN's Argonauta Reactor

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Selenium is a chemical element which play an essencial role on human health, for, besides the considerable antioxidant function, it acts on the conversion of hormones T4 to T3, on the protection against the harmful action of heavy metals, on the prevention of Chronic Noncommunicable Diseases (NCDs) and on the increase of the immune system resistance [1]. *Bertholletia excelsa,* the main source of selenium grown in Brazil, is commonly known as Brazil nuts. The consumption of these nuts have been largely recommended by nutritionists mainly by its high Selenium concentration whose values vary between 5.8 and 169.9 µg / g [2]. In this work, in order to initiate the qualitative studies on this valuable food piece in the city of Rio de Janeiro, this research project focused on the identification of Selenium in Brazil Nuts samples by the Neutron Activation Technique, in which the sample were irradiated in the J9 channel of the Argonauta research reactor of the Nuclear Engineering Institute (IEN). The Selenium identification, activated by (n,γ) reaction, was carried by the Gamma Ray Spectrometry technique with a CANBERRA Hiper-Pure Germanium Detector (HPGe).
The radioisotope used is Se-75, which has a half-life of 119.8 days. The use of this radionuclide has good selenium determinations, but it requires a long period of irradiation, under a high neutron flux and long counting and decay times [3 and 4].
The samples used were ground Brazil nuts. They were packed compactly in the cylindrical polyethylene containers (A and B), and they were weighed on the high precision scale and placed in two holes in the graphite block and after this, they were inserted into the J9 channel for the neutron activation process. The mass of the samples A and B are 6.2763 g and 6,1257 g respectively, the experimental set can be seen in figure 1.

Figure 1. Brazil nuts samples A and B (left side) and J9 channel (rigth side)

The analysed spectrum of Brazil Nuts samples shown in Figures 2 and 3, which were irradiated for short periods during 7 days, showed all the main Se-75 photopeaks mentioned on reference data [3], thus, the presence of Selenium in the Brazil Nuts samples could be verified.

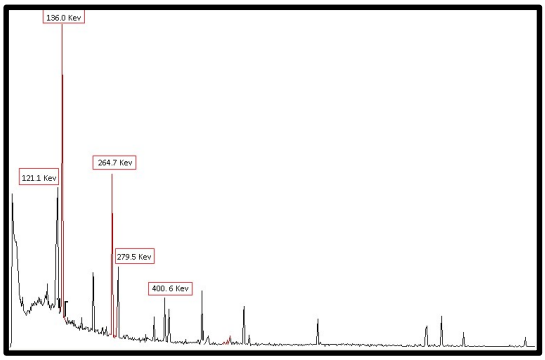

Figure 2. Sample A - Se-75 gamma ray energy spectrum of Brazil Nuts

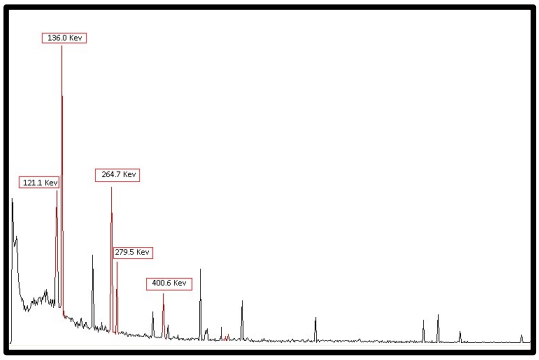

Figure 3. Sample B - Se-75 gamma ray energy spectrum of Brazil Nuts

Thereby, the Neutron Activation Analysis and Gamma Ray Spectrometry methods demonstrate their effectiveness on elements identification on food products, being, therefore, an alternative and effective path when compared with another analytical methods.

References

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